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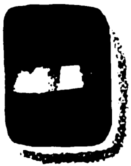
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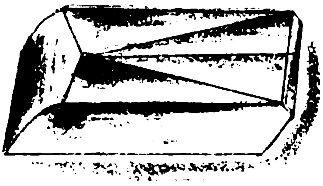
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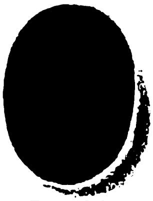
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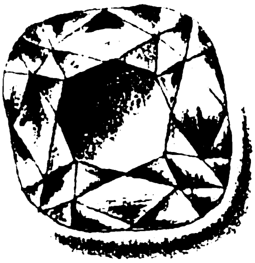
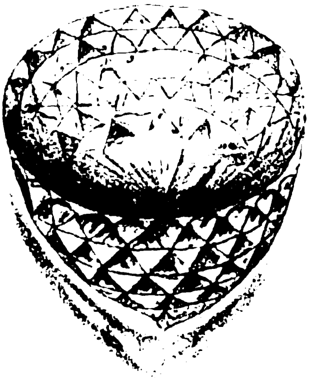

The Regent, 136½ Carats.

Hyacinth.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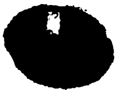
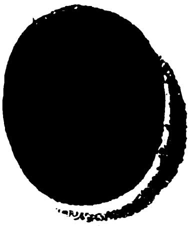
Oriental Ruby.

The Orlow, 194 Carats.


Cat's Eye.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Amethyst.

Agate.

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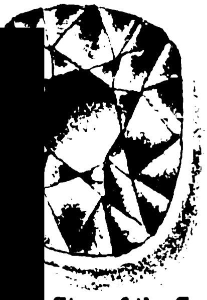
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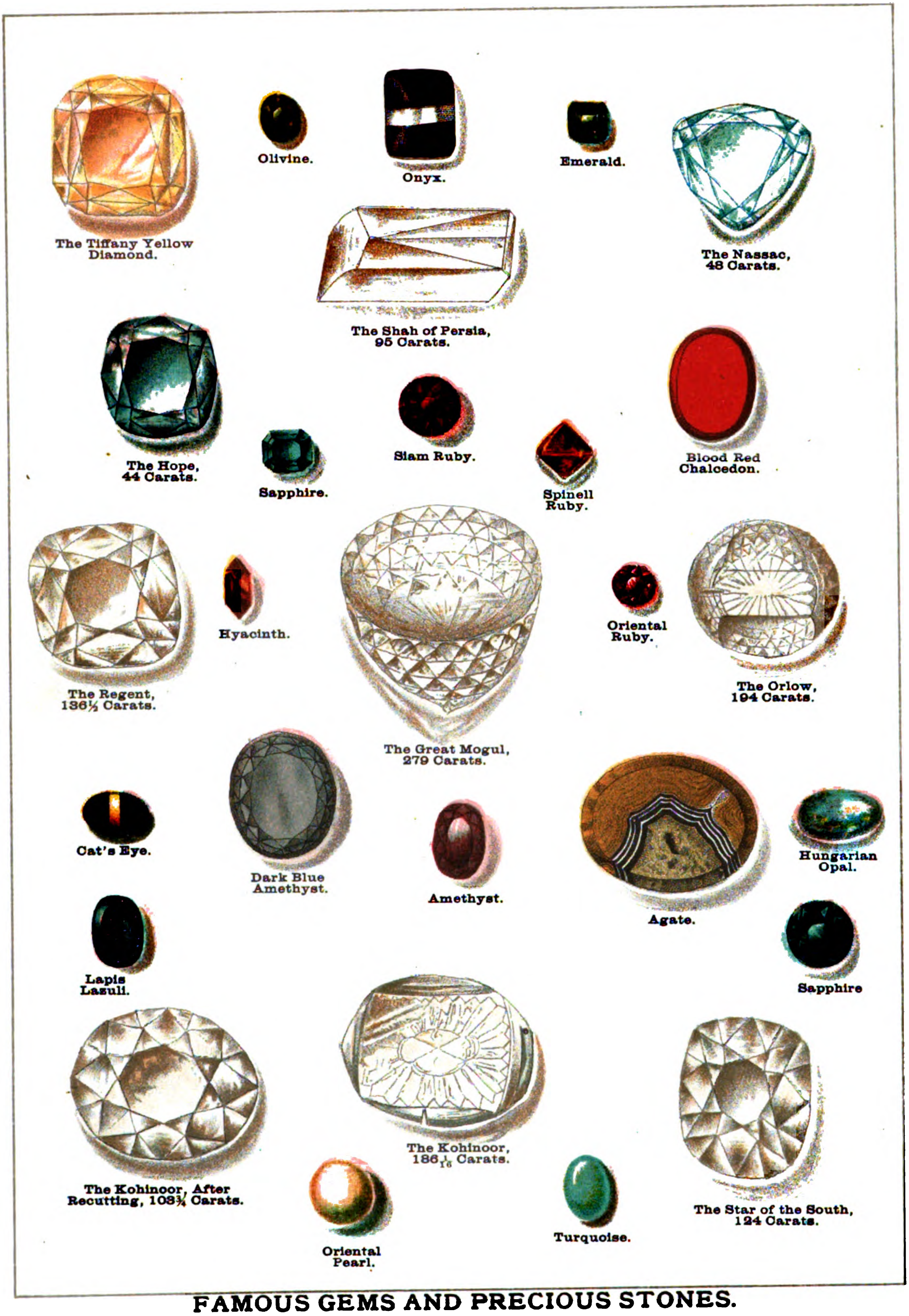
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LIST OF ILLUSTRATIONS

VOLUME XIV.

PAGE
Kentucky, Geological Map of 43
Kieff, Russia, Plan of 72
King-Bird 83
Kiwi 107
Knot (25 Specimens) 128–130
Königsberg, Prussia, Plan of 140
Labyrinth (6 Descriptive Cuts) 180–182
Lace (33 Descriptive Cuts) 186–191
Lahore, India, Plan of 212
Lamp (10 Descriptive Cuts) 246–249
Lancelet 259
Laocoon (Plate V) 292–293
Lapidary (8 Descriptive Cuts) 298–300
Larch, Branchlet of 309
Lark (5 Descriptive Cuts) 315, 316
Lathe (9 Descriptive Cuts) 323–325
Lausanne, Switzerland, Plan of 351
Lead, Views of Extracting Furnaces 375, 376
Leamington, England, Sketch Map of 380
Leather (12 Descriptive Cuts) 383–387
Leech (7 Specimens) 400–405
Leeds, England, Plan of 407
Leghorn, Italy, Plan of 416
Leicester, England, Plan of 425
Leipsic, Germany, Plan of 430
Leith, Scotland, Plan of 431
Lemberg, Austria-Hungary, Plan of 435
Lemming 436
Lemur (6 Descriptive Cuts) 441–444
Leopard 463
Leyden, South Holland, Plan of 494
Lhasa (4 Descriptive Cuts) 497–499
Lichens (6 Descriptive Cuts) 556–560
Liége, Belgium, Plan of 572
Lifeboat (4 Descriptive Cuts) 574, 575
Lifts (6 Descriptive Cuts) 579, 580

PAGE
Light (35 Descriptive Cuts) 585–617
Lighthouse (72 Descriptive Cuts) 620–636
Lille, France, Plan of 648
Lima, Peru, Plan of Neighborhood of 650, 651
Limerick, Ireland, Plan of 656
Limoges, Plan of 658
Lincoln, England, Plan of 663
Linen (2 Descriptive Cuts) 671, 673
Linz, Upper Austria, Plan of 685
Lion (2 Descriptive Cuts) 686
Lisbon, Portugal, Plan of 697
Lisbon, Portugal, Port of 698
Liverpool, England, Plan of 719
Liverpool, England, Port of 718
Lizard (7 Descriptive Cuts) 740–744
Llama (3 Descriptive Cuts) 744–746
Lock (25 Descriptive Cuts) 750–757
Locust (4 Descriptive Cuts) 773, 774
Log-Ship (5 Descriptive Cuts) 777, 778
London, Map of Tudor 857
London in 1720, Reduced Facsimile Map of 860
Long Island, Map of 876
Longfellow 872–873

MAPS

Kent 38–39
Kentucky 42–43
Lanark 250–251
Lancashire 252–253
Leicester and Rutland 424–425
Lighthouses 632–633
Lincoln 664–665
London (Plate IX) 832–833
London, Central (Plate X) 840–841

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ENCYCLOPÆDIA BRITANNICA.

KAOLIN.

KAOLIN, a name applied to the pure white clay which forms an important ingredient in the manufacture of porcelain, and which is, therefore, known also as *china clay*. Large quantities are raised in Cornwall, whence it is frequently termed *Cornish clay*. The name *kaolin* is said to be derived from a hill near King-tih-chin, in China, named Kao-ling or "lofty ridge." The clay from this locality was first sent to Europe, under the name of kaolin, by the Père d'Entrecolles, a Jesuit missionary who resided at King-tih-chin in the early part of the last century. A similar white clay was soon afterwards found at Aue, near Schneeberg in Saxony, and was used by Böttcher in the manufacture of porcelain, thus laying the foundation of the factory at Meissen for producing the famous Dresden china. In England kaolin was first detected in Cornwall by William Cookworthy, of Plymouth, about 1755, a discovery which resulted in the manufacture of hard paste china at Plymouth and Bristol. In Cookworthy's writings the clay is called "caulin." Kaolin is found in Nebraska, and in several of the Eastern States of the American Union.

Certain clays, when examined under the microscope, are seen to contain crystalline pearly scales of a mineral which Messrs. Johnson and Blake have described as *kaolinite* (*American Journal of Science*, ser. ii. vol. xliii., 1867, p. 351). They regard this crystalline substance as a distinct mineral species, a hydrated silicate of aluminium, forming the basis of pure kaolin. Its composition appears to agree with Forchhammer's formula for true kaolin, viz., $Al_2O_3.2SiO_2 + 2H_2O$. Mr. J. H. Collins regards the crystalline scales which are associated with the Cornish kaolin, not as kaolinite, but as a white lithia-mica or lepidolite.

Kaolin is almost invariably a product of the alteration of felspar, and is therefore always found in association with felspathic rocks, usually granite. The china-clay rocks of Cornwall and Devon are simply granites in which the orthoclase-felspar has become decomposed or kaolinized. Such rocks are termed by Mr. Collins *carclazite*, after the Carclaze mine, near St. Austell, where typical varieties occur. The production of kaolin from felspar is rather difficult to explain, inasmuch as the alteration is sometimes observed under conditions which appear to preclude the operation of atmospheric agencies. It is not simply the effect of water charged with carbonic acid, whereby the felspar might be decomposed and its alkaline silicate removed as a soluble carbonate, while the silicate of aluminium remained behind, in a hydrated condition, as kaolin or china clay. Many chemists have been inclined to attribute the decomposition to the effect of water or watery vapor at a high temperature, charged with hydrofluoric and boric acids. It is certain that minerals containing fluorine and boron—such as fluor spar, lepidolite, and schorl—are common associates of kaolin.

The localities from which kaolin is obtained in Britain are all situated in Cornwall and Devon; in the former county the workings are principally in the neighborhood of St. Austell, St. Stephen's, and Breague, while in Devon they are situated at Lee Moor and Meavy, on the south of Dartmoor. In working the clay the "overburden" or superficial deposit is first removed, in order to reach the clay-bearing rock. The rock is broken up by the pick, and water is introduced to wash out the clay. A quantity of sand is left behind, and requires to be constantly removed. The water containing the clay in suspension is either pumped to the surface up a shaft, or, if the working be upon a hillside, is run out at an adit level. This clay-water is led into channels called "drags," where the sand and coarser flakes of mica are deposited. From the drags the liquid passes into another set of channels called "micas," in which further deposition of suspended matter occurs. Thus purified, the clay-water is conducted into a series of pits and tanks, where the finely-divided particles of clay slowly subside. In the tanks it is allowed to settle until it acquires a thick creamy consistency, when it is transferred to the drying-house or "dry." Formerly the clay was dried naturally by exposure to sun and air, but it is now always artificially dried by means of heated flues, and the preparation of the clay is thus greatly facilitated.

China clay is not only used in the manufacture of pottery, but is also extensively employed by the paper-maker and by the calico-bleacher. It is likewise used to a small extent in the manufacture of alum, artificial ultramarine, and some other chemical products. In 1880 the quantity of china clay raised in Cornwall amounted to 278,572 tons, and in Devon to 25,370 tons.

See J. H. Collins, in *Journal of the Society of Arts*, May 5, 1876; and *Treatise on China Clay*, by D. Cook, 1880.

KAPURTHÁLA, or **KOPURTHELLA**, a native state in the Punjab, India, lying between 31° 9′ and 31° 39′ 30″ N. lat., and between 73° 3′ 15″ and 75° 38′ 30″ E. long. Area, 800 square miles; estimated population, 250,000. The Kapurthála family at one time held possessions on both sides of the Sutlej, and also in the Bari Doáb. The cis-Sutlej estates and scattered possessions in the Bari Doáb were escheated owing to the hostility of the chief in the first Sikh war, but the latter possessions were afterwards restored to the family in recognition of the loyalty of Rájá Randhír Sinh during the mutiny of 1857, when he led a contingent to Oudh which did good service. He also received a grant of estates in Oudh, 850 square miles in extent, and with an estimated population of 220,000. In these tracts, however, he exercised no sovereign powers, occupying the status only of a large landholder. His total revenue is estimated at £170,000, subject to a charge of £13,000 payable to the British Government in commutation of military service.

KARÁCHI. See Kurrachee.

KARA-HISSAR is the name of several towns in Asiatic Turkey. (1.) Afium Kara Hissar has been already noticed, vol. i. p. 219. (2.) Eski Kara Hissar, lies 10 miles to the north of Afium. It is identified with the ancient Synnada, which in the time of Pliny was the chief town of a considerable district. The quarries of Docimia, which furnished the famous Synnadic or Docimitic marble, are about 2½ miles distant, and in the town numerous traces have been found of ancient sculpture in various stages of execution (see Hamilton's *Asia Minor*, i. 461, ii. 177; and Texier, *Asie Mineure*). (3.) The eastern Kara-Hissar, usually distinguished by the prefix Shabin (*i. e.*, "alum"), is situated in the vilayet of Siwas, about 70 miles east of Niksar, on a northern tributary of the Lycus. It is the seat of a mutaşarrif or vice-governor, and on a hill to the east there is an old castle, which must at one time have been of military importance. The population is estimated at 11,000, mainly Mohammedans, though Armenians also form an important element. The district is rich in mineral products—silver, lead, copper, and iron; but only the alum mines, yielding from 120 to 250 tons per annum, are worked. The remains of the citadel, the ruins of a Byzantine church, traces of Roman brickwork, ancient coins, and a few Greek and Latin inscriptions, all go to show that Kara-Hissar has passed through many vicissitudes. The old town was evidently built not at the foot but at the steep slope of the hill, tier above tier. In 1473 Kara-Hissar made voluntary submission to Sultan Mohammed II. A full description, with a plan of the town and neighborhood, is given by Barth in Petermann's *Mittheilungen*, *Ergänzungsheft*, 1860. See also Taylor's "Journal," etc., in *Jour. Roy. Geogr. Soc.*, 1868.

KARAITES, or Caraites, a Jewish sect of the Middle Ages, claiming to be distinguished by adherence to Scripture as contrasted with oral tradition, whence the name (from קרא, as if "readers," *scripturarii*, sometimes also בְּנֵי מִקְרָא). They have frequently been identified with the Sadducees or with the Samaritans, with neither of whom have they any historical connection or much spiritual affinity. The schism arose at Baghdad about the middle of the 8th century, when the hereditary claims of Anan, a learned Talmudist, to the office of Resh Galutha were set aside by the Gaonim or heads of rabbinical schools at Sura and Pumbeditha because he was believed to undervalue the authority of the Talmud. An appeal by Anan to the caliph proved unsuccessful, and he appears even to have been imprisoned for some time; but ultimately he was permitted to migrate along with his followers to Palestine, where they erected in Jerusalem a synagogue which continued to be maintained until the time of the crusades. From this centre the sect diffused itself thinly over Syria, spread into Egypt, and ultimately reached Southeastern Europe. Anan, who is said to have died in 765 A.D., was the author of a commentary on the Pentateuch and other works in Talmudic Hebrew and Arabic,—all of which unfortunately are lost; for our knowledge of the distinctive principles maintained by him we are thus left entirely dependent on the hostile indications of opponents. In general we know that he showed great bitterness against the Talmud and its upholders (the "Rabbanites") for their falsification of the written law by arbitrary additions and subtractions, but there is nothing to indicate that he himself had the insight or the fervor by which he could have become the pioneer of any really great reformation in religion or morals. The questions in dispute appear to have turned entirely on points of very minute detail. Several of them related to the regulation of the calendar, the new moon, for example, being fixed by the Karaites by direct observation, not by astronomical calculation, and the intercalary year also being determined empirically; others related to paschal and pentecostal ritual, such as the precise hour for killing the lamb or for burning its remains. The differences which affected social life most deeply were those relating to Sabbath observance and the forbidden degrees of marriage, the Karaites not recognizing any distinction between relationships of consanguinity and those of affinity, while in their zeal to avoid all risk of infringement of the sacredness of the day of rest they prohibited the burning of any light at all in their houses from sunset to sunset. Little information as to the Karaites can be derived from their liturgies, which are comparatively modern; though differing from those used by the Rabbinical Jews, they are not characterized by any marked divergence in principle. The controversies as to the rule of faith which so deeply divided the Christian church in the 16th century gave to this obscure sect an illusory and passing importance, the Catholics frequently hurling the epithet Karaei, in token of contempt, at the Protestants, who in their turn willingly accepted it as sufficiently descriptive of their attitude towards Scripture. The Karaites never have been numerous; the present community in Jerusalem numbers only about ten families. They occur in Constantinople and elsewhere in Turkey, but are chiefly met with in Southern Russia, and especially in the Crimea, where in 1874 they numbered some 6000, chiefly in Eupatoria, Theodosia, and Sebastopol. In the Crimea their historical capital and chief synagogue was formerly the "Jews' Castle" (Tshufut-Kale), near Bakhchisarai. The place is now deserted; its cemetery was the seat of Firkowitsch's notorious forgeries (inscriptions of 1st century), by which he sought to establish a fabulous antiquity for his sect. According to Strack (*A. Firkowitsch u. seine Entdeckungen* 1876), the oldest tombstones do not go back beyond the 14th century. The modern Karaites are generally well spoken of for their honesty, perseverance, and simple habits of life; but their enslavement to tradition is quite as complete as that of any Talmudist could possibly be.

Among the older authorities may be mentioned Morinus, *Exercit. Bibl.*, lib. ii. ex. 7, 1669; and Triglandius, *Diatribe de Secta Karæorum*, 1703. See Gräts, *Gesch. der Juden*, especially in vol. v., 1860; and Fürst, *Gesch. des Karäerthums*, 1865.

KARAKORUM, or Karakoram, a name applied to a city, a mountain range, and a mountain pass in Central Asia. For the range and pass see Kuen-lun. The ancient city or rather camping-ground of Karakorum (the Caracaron of Marco Polo), was situated near the upper course of the Orkhon, a tributary of the Selenga. Founded, according to Chinese authority, by Buku, khan of the Uigurs, in the 8th century, it was at the time of Jenghiz the chief seat of Togrul Wang, Marco Polo's Prester John, and under Jenghiz's successor Okkodai it became what it continued to be till 1256, the capital of the Mongolian power. It was visited by Carpini (1246) and Rubruquis (1253). Some ruins of earthworks are still to be traced.

See Rémusat, *Rech. sur la ville de Karakorum*; Yule, *Marco Polo*; *Geographical Magazine*, 1874.

KARAMZIN, Nikolai Mikhailovich (1765-1826), Russian historian, critic, novelist, and poet, was born at the village of Mikhailovka, in the government of Orenburg, and not at Simbirsk, as many of his English and German biographers incorrectly state, on the 1st of December (old style), 1765. His father, an officer in the Russian army, of Tartar extraction, was anxious that his son should follow his own profession. The idea was not, however, persevered in, and the future author was sent to Moscow to study under Professor Schaden, whence he afterwards removed to St. Petersburg, where he made the acquaintance of Dmitrieff, a Russian poet of some merit, and occupied himself with translating essays by foreign writers into his native language. After residing some time at St. Petersburg, he went to Simbirsk, where he lived in retirement till induced by a friend to revisit Moscow. There, finding himself in the midst of the society of learned men, he again betook himself to literary work. In 1789 he resolved to travel, and visited Germany, France, Switzerland, and England. On his return he published his *Letters of a Russian Traveller*, which met with great success. They are elegantly written, and show the feeling of a poet for the scenery of the countries through which he passed, but to many readers of the present day they will appear insipidly sentimental. These letters were first printed in the *Moscow Journal*, but were afterwards collected and issued in 6 vols. (1797–1801). In the same periodical Karamzin also published translations of some of the tales of Marmontel, whose sickly elegance was then in fashion, and some of his own original stories, among which may be mentioned *Poor Liza* and *Natalia the Boyar's Daughter*. To judge by the cheap editions which are continually appearing, these tales still find readers in Russia. The best of them is *Marfa the Posadnitza of Novgorod*, but all are more or less disfigured by the sentimentalism already referred to. In 1794 and 1795 Karamzin abandoned his literary journal, and published a miscellany in two volumes, entitled *Aglaia*, in which appeared, among other things, "The Island of Bornholm" and "Ilia Mourometz," a story based upon the adventures of the well-known hero of many a Russian legend. In 1797–99 he issued another miscellany or poetical almanac, *The Aonides*, in conjunction with Derzhávin and Dmitrieff. In 1798 he compiled the *Pantheon*, a collection of pieces from the works of the most celebrated authors ancient and modern, translated into Russian. Many of his lighter productions were subsequently printed by him in a volume entitled *My Trifles*. In 1802 and 1803 Karamzin edited the journal *The European Messenger*. It was not till after the publication of this work that he realized where his strength lay, and commenced his *History of the Russian Empire*. In order to accomplish the task, he secluded himself for some years; and, on the cause of his retirement becoming known to the emperor Alexander, Karamzin was invited to Tver, where he read to the emperor the first eight volumes of his history. In 1816 he removed to St. Petersburg, where he spent the happiest days of his life, enjoying the favor of Alexander, and submitting to him the sheets of his great work, which the emperor read over with him in the gardens of the palace of Tzarskoë Selo. He did not, however, live to carry his work farther than the eleventh volume, terminating it at the accession of Michael Romanoff in 1613. In 1825 the health of Karamzin began to decline, and the emperor Nicholas, who had succeeded to the throne in that year, and continued the favors which his brother had bestowed on the historian, ordered a frigate to be got ready, that he might visit a warmer climate to recruit his failing powers. It was, however, too late; on the 22d of May (old style), 1826, Karamzin died in the Taurida palace. A monument was erected to his memory at Simbirsk in the year 1845.

As an historian Karamzin has deservedly a very high reputation. Till the appearance of his work little had been done in this direction in Russia. The preceding attempt of Tatistcheff was merely a rough sketch, inelegant in style, and without the true spirit of criticism. Karamzin was most industrious in accumulating materials, and the notes to his volumes are mines of curious information. The style of his history is elegant and flowing, modelled rather upon the easy sentences of the French prose writers than the long periodical paragraphs of the old Slavonic school. Perhaps Karamzin may justly be censured for the false gloss and romantic air thrown over the early Russian annals, concealing the coarseness and cruelty of the native manners; in this respect he reminds us of Sir Walter Scott, whose writings were at this time creating a great sensation throughout Europe, and probably had their influence upon our author. Karamzin appears openly as the panegyrist of the autocracy; indeed, his work has been styled the "Epic of Despotism." He does not hesitate to avow his admiration of Ivan the Terrible, and considers him and his grandfather Ivan III. as the builders up of Russian greatness, a glory which in his earlier writings, perhaps at that time more under the influence of Western ideas, he had assigned to Peter the Great. In the battle-pieces (*e. g.*, the description of the field of Koulikovo, the taking of Kazan, &c.) we find considerable powers of description; and the characters of many of the chief personages in the Russian annals are drawn in firm and bold lines. The study of ethnology and historical criticism has advanced so much since the days of Karamzin that some of his work has necessarily become obsolete, but it will always be read with pleasure and advantage. No translation into English of this *opus magnum* has appeared, although even modern Greek boasts its version. Of the French translation by MM. Saint Thomas and Jauffret Karamzin himself had a mean opinion; he declared that the average number of mistakes in each of the many volumes was two hundred. As a critic Karamzin was of great service to his country; in fact he may be regarded as the founder of the review and essay (in the Western style) among the Russians. He had read extensively, and modelled himself upon Addison and others of our best writers. As a novelist and writer of tales he imitated the sentimental school then in vogue throughout Europe. As a poet he occupies a subordinate place, but his productions are above mediocrity. Many of his lyrics are graceful and melodious, and the sentiments expressed are those of a benevolent and healthy-minded man. The little poem entitled *The Grave* deserves special mention.

KARASU-BAZAR, a town of Russia, in the government of Taurida, near the rivers Tunas and Karasu, in 45° 3′ N. lat. and 34° 26′ E. long., 27 miles from Simpheropol on the road to Theodosia. The site is low, but it is surrounded by hills, one of which, the Ak-Kaya or White Rock, not only affords protection from the north wind, but so reflects the sunshine upon the town that it enjoys a much milder climate than the surrounding region. The dirty streets full of petty traders, the gloomy bazaar with its multitude of small shops, the market squares, the blind alleys, the little gates in the dead court-yard walls, all give the place the stamp of a Tartar or Turkish town, and remind the visitor that here was after 1763 the seat of the Crimean khans. In 1861 there were twenty-four mosques, but several have fallen into decay; in one of them is the tomb of Yakubaga-Rudzvitch, the founder of the well-known Crimean family. Of the numerous caravanserais, the Tash-Khan is the most notable—a strong half-fortified building erected in 1656. Placed on the high road between Simpheropol and Kertch, and in the midst of a country rich in corn-land, vineyards, and gardens, Karasu-Bazar used to be a chief seat of commercial activity in the Crimea; but it is gradually declining in importance. The population consists of Armenians, Greeks, Jews, Tartars, and (in smaller numbers) Russians. The bulk of the trade is in the hands of the Armenians, and they are also the owners of the great proportion of the buildings in the town. About 2000 of the Jews are what are known as Krimtchaks, or sometimes as Constantinopolitan Jews. From the ordinary "rabbinical Jews" of Russia they differ by wearing the Tartar costume and by the use of the Tartar tongue, instead of the German jargon. They are engaged in making leather, Tartar knives, Tartar embroidery, and similar articles. The population of Karasu-Bazar is given by the St. Petersburg *Calendar* for 1874 as 14,397. Round about the town lie cemeteries of unusual extent.

By Thunman and others Karasu-Bazar has been identified with the Greek town of Mauron-Kastron, but Professor Bruhn thinks that, as there has never apparently been any fortress at Karasu-Bazar, the site of the "Black Castle" is more probably at Mangup-Kale. The caves of Akkaya, however, give evidence of early occupation of the spot. When in 1736 Khan Feta Ghirei was driven by the Russians from Bakhchisarai he settled at Karasu-Basar, but next year the town was captured, plundered, and burned by General Douglas. In 1784 it was the temporary seat of the Russian administration of the Crimea.

KARATCHEFF, a town of Russia, in the government of Orel, near the river Snezheti, 59 miles northwest from Orel on the railway to Smolensk. The population is given in the St. Petersburg Calendar for 1874 at 10,023. A yearly fair is held in the adjoining village of Berezhka, and a good trade is carried on in agricultural produce, as well as in the oil, wax candles, rope, etc., furnished by the local industry.

Karatcheff is mentioned as early as 1146. In the 17th century it was one of the frontier or "watch" towns of Russia towards the Crimea, and sent out its scouts as far as Kursk. About half the inhabitants perished of the plague in 1654. Only since 1778 has the town been at the head of a district in Orel; it formerly belonged to the governments of Kieff (1708) and Bielgorod (1732).

KARATEGIN, a country of Central Asia, now subject to Bokhara, consisting of a highland district between the Hissar and the Darwaz chains. It is bounded on the N. by the Russian province of Ferghana (Khokand), on the E. by Kashgar, on the S. by independent Darwaz, and on the W. by Hissar and other Bokharian provinces. The plateau is traversed by the Surkhab or Kyzyl Su, a right-hand tributary of the Oxus, which rises in the Alai mountains, and for the first 132 miles of its course "runs through gorges of extreme wildness." Below the hamlet of Khantia-hota (according to Abramof), the valley widens considerably, and at Sar-i-pul, the only point where it is crossed by a bridge, the river has a depth of 7 feet. With the neighboring lands Karategin has no communication except during summer, that is, from May to September. The winter climate is extremely severe even in the more populous districts: the snow begins to fall in October, and it is May before it disappears. During the warmer months, however, the mountain sides are richly clothed with the foliage of maple, mountain ash, apple, pear, and walnut trees; the orchards furnish, not only apples and pears, but peaches, cherries, mulberries, and apricots; and the farmers grow so much corn that the surplus is a regular article of export to the neighboring states. Every householder has a portion of the soil which he can call his own: but if he leave it fallow for more than three years in succession, he runs the risk of having it confiscated by the Government. Some proprietors possess as much as from 300 to 500 acres, and keep from ten to twelve yoke of work oxen and from six to twelve laborers. The necessity of storing fodder to last for five months tends to keep low the number of domestic cattle. Both cattle and horses are of a small and hardy breed. The wild animals—bears, wolves, foxes, jackals, lynxes, martens, otters, etc.—are of no small economic importance; but the hunters and trappers are obliged to sell their pelts to the Government at half the market price. Rough woollen cloth and mohair are woven by the natives during their long winter; and they make excellent firearms and other weapons. Trade is still carried on by barter, there being neither coinage nor fixed market-place in the country. Foreign wares—iron, cotton, silk, combs, mirrors, soap, etc.—are introduced by merchants from Kashgar and Hissar, who receive in exchange mainly cattle, hides, and skins. Gold, however, is found in various places, more particularly at Sarym Saly (according to Abramof); and there are salt-pits in the mountains near Langar-sha. The chief town, Harm or Gharm, is a place of some eight hundred houses (Arandarenko says three hundred and forty) situated on a hill on the right bank of the Surkhab. With the exception of about five thousand tents of nomadizing Kirghiz, the inhabitants of Karategin are understood to be Galtchas—by some identified with, by others distinguished from, the Tadjiks. They speak a Persian dialect and profess the Mohammedan faith. Schuyler, who met with some of them at Khokand, describes the Karateginese as swarthy, thickset, good-natured fellows, who, gathered in a circle, would after prayers and supper tell tale after tale and legend after legend till they dropped off to sleep. It is calculated that the settled population of Karategin may amount to about 382,000 souls, the number of households being 36,672, distributed among four hundred settlements.

Karategin has hardly been touched by European exploration (the first expedition was that of Oshanin in 1878); and of its history almost nothing is known. The native princes or shahs, who claimed to be descended from Alexander the Great, were till 1868 practically independent, and kept up a considerable degree of state. Their allegiance was indeed claimed in an ineffective way by Khokand, but eventually Bokhara took advantage of intestine feuds to secure their real submission. Some geographers (Kiepert, for example) have been disposed to recognise in Karategin the Paraetaceni of Alexander's historians, and Colonel Yule has conjecturally identified it with the Holumo (Garma?) of Hwen Tsang.

See Abramof in *Journ. Roy. Geogr. Soc.*, 1871; Arandarenko's paper in the *Russische Revue*, epitomized in *Das Ausland*, 1878; and letters from Oshanin in *Globus*, 1878. See also Colonel Yule's essay prefixed to Wood's *Journey to the Source of the River Oxus*, 1872.

KARAULI, or Kerowly, a native state in Rájputana, India, lying between 26° 3′ and 26° 49′ N. lat., and between 76° 35′ and 77° 26′ E. long. It is entirely surrounded by neighboring states, and has an area of about 1260 miles, and an estimated population of 140,000. Almost the entire territory is composed of hills and broken ground, but there are no lofty peaks, the highest having an elevation of less than 1400 feet above sea-level. The Chambal river flows along the southeast boundary of the state. Iron ore and building stone comprise the mineral resources of Karauli. The prevailing agricultural products are *bájra* and *jodr*, which form the staple food of the people. The only manufactures consist of a little weaving, dyeing, wood-turning, and stone-cutting. The principal imports are piece goods, salt, sugar, cotton, buffaloes, and bullocks; the exports rice and goats. The Bráhmans form the most numerous class of the population. The Minas, who come next, make up the bulk of the cultivating class. The Rájputs, although numerically few, constitute the most important section. These belong almost entirely to the Jadu clan; they make good soldiers, but are indifferent agriculturists. The feudal aristocracy of the state consists entirely of Jadu *thakúrs* connected with the ruling house. They pay a tribute in lieu of constant military service, but in case of emergency or on occasions of state display they are bound to attend on the chief with their retainers. The mahárájá is the head of the clan, which claims descent from Krishna.

Karauli, or Kerowly, the capital of the above state, is situated in 26° 30′ N. lat. and 77° 4′ E. long. The town, which is fortified, is surrounded by a wall of sandstone, and is also protected on the north and east by deep winding ravines. The streets are narrow and irregular, and almost impassable for wheeled conveyances; there are, however, many costly houses and handsome temples, the sole building material being sandstone. The population is estimated at 28,000.

KARCZAG, or Kardszag, a corporate town of Hungary, and formerly the capital of the district of Great Cumania (now included in the county of Jász-Nagy-Kun-Szolnok), lies about 88 miles east-southeast of Budapest, with which city it is connected by railway, in 47° 19′ N. lat., 20° 56′ E. long. Karczag is a large straggling town, and contains Roman Catholic, Greek Orthodox, and Protestant churches, royal and magisterial courts of law, and tax and post-offices. The soil of the surrounding country is exceedingly humid and fertile, and enormous quantities of melons, fruit, grapes, wheat, maize, rape-seed, and mangcorn are grown. In the more marshy places water-fowl and tortoises are caught in large numbers. Population in 1880, 15,962, almost exclusively Magyars.

KÁRIKAL, a French town and settlement in India, situated on the southeast coast, within the limits of Tanjore district, 10° 55′ 10″ N. lat., 79° 52′ E. long., with an area of 52 square miles, and a population of 92,516. The site was purchased by the French from the Tanjore rájá in 1738. It was captured by the English in 1760, restored in 1765, again taken in 1768, and finally restored in 1816. It formed the base of Lally's operations against Tanjore. The town is neatly built on one of the mouths of the Kaveri (Cauvery), and carries on a brisk trade with Ceylon, Europe, and the French colonies, exporting rice, and importing chiefly European articles and timber. A chef de l'administration, subordinate to the government at Pondicherri, is in charge of the settlement.

KARMATHIANS. See **Arabia**, vol. ii. p. 227, and **Mohammedanism**.

KARNAK. See **Architecture**, vol. ii. p. 341, and **Egypt**, vol. vii. p. 674.

KARNÁL, a district in the lieutenant-governorship of the Punjab, India, lying between 29° 9′ and 30° 11′ N. lat., and between 76° 13′ and 77° 15′ 30″ E. long., bounded on the N. by Umballa (Ambala) and the Patiála state, W. by Patiála and Jínd states and by Rohták district, S. by Delhi district, and E. by the Jumna river. The area is 2351 square miles. Karnál forms a portion of the low dividing ridge which separates the watersheds of the Indus and the Jumna. The district falls naturally into two divisions,—the *bángar*, or upland plain, and the *khádar*, or low-lying land, which skirts the valley of the great river. The banks of the larger streams are fringed with magnificent forest trees, and groves of mangoes mark the neighborhood of every temple or homestead. Irrigation is afforded by the western Jumna canal. As a whole, Karnál is better supplied with trees than most of the plain country of the Punjab. The Jumna itself here presents the usual characteristics of the upper part of its course. Sandbanks shift from one side to the other of the main channel, and from time to time the whole stream suddenly changes its bed, transferring half a dozen villages together from Muzaffarnagar to Karnál, or *vice versa*. The district is famous for its sport.

The population in 1868 amounted to 610,927 (330,763 males and 280,164 females)—Hindus, 356,305; Mohammedans, 151,723; and "others," 93,604. Játs numbered 74,840, representing the chief agricultural element; Bráhmans, 52,396, most of them engaged in tillage; Rájputs, 47,860, chiefly Mohammedans; Chamárs, the landless laboring class, 37,053; pastoral Gújars, 20,857, about one-third of them Mohammedans. Five towns have a population exceeding 5000, viz., Karnál, 27,022; Pánipat, 25,276; Káithal, 14,940; Sewán, 6206; and Kunjpurah, 5163. The area under cultivation is 645,120 acres, the uncultivated area 860,800 acres, of which 578,027 are cultivable. The principal spring crop is wheat; the autumn harvest consists of rice, cotton, and sugar-cane, besides millets and pulses for home consumption. The growth of the more lucrative crops is on the increase. Grain and raw materials are exported to Umballa, Hissár, and Delhi,—the return trade consisting of European piece goods, salt, and refined sugar. A considerable quantity of cotton is woven for local use. Sal-ammoniac is obtained from the clay of Káithal and Gúla *tahsíls* to the value of £3450 per annum. Karnál town has a few blanket factories, and ornamental glassware is made at Pánipat. The Grand Trunk Road connects Karnál with Delhi and Umballa. The district is administered by a deputy commissioner. In 1872–73 the revenue was £78,847, of which £67,048 was derived from the land; and education was afforded by 99 schools, with 2541 pupils.

No district of India can boast of a more ancient history than Karnál, as almost every town or stream is connected with the legends of the *Mahábhárata*. The city of Karnál itself is said to owe its foundation to Rájá Karna, the mythical champion of the Kauravas in the great war which forms the theme of the national epic. Pánipat, in the south of the district, is said to have been one of the pledges demanded from Duryodhana by Yudisthira as the price of peace in that famous conflict. In historical times the plains of Pánipat have three times proved the theatre of battles which decided the fate of Upper India. It was here that Ibráhím Lodí and his vast host were defeated in 1526 by the veteran army of Baber; in 1556 Akbar reasserted the claims of his family on the same battlefield against the Hindu general of the house of Sher Sháh, which had driven the heirs of Baber from the throne for a brief interval; and at Pánipat too, on the 7th of January, 1761, the Marhattá confederation was defeated by Ahmed Sháh Duráni. During the troublous period which ensued, the Síkhs managed to introduce themselves, and in 1767 one of their chieftains, Desu Sinh, appropriated the fort of Káithal, which had been built during the reign of Akbar. His descendants, the Bháis of Káithal, were reckoned amongst the most important cis-Sutlej princes. Different portions of this district have lapsed from time to time into the hands of the British. The towns are not generally in a flourishing condition, but the district possesses considerable commerce and great agricultural resources.

Karnál, a municipal town, the headquarters of the above district, 29° 42′ 17″ N. lat., 77° 1′ 45″ E. long., with a population in 1868 of 27,022. The civil station stretches to the west of the town. The Government maintains a large stud farm. There is a brisk trade with Delhi and Umballa; country cloth is manufactured for local consumption, and blankets for export, the latter trade employing about one hundred looms.

KARNÚL, a district in Madras, India, bounded on the N. by the Tungabhadra and Kistna rivers and by Kistna district, S. by Cuddapah and Bellary, E. by Nellore and Kistna, and W. by Bellary, lies between 14° 54′ and 16° 14′ N. lat., and between 77° 46′ and 79° 15′ E. long., with an area of 7151 square miles.

Two long mountain ranges, the Nallamalais and the Yellamalais, extend in parallel lines, north and south, through the centre of the district. The principal heights of the Nallamalai range are Biranikonda (3149 feet), Gundlabráhmeswaram (3055 feet), and Durugapukonda (3086 feet). The Yellamalai is a low range, generally flat-topped with scarped sides; the highest point is about 2000 feet. Several low ridges run parallel to the Nallamalais, broken here and there by gorges, through which mountain streams take their course. Several of these gaps were dammed across under native rule, and tanks formed for purposes of cultivation. One of these is the magnificent Cumbum Tank, closed in by a dam across the Gundlakamma river. It covers an area of nearly 15 square miles. The principal rivers are the Tungabhadra and Kistna, which bound the district on the north. When in flood, the Tungabhadra averages 900 yards broad and 15 feet deep. In 1860 an anicut or weir was built across the river at Sunkesala, 18 miles above Karnúl town, and a canal dug for irrigation and navigation. The Kistna flows here chiefly through uninhabited jungles, sometimes in long smooth reaches, with intervening shingly rapids. The Bhavanási rises on the Nallamalais, and falls into the Kistna at Sungameswaram, a place of pilgrimage. Below their junction is a whirlpool which is regarded as holy by the native pilgrims. There are three recognized forest divisions in the district,—the Nallamalai, the Vellikonda, and the Yellamalai. The first two are conserved by the forest department. The chief timber-trees are teak and *yepi*. In the northern parts, where the jungle is poor, there are extensive level grassy lands, which afford pasture to numerous herds of cattle. The jungle products consist of gall-nuts, honey, wax, tamarinds, stick-lac, and bamboo rice. Tigers are numerous in the Nallamalais, and commit great havoc among the herds of cattle pastured in the jungles. The other animals include cheetahs, wolves, hyænas, foxes, bears, spotted deer, wild goats, several varieties of antelopes, bison, porcupines, and pigs.

The population in 1871 numbered 914,432, of whom 819,453 were Hindus, 60,579 Mohammedans, and about 3844 Christians, chiefly Roman Catholics, whose principal station is at Polur. The Catholics originally belonged to the Kapu caste, and their conversion to Christianity has not made any material change in their manners and customs. They eat and drink with Hindus, and in several cases intermarry with them. The Protestant converts are almost entirely low-caste natives in rural tracts. The wild tribes or Chenchus live on the Nallamalais in small communities called *gudems*. Each *gudem* includes several tribes, and has a portion of the hills allotted to it by common consent. The Chenchus are unwilling to cultivate, but are sometimes employed by the villagers in the plains to watch their fields during the harvest, and some of them are employed as road watchmen. During the hill festival they collect fees from pilgrims. Some of them also enjoy free lands for guarding the jungles. The principal towns are Karnúl (population in 1871, 25,579), Nandial (9378), Cumbum (7137), Gúdur (5825), Meddikera (8586), Kodumúr (6064), and Paikali (5076).

The chief crops are rice, wheat, and other cereals, gram, cotton, tobacco, indigo, sugar-cane, betel, chillies, etc. The staple of the district is *cholam* (*Sorghum vulgare*). The total area under cultivation in 1877 was 2,089,689 acres, area uncultivated but capable of cultivation 1,017,389 acres, and uncultivable waste 1,396,602 acres. There is not much waste land in the plains, but there is a good deal in the Nallamalais, which was cultivated in ancient times, but is now overgrown with jungle. The main canal of the Madras Irrigation Company, intended for both irrigation and navigation, runs 142 miles within Karnúl; the extent actually irrigated in 1875–76 was 10,479 acres. Both Karnúl and the neighboring district of Bellary suffer from droughts at periodic intervals; and, the mass of the population being small landowners, with no reserve capital, the failure of a single monsoon involves general distress; 1804, 1810, 1824, 1833, 1854, 1866, and 1876 were all years of drought and consequent scarcity. In the famine of 1876–77 nearly £600,000 was spent on relief works, yet the number of deaths recorded from 1st October, 1876, to 30th June, 1877, was 48,000, as compared with 19,974 in the corresponding period of the previous year. The chief manufacture in Karnúl is weaving. Iron is worked at the foot of the Nallamalais. Of late years this industry has greatly diminished, native iron being superseded for agricultural implements by imported iron. Diamond mines have been worked from early times in the quartzite beds of the Yellamalai hills, which are now rented out by Government for about £20 a year. Quarrying stones is an important industry. Indigo and sugar are also manufactured. Weekly markets are held in most of the towns and important villages. There is little or no export of grain. Salt is imported from the eastern coast, but earth salt is largely manufactured. Cotton, indigo, tobacco, and hides, with cotton carpets and cotton cloth, are the chief exports. European piece goods, areca-nut, cocoa-nut, and various dry condiments required for native households, are the chief imports. The total net revenue of the district in 1870–71 was £196,468, the total civil expenditure £46,998; the land revenue was £135,929. Education is backward, only 4 per cent. of the population in 1871 being returned as able to read and write. In 1875 there were altogether 263 schools, with 5781 pupils. The climate is on the whole healthy. The prevailing winds are west and northeast, and the mean temperature is about 85° Fahr. The total annual rainfall is about 35 inches. In the villages along the foot of the Nallamalais, a severe type of fever prevails, accompanied by enlargement of the spleen.

Karnúl, the headquarters of the above district, in 15° 49′ 58″ N. lat. and 78° 5′ 29″ E. long., had a population in 1871 of 25,579. It is a hot unpleasant town, built on rocky soil at the junction of the Hindri and Tungabhadra rivers. The old Hindu fort was levelled in 1865, with the exception of one of the gates, which was preserved as a specimen of ancient architecture, and in some measure restored. In the famine of 1877–78 Karnúl and the surrounding country suffered terribly, owing to their isolated position. The nearest railway station is Gooty, 80 miles distant; and it was only by extraordinary efforts that food was conveyed to the town. The population is half Hindu and half Moslem, this unusual proportion marking the long rule of the Pathán nawábs.

KARS, a fortified town of Armenia, formerly at the head of a sandjak in the Turkish vilayet of Erzeroum, but since 1878 the centre of a territory attached to the Russian governor-generalship of the Caucasus. It is situated in 40° 36′ 52″ N. lat. and 43° 5′ 76″ E. long., 30 miles southwest of Alexandropol (Gumri) and 130 miles northeast of Erzeroum, on the eastern end of a spur of the Soghanli Dagh, the site of the town proper being cut off from the rest of the range by the Kars Tchai, a sub-tributary of the Araxes. There are three considerable suburbs,—Orta Kapi to the south, Bairam Pasha to the east, and Timur Pasha on the western side of the river. To the southeastward opens up a vast plain. Owing to the bareness of the dark basalt hills, and the sombre color of the buildings, a touch of melancholy mingles with the picturesqueness of the view. At the northwest corner of the town, overhanging the river, rises the ancient citadel (the Itch Kaleh of the Turks), which in earlier times was a strong military post, but is now of almost no moment in a regular siege, being commanded completely by several of the surrounding eminences. The value of the position depends on the line of forts, and even this is greatly diminished by the fact that they are disposed in a circuit of about 10 miles round the town. Of chief importance are the works on the Kara Dagh heights to the northeast and the line on the heights above the left bank of the river. The population of Kars was at one time estimated at 40,000; but, according to Baron von Seidlitz, it had in 1878 only 8672 inhabitants (including 7330 Turks, 1191 Armenians, 138 Greeks).

Though during the 9th and 10th centuries the seat of an independent Armenian principality, Kars has nothing to boast of beyond its military fame. The citadel, it would appear, was built by Amurath III. during the war with Persia, in the close of the 16th century. It was strong enough to stand a siege by Nadir Shah in 1731, and in 1807 it successfully resisted the Russians. After a brave defence it surrendered on 23d June, 1828, to the Russian general Paskievitch, 11,000 men becoming prisoners of war. During the Crimean war the Turkish garrison, guided and stimulated by General Williams (afterwards knighted as Sir W. Fenwick Williams of Kars) and other foreign officers, kept the Russians gallantly at bay during a protracted siege; but, after the garrison had been devastated by cholera, and food had utterly failed, nothing was left but to capitulate (November, 1855). The fortress was again stormed by the Russians in the war of 1877–78.

See Kmety, *The Defence of Kars*, 1856, translated from the German; Lake, *Kars and our Captivity in Russia*, 1856, and *Narrative of the Defence of Kars*, 1857; Dr. Sandwith, *The Siege of Kars*, 1856; C. B. Norman, *Armenia and the Campaign of 1877*, 1878; Greene, *Russian Army and its Campaigns in Turkey*, 1879.

KARSHI, an important town of Central Asia, the centre of a begship dependent on Bokhara. It is situated about 85 miles south-southwest of Samarkand, in a vast plain at the junction of two of the main confluents of the Kashkadarya, a river which, though fed by numerous mountain streams, soon loses itself in the sands. It is a large and straggling place, with a circuit of 5 miles, and the population within the walls amounts to 25,000. There are three colleges, with accommodation for upwards of three hundred students. The Biki mosque is a fine building inlaid with blue and white tiles. All the ordinary houses are built of clay, but they are often two stories high. Along the river stretches a fine public promenade sheltered by clumps of poplars. Round the town lie gardens and fields watered from wells. Poppies and tobacco are both largely grown, the tobacco being deemed the best in Central Asia. There is also a considerable trade in grain; but the commercial prosperity of Karshi is mainly due to the fact that it is a meeting-point for the roads from Samarkand, Bokhara, Hissar, Balkh, and Maimene, and serves as the mercantile centre for the surrounding steppes, the market where horses are obtained for the caravans, and where the Turkomans and Uzbegs dispose of the products of their camps (carpets, seats, etc.). The knives and weapons manufactured in Karshi are known as far as Persia and Arabia, and its coppersmiths turn out excellent work.

KÁRWÁR, or **Carwar**, the chief town and head quarters station of North Kánara district, Bombay, 50 miles southeast of Goa, 14° 50′ N. lat., 74° 14′ E. long. It was once an important place of commerce; the East India Company had a factory there in the year 1663. It is the only safe harbor all the year round between Bombay and Cochin. In the bay is a cluster of islets called the Oyster Rocks, on the largest of which is a lighthouse. There are two smaller islands in the bay, which afford good shelter to native craft and small vessels during the strong northwest winds that prevail from February to April. The average annual value of the imports at Kárwár port during the five years ending 1873–74 was £244,469, of the exports £310,884. Population in 1872, 13,263,

KASAN. See Kazan.

KASANLIK, or Kezanlyk, a town of Roumelia, in the vilayet of Adrianople, is situated at the foot of the Balkans, about 5 miles south of the Shipka Pass, in a highly fertile plain watered by the Tundja and its numerous tributaries. Throughout the plain there are extensive fields of roses grown for the manufacture of attar of roses, which is exported largely to western Europe. Maize is also grown; and cattle and sheep are reared in considerable numbers. The town is surrounded by valuable woods of walnut trees. The Russo-Turkish war of 1877–78 has done serious injury to the prosperity of the whole region, and has told on the production of attar of roses, which formerly was estimated at about 200 gallons for the Kasanlik district. The population is variously estimated at from 10,000 to 12,000. Two-thirds of these are Bulgarians and Christians; the remainder are Turks.

KASCHAU (Hung., *Kassa;* Lat., *Cassovia*), an ancient royal free town, and capital of the cis-Tisian county of Abauj, Hungary, is pleasantly situated on the right bank of the Hernád, in a valley surrounded by sloping vineyards, about 130 miles northeast from Budapest, with which city, as also with Cracow, Lemberg, and other centres, it is connected by railway, 48° 42′ N. lat., 21° 17′ E. long. Kaschau is the see of a Roman Catholic bishop suffragan of Eger (Erlau), the headquarters of the general administration for the county, and has royal and magisterial courts of law, as well as boards of assay, finance, and postal direction, and the supervision of the tobacco manufacture. Kaschau is one of the best built towns in Hungary, and consists of the inner town, intersected by the Csermel, which forms an island and is crossed by several bridges, and three suburbs (upper, middle, and lower) approached by a broad glacis. The most remarkable edifice, considered the grandest masterpiece of architectural skill in Hungary, is the cathedral of St. Elizabeth, situated in the great square, and built in a faultless Gothic style. Commenced about 1270 by Stephen V., the structure was continued 1324–82 by Queen Elizabeth, wife of Charles I., and her son Louis I., and finished about 1468, in the reign of Matthias I. (Corvinus). The interior was transformed in the 18th century to the Renaissance style, and restored in 1859–65. The church of St. Michael and the Franciscan or Garrison church date from the 13th century. The royal law academy, founded in 1659, and sanctioned by golden bull of King Leopold I. in 1660, has an extensive library; there are also a museum, a Roman Catholic upper gymnasium and seminary for priests, and other schools and benevolent institutions. Kaschau is the centre of the trade for the surrounding counties in wine, gall-nuts, salt, and most descriptions of grain, and from its commercial importance forms a kind of provincial capital. About 3 miles northwest of the town are the baths of Bankó, with alkaline and ferruginous springs. The population of Kaschau in 1880 amounted to 26,422 (in 1870 it was 21,742), consisting of Magyars, Germans, Slovaks, and Ruthens. The majority are Roman Catholics.

Kaschau consisted originally of two villages, Upper and Lower Kassa, of which the latter was created a town and granted special privileges by Béla IV. (1235). Under Stephen V. (1270) the two separate portions were united, and raised to the rank of a royal free town. In 1290 it was surrounded with walls. The subsequent history presents a long record of revolts, sieges, and disastrous conflagrations. In 1430 the plague carried off a great number of the inhabitants. In 1458 the right of minting money according to the pattern and value of the Buda coinage was granted to the municipality by King Matthias I. The bishopric was established in 1804. In the revolutionary war of 1848–49 the Hungarians were twice defeated before the walls of Kaschau by the Austrians under General Schlick, and the town was held successively by the Austrians, Hungarians, and Russians.

KASHGAR, or Káshghar, an important city of Eastern Turkestan, in 39° 24′ 26″ N. lat., 76° 6′ 47″ E. long., 4043 English feet above the sea-level. It consists of two towns, Kuhna Shahr or "old city," and Yangi Shahr or "new city," about 5 miles apart, and separated from one another by the Kizil Su, a tributary of the Tarim river, which receives and deposits in the distant lake Lob Nor the drainage of the vast semi-desert plain included between the Kuen-lun, Thian Shan, and Pamir mountains. Situated at the junction of routes from the valley of the Oxus, from Khokand and Samarkand, Almati, Aksu, and Khotan, the last two leading from China and India, Kashgar has been noted from very early times as a political and commercial centre. Like all other cities of Central Asia, it has changed hands repeatedly, but its greatest modern prominence is probably due to its having formed a few years ago the seat of government of the Amir Yakub Beg, surnamed the Atalik Ghazi, who established and for a brief period ruled with remarkable success a Mohammedan state comprising the chief cities of the Tarim basin from Turfan round along the skirt of the mountains to Khotan. During his rule both Russian and British missions visited Kashgar, and it is chiefly to this circumstance that we are indebted for a full and tolerably recent knowledge thereof. Kuhna Shahr is a small fortified city on high ground overlooking the river Tuman. Its walls are lofty and supported by buttress bastions with loopholed turrets at intervals; the fortifications, however, are but of hard clay, and are much out of repair. The city contains about 2500 houses. Beyond the bridge, a little way off, are the ruins of ancient Kashgar, which once covered a large extent of country on both sides of the Tuman, and the walls of which even now are 12 feet wide at the top and twice that in height. This city—Aski Shahr as it is now called—was destroyed in 1514 by Mirza Ababakar on the approach of Sultan Said Khan's invading army. About 2 miles to the north beyond the river is the shrine of Hazrat Afak, the saint king of the country, who died and was buried here in 1693. It is a handsome mausoleum faced with blue and white glazed tiles, standing under the shade of some magnificent silver poplars. About it Yakub Beg erected a commodious college, mosque, and monastery, the whole being surrounded by rich orchards, fruit gardens, and vineyards. The Yangi Shahr of Kashgar is, as its name implies, quite modern, having been built in 1838. It is of oblong shape, running north and south, and is entered by a single gateway. The walls are lofty and massive, and topped by turrets, while on each side is a projecting bastion to protect the curtains by a flank fire. The whole is surrounded by a deep and wide ditch, which can be filled from the river, at the risk, however, of bringing down the whole structure, for the walls are of mud, and stand upon a porous sandy soil. In the time of the Chinese, before Yakub Beg's sway, Yangi Shahr held a garrison of six thousand men, and was the residence of the *amban* or governor. Yakub erected his *orda* or palace on the site of the amban's residence, and two hundred ladies of his harem occupied a commodious inclosure hard by. The mixture of the various types seen in the markets of Kashgar has struck more than one traveller. A square-faced flat-nosed Calmuck, with high cheek bones and a ruddy hairless countenance, stands next to an Afghan of gigantic proportions, with nut-brown complexion, handsome features, and glossy black beard, while one's eye rests next on the fair, full face and Dutch built frame of the Andijani, who is jostled in turn by the familiar black-skinned and oily-faced Hindustani Mussulman, the muddy-complexioned opium-smoking Chinaman, and the brown-skinned bewhiskered and gentle-looking Badakshi, with high full forehead, long arched finely carved nose and oval face of the true Aryan stamp. The population of Kashgar at the time of the visit of Sir Douglas Forsyth's mission in 1873 was about 112,000.

With the overthrow of the Chinese rule in 1865 the manufacturing industries of Kashgar declined, and in the case of some of the profitable arts altogether disappeared. Silk culture and carpet manufacture have flourished for ages at Khotan, and the products always find a ready sale at Kashgar. Other manufactures consist of a strong coarse cotton cloth called *kham* (which forms the dress of the common people, and for winter wear is padded with cotton and quilted), boots and shoes, saddlery, felts, furs and sheep skins made up into cloaks, and various articles of domestic use. A curious street sight in Kashgar is presented by the hawkers of meat pies, pastry, and sweetmeats, which they trundle about on hand-barrows just as their counterparts do in Europe; while the knife-grinder's cart, and the vegetable seller with his tray or basket on his head, recall exactly similar itinerant traders further west.

The earliest mention of Kashgar of which we have any authentic record is during the second period of ascendency of the Han dynasty, when the Chinese general Pan-Shan conquered and wrested from the hands of their masters the Hiungnu, Yutien (Khotan), Sulei (Kashgar), and a group of states in the Tarim basin almost up to the foot of the Thian Shan mountains. This happened in 76 B.C., about the time that the Chinese and Roman empires attained their furthest expansion of dominion westward and eastward respectively, and were separated only by the breadth of the Caspian. Kashgar lies in the country which Ptolemy calls Scythia beyond the Imaus; in this he has a *Kasia Regio*, possibly exhibiting the name whence Kashgar is formed. Next ensues a long epoch of obscurity. The Chinese lost their hold over the western provinces, and Ptolemy found no successor to continue his investigations into the countries of the far East. In 634 Tai-tsung reëstablished Chinese sway over eastern Turkestan and Sulei (Kashgar), and other places were converted into garrison towns. It was shortly after this that Hwen Tsang passed through Kashgar (which he calls Kie-sha) on his return journey from India to China. The Buddhist religion, then fast decaying in India, was working its way to a new growth in China, and contemporaneously the Nestorian Christians were establishing bishoprics at Herat, Merv, and Samarkand, whence they subsequently proceeded to Kashgar, and finally to China itself. In the 8th century came the Arab invasion from the west, and we find Kashgar and Turkestan lending assistance to the reigning queen of Bokhara, to enable her to repel the enemy. But although the Mohammedan religion from the very commencement sustained checks, it nevertheless made its weight felt upon the independent states of Turkestan to the north and east, and thus acquired a steadily growing influence, which, aided as it was through the channels of trade, facilitated the spread of the faith, and brought it into serious collision with the Chinese religion, a struggle which has endured down to our day, and can by no means be said to be unlikely to recur, It was not, however, till the close of the 10th century that Islam was established at Kashgar, when a prince of the hereditary family of Bughra Khan became a convert thereto, and enforced it upon his subjects at the point of the sword. After an interval, during which the Kara Khitai, a nomad race from the northeast under rulers called the Gur Khans, became suzerains of Kashgar, the growing power of Jenghiz Khan began to overspread the Kashgar borders. This great conqueror in the space of six years overran the entire country from Azerbijan on the west to the Indus on the east, and from the steppes of Kipchak on the north to Seistan on the south, laying waste and butchering with a ferocity which is said to have left its traces for centuries after. The invasion of Jenghiz Khan had given a decided check to the progress of the Mohammedan creed, but on his death, and during the rule of the Chaghatai Khans, who became converts to that faith, Islam began to reassert its ascendency. In 1389–90 Timur the Mughal undertook a campaign for the conquest of Moghulistan, and one of his armies ravaged Kashgar, Andijan, and the intervening country. Moghulistan was at this time under the governorship of Khudadad, a beneficent and popular ruler, who at a later date entertained the famous embassy sent from Shah Rukh to the emperor of China. Kashgar next passed through a troublous time, and in 1514, on the invasion of the Khan Sultan Said, was destroyed by Mirza Ababakar, who with the aid of ten thousand men built the new fort with massive defences higher up on the banks of the Tuman. The dynasty of the Chaghatai Khans collapsed in 1572 by the dismemberment of the country between rival representatives; and soon after two powerful Khojah factions, the White and Black Mountaineers (*Ak* and *Kara Taghluk*), arose, whose dissensions and warfares, with the intervention of the Calmucks of Zungaria, fill up the history till 1759, when a Chinese army from Ili invaded the country, and, after perpetrating wholesale massacres, finally consolidated their authority by settling therein Chinese emigrants, together with a Manchu garrison. The Chinese had thoughts of pushing their conquests towards western Turkestan and Samarkand, the chiefs of which sent to ask assistance of the Afghan king Ahmed Shah. This monarch despatched an embassy to Peking to demand the restitution of the Mohammedan states of Central Asia, but the embassy was not well received, and Ahmed Shah was too much engaged with the Sikhs to attempt to enforce his demands by arms. The Chinese continued to hold Kashgar, with sundry interruptions from Mohammedan revolts, —one of the most serious occurring in 1827, when the territory was invaded and the city taken by Jahanghir Khojah; Chang-lung, however, the Chinese general of Ili, recovered possession of Kashgar and the other revolted cities in 1828. A revolt in 1829 under Mohammed Ali Khan and Yusuf, brother of Jahanghir, was more successful, and resulted in the concession of several important trade privileges to the Mohammedans of the district of Alty Shahr (the "six cities"), as it was then named. Until 1846 the country enjoyed peace under the just and liberal rule of Zahir-ud-din, the Chinese governor, but in that year a fresh Khojah revolt under Kath Tora led to his making himself master of the city, with circumstances of unbridled license and oppression. His reign was, however, brief, for at the end of seventy-five days, on the approach of the Chinese, he fled back to Khokand amid the jeers of the inhabitants. The last of the Khojah revolts (1857) was of about equal duration with the previous one, and took place under Wali-Khan, a degraded debauchee, and the murderer of the lamented traveller Adolf Schlagintweit. The great Tungani revolt, or insurrection of the Chinese Mohammedans, which broke out in 1862 in Kansuh, spread rapidly to Zungaria and through the line of towns in the Tarim basin. The Tungani troops in Yarkand rose, and (10th August, 1863) massacred some seven thousand Chinese, while the inhabitants of Kashgar, rising in their turn against their masters, invoked the aid of Sadik Beg, a Kurghis chief, who was reinforced by Buzurg Khan, the heir of Jahanghir, and Yakub Beg, his general, these being despatched at Sadik's request by the ruler of Khokand to raise what troops they could to aid his Mohammedan friends in Kashgar. Sadik Beg soon repented of having asked for a Khojah, and eventually marched against Kashgar, which by this time had succumbed to Buzurg Khan and Yakub Beg, but was defeated and driven back to Khokand. Buzurg Khan delivered himself up to indolence and debauchery, but Yakub Beg, with singular energy and perseverance, made himself master of Yangi Shahr, Yangi-Hissar, Yarkand, and other towns, and eventually became sole master of the country, Buzurg Khan proving himself totally unfitted for the post of ruler. Kashgar and the other cities of the Tarim basin remained under Yakub Beg's rule until 1877, when the Chinese regained possession of their ancient dominions after a campaign which, originally organized years before, and conducted in the most leisurely fashion, was characteristic of the measured tenacity and resolution with which this nation follow up a settled policy. Since the reoccupation of the country by the Chinese, trade has much declined, especially with India, this traffic being regarded as illegal by the Chinese authorities. Heavy exactions are made for military purposes, and considerable emigration has taken place to Ladak and India. (C. E. D. B.)

KASHÍ, the name given to the glazed and colored ornamentation of Mohammedan buildings in parts of Persia and India, and to the art of making it. The work is of two kinds—on clay (bricks or tiles), and on cakes of lime mortar. For surfaces of one color, domes, etc., both kinds are used, differing only in the shape of the tiles or mortar-cakes. Figured patterns are differently treated with the different materials. On clay tiles, the designs with their several colors are laid on by stencilling, and the tile then glazed. Designs in colored mortar work have each separate piece of color on a separate cake of hardened mortar, cut to the required shape; and these, glazed separately, are afterwards cemented together on the walls of the building, or first made up into complete panels, which are then set in their place on the walls. The designs are commonly foliage and flowers, or geometrical figures and interlacing arabesques, and inscriptions in Arabic and Persian characters, and are, many of them, very beautiful.

The colors chiefly used are blue, green, yellow, purple, brown, and white. A tile is first painted over with a very fine clay paste, to make a smooth surface on which to apply the color; and similarly the little mortar cakes are first painted, on the side to be colored, with a thin liquid glass. It is perhaps owing to defect in this part of the process, or to imperfect burning, that the tile figured work on some old buildings, particularly on the south side, has flaked off. The glazed work on mortar, and on tiles of one color, is generally more permanent.

The best specimens of káshí work in India are at Tatta and Hyderabad in Sind, and at Multán and Lahore in the Punjab. There are also buildings thus ornamented, chiefly of the time of Akbar and Jahangír (16th and 17th centuries), at Delhi, Agra, Gwalior, and some other places, but the best and most numerous are in the western provinces above named, particularly at Lahore and at Tatta. The buildings at Lahore having the finest figured káshí work are the mosque of Wazír Khan, the gateways of certain old pleasure gardens, and the Gola Sarai. There is a tomb at the same place (the tomb of Abd' ur Razzák) built in the early part of the 16th century, which bears the name of the blue dome, its covering being of clay bricks colored blue on the narrow exposed face. Another, built about fifty years later (the tomb of Shah Músa), is known as the green dome. It is covered with little mortar blocks, in shape half cylinders, colored and glazed on the flat face, and with two deep nicks on the rounded back to give a hold on the plaster in which they are set. A celebrated tomb at Meshhed in northern Persia bears the same name, and likewise another at Kirman; the domes of these buildings, however, though called green, are in reality blue. At Tatta the káshí work is all on clay tiles; there is no inlaid work of colored mortar. The finest of the buildings at Tatta, a mosque built by Shah Jahán, has lately had the defective parts of the figured tile-work restored.

The art is now carried on at Tatta, at Hala, a village 30 miles north of Hyderabad, and at a few other places.

KASHIN, a district town of Russia, in the government of Tver, 125 miles northeast of the government town, near the Kashinka, a sub-tributary of the Volga. A considerable trade is carried on in the despatch of grain to St. Petersburg. The chief buildings are the cathedral and three monastic establishments. Kashin, first mentioned about 1238, was in the 14th century a separate principality which contended with Tver for pre-eminence in the region. There are still some remains of the defences erected in 1661. Population, according to St. Petersburg Calendar for 1874, 7346.

KÂSHKÂR, also called CHITRÂL, from the residence of the prince, a high-lying Mohammedan state among the spurs of Hindú Kúsh, has been already spoken of under HINDÚ KÚSH (vol. xi. p. 747). Since that was published, a work (*Tribes of the Hindoo Koosh*, Calcutta, 1880) has come from the pen of Major Biddulph, the only European known to have visited the state, and we here enter a very few corrections or new particulars from his work. The geographical position of Kâshkâr is likely to give it great interest in the future. A considerable part of Upper Kâshkâr belongs to Yassin, in the Gilgit basin (see GILGIT, vol. x. p. 532). Indeed the left bank of the Chitrâl river, down to within 20 miles of Chitrâl itself, belongs to Yassin. The chief place of this Upper Kâshkâr is Mastúj (vol. x. p. 532). The rulers of the two states are of the same blood, sprung from a Khorâsâni adventurer who emigrated hither about the first half of the 17th century, and are respectively descended from two brothers of his family, Shâh Katôr and Shâh Khûshwakt, who lived a century later. The two royal families are hence known as *Katôré* and *Khûshwakté* respectively; they generally act in concert, though neither is dependent on the other. We know not the origin of the former name, but most probably it is connected with an ancient tribal name in KAFIRISTÂN (*q.v.*). The ruler of Chitrâl is known both as *Mihtar*, or "Prince," and by the pretentious title of *Bâdshâh*. He has five viziers, of whom the chief, or Dewân-Begi, has charge of the king's slave-agency, an important part of the reigning system. Under this the rulers of Chitrâl have come to regard the sale of their subjects as a legitimate and ordinary supplement to their revenue. But of late the market has become circumscribed. The population of the kingdom is estimated at 200,000, not including the tributary tribe of Bashgali Kafirs, who occupy a nearly parallel valley on the west, confluent with that of Kâshkâr. The ethnology of Kâshkâr is very intricate. The largest, and probably aboriginal, population are called *Kho*. Their language, *Khowâr*, is closely allied to the dialects of the Kafir tribes. There are also tribes in a depressed position, immigrants from the other side of the watershed, and speaking the language of Munjân, a hill canton of the Oxus valley, calling themselves *Yidghâh*. In the lower part of the valley is a race, also with a peculiar language, called *Gabar* (mentioned by Sultan Baber), and some broken tribes of Siâhposh, etc. All these constitute the lower or *ryot* class, who alone pay regular revenue, cannot hold slaves, and are styled *fakír mushkín* ("poor beggars"). Above them are several privileged classes, descended from the founders of the reigning family, or from older ruling families also of foreign blood. We may add that Chitrâl is identical with the *Shang-mi* of Hwen Tsang (644 A.D.), see *J. R. As. Soc.*, new ser., vol. vi. p. 114. A somewhat latter Chinese record gives, as an alternative name of Shang-mi, *Khiu-wei*, which evidently contains the *Kho* just mentioned. In this *Kho* also we have probably an element of *Choaspes*, the Greek name of the Chitrâl river. A singular point in Chitrâl history is the fact that it was invaded by a Chinese army about the middle of last century, probably in 1759–60, and continued to send occasional tribute to China at least to 1769, *i.e.*, twelve years after the battle of Plassy. This was brought to notice by the present writer in 1872 (*J. R. G. S.*, xlii. 477), when tracing the curious history of the name *Bolor*. And now Major Biddulph has found in the country itself the memory of the Chinese invasion, and thus entire corroboration of the identification of the Chinese *Poloeul* or Bolor with Kâshkâr. (H. Y.)

KASHMÍR, or CASHMERE, an elevated and enclosed valley in the Himalaya mountains, north of the Punjab. It is surrounded by lofty hills, with one opening on the west, by which flows out from the valley the river Jhelum. The enclosing hills on the north and east belong to the Bára Lácha chain, and on their outer side is the broad mountainous region which holds the valley of the upper Indus, and which, beyond the Indus, culminates in the great parallel range of Karakorum or Mustágh. On the west and south, the hill boundary, which joins the other half of the enclosure at the southeast end of the valley, is the Panjál or Panchál range, which on its outer side sends down its branches southward, through the Jamú territory, to the plains of the Punjab. The length of the Kashmír valley, including the inner slopes of its surrounding hills, is about 120 miles from northwest to southeast. Its greatest width is about 75 miles. The low and comparatively level floor of the basin is 84 miles long and 20 to 24 miles broad. Its lowest part is 5200 feet above the sea, and its mean height 6000 feet.

This valley is but a small portion, in area, of the dominions of the maharájá of Kashmír, which, in addition to the Jamú territory on the south (the previous possession of the present maharájá's father, Ghuláb Singh, before he acquired Kashmír), include Baltistán and Gilgit on the north, and Kishtwár and Ládák on the east. On the west Kashmír is separated from the valley of Khagán by a continuous range of high hills, and from the British district of Hazára by the river Jhelum.

Jamú, to which Kashmír was annexed in 1846, occupies the southern slopes of the Panjál range, with a strip of plain country at their foot, and extends about 220 miles from east to west, with a greatest direct breadth, north to south, of about 75 miles. All the rest of the maharájá's dominions is hill country.

The hills forming the northern half-circuit of the Kashmír valley, and running beyond, include many lofty mountain masses and peaks, the most conspicuous of which, a little outside the confines of Kashmír, is Nanga Parbat, a grand hill (35° 15′ N., 74° 35′ E.), rising 26,629 feet above the sea, with an extensive area of glacier on its eastern face. The great ridge which is thrown off to the southwest by Nanga Parbat rises, at a distance of 12 miles, to another summit 20,740 feet in height, from which run southwest and southeast the ridges which are the northern watershed boundary of Kashmír. The former range, after running 70 miles southwest, between the valleys of the Kishanganga and the Kunhár or Nain-súkh, turns southward, closely pressing the river Jhelum, after it has received the Kishanganga, with a break a few miles further south which admits the Kunhár. This range presents several prominent summits, the two highest 16,487 and 15,544 feet above the sea. The range which runs southeast from the junction peak above mentioned divides the valley of the Kishanganga from that of the Astor and other tributaries of the Indus. The highest points on this range, where it skirts Kashmír, are 16,795, 16,930, and 17,202 feet above the sea. For a distance of more than 50 miles from Nanga Parbat there are no glaciers on this range; thence eastward they increase; one, near the Zójí-lá Pass, is only 10,850 feet above the sea. The mountains at the east end of the valley, running nearly north and south, drain inwards to the Jhelum, and on the other side to the Wardwán, a tributary of the Chenáb. The highest part of this eastern boundary is 14,700 feet. There are no glaciers. The highest point on the Panjál range, which forms the south and southwest boundary, is 15,523 feet above the sea.

The river Jhelum or Behat (Sanscrit *Vitasta*)—the Hydaspes of Greek historians and geographers—flows northwestward through the middle of the valley. After a slow and winding course it expands, about 25 miles below Srínagar, over a slight depression in the plain, and forms the Wúlar lake and marsh, which is of ill-defined extent, but may be called about 10 miles long and 6 broad. The hills which this lake touches at its north end give it a more defined margin on that side. Leaving the lake on the southwest side, near the town of Sópúr, the river pursues its sluggish course southwestward, about 18 miles, to the gorge at Baramúla. From this point the stream is more rapid through the narrow valley which conducts it westward 75 miles to Muzaffarábád, where it turns sharply south, joined by the Kishanganga. At Islámábád, about 40 miles above Srínagar, the river is 5400 feet above sea-level, and at Srínagar 5235 feet. It has thus a fall of about 4 feet per mile in this part of its course. For the next 24 miles to the Wúlar lake, and thence to Baramúla, its fall is only about 2¼ feet in the mile. On the 80 miles of the river in the flat valley between Islámábád and Baramúla there is much boat traffic; but none below Baramúla, till the river comes out into the plains.

On the northeast side of this low narrow plain of the Jhelum is a broad hilly tract between which and the higher boundary range runs the Kishanganga river. Near the east end of this interior hilly tract, and connected with the higher range, is one summit 17,839 feet. Around this peak and between the ridges which run from it are many small glaciers. These heights look down on one side into the beautiful valley of the Sind river, and on another into the valley of the Lidar, which join the Jhelum. Among the hills north of Srínagar rises one conspicuous mountain mass, 16,903 feet in height, from which on its north side descend tributaries of the Kishanganga, and on the south the Wangat river, which flows into the Sind. By these rivers and their numerous affluents the whole valley of Kashmír is watered abundantly.

Around the foot of many spurs of the hills which run down on the Kashmír plain are pieces of low tableland, which are called *karéwa*. These terraces vary in height at different parts of the valley from 100 to 300 feet above the alluvial plain. Those which are near each other are mostly about the same level, and separated by deep ravines.

The level plain in the middle of the Kashmír valley is fine clay and sand, with water-worn pebbles. The karéwas consist of horizontal beds of clay and sand, the lacustrine nature of which is shown by the shells which they contain. The hills surrounding the valley are chiefly gneiss and schists. In the Lidar valley are slate and sandstones of the Carboniferous period over green slate of a period corresponding to Silurian. The irregular ridges of the Panjál range are granite and gneiss, with schists and slates. Limestone is found in parts of the east and west ends of the valley, and in the hills upon the Mánas Bal lake. In various places are marks of glacial action, down to a height of about 500 feet above the level part of the basin. From the plain rise isolated hills of trap; among these are the Hari Parbat and the Takht-i-Sulimán at Srínagar, on the former of which stands the fort, and on the latter a conspicuous and well known ancient Hindu temple. No fossils have been found in Kashmír below the rocks of the Carboniferous period. The chief mineral resources of the maharájá's dominions are outside the Kashmír valley, especially in Ládák.

In the hills of the north boundary are two passes, the Burzil (13,500 feet) and the Kamri (13,200). By the former is the direct route between Srínagar and Iskardo. It is usually practicable only between 15th July and 15th September. The road from Srínagar to Lé in Ládák goes by the Zójí-lá Pass (11,300 feet), near the northeast corner of the valley. Only a short piece of the road, where snow accumulates, prevents this pass being used all the year. At the southeast end of the valley are three passes, the Murgil (11,600 feet), the Hoksar (13,315), and the Murbul (11,550), all leading over to the valleys of the Chenáb and the Rávi. South of Islámábád, on the direct route to Jamú and and Siálkót, is the Banihál Pass (9200 feet). Further west on the Panjál range is the Pír Panjál or Panchál Pass (11,400 feet), with a second pass, the Rattan Pír (8200 feet), across a second ridge about 15 miles southwest of the other. Between the two passes is the beautifully situated fort of Báramgali and a well known rest-house for travellers. This place is in the domain of Raja Móti Singh of Púnch, cousin and tributary of the maharájá of Kashmír. At Rájáori, south of these passes, the road divides: one line leads to Bhimbar and Gujrát, the other to Jamú and Siálkót by Aknúr. Next, southwest of Baramúla, is the Hajjí Pír Pass (8500 feet), by which crosses the road to Púnch. From Púnch one road leads down to the plains at the town of Jhelum, another eastward through the hills to the Rattan Pír Pass and Rájáori. Lastly there is the river pass of the Jhelum, which is the easy route from the valley westward, having two ways down to the plains, one by Muzaffarábád and the Hazára valley to Hassan Abdál, the other by the British hill station of Marri (Murree) to Ráwal Pindí.

The valley of Kashmír, sheltered from the southwest monsoon by the Panjál range, has not the periodical rains of India. Its rainfall is irregular, greatest in the spring months. Occasional heavy storms in the monsoon pass over the crests of the Panjál and give heavy rain on the elevated plateaus on the Kashmír side. And again clouds pass over the valley and are arrested by the higher hills on the northeast side, on which they pour themselves. Snow falls on the surrounding hills at intervals from October to March, and sometimes in great quantity. In the valley the first snow generally falls about the end of December, and never to any great amount. The highest monthly average of temperature from May to October, at Srínagar, is 89° in the shade at noon. There has been no regular winter register; but the temperature is never very low.

For all crops except rice, which is irrigated, the rain is ordinarily sufficient. Barley, sown in November, ripens in June, wheat in July. Rice, sown in May and June, ripens in October. Millet, maize, and buckwheat, also turnips, pease, and mustard, are grown in considerable quantity.

There is no natural forest in the level parts of the valley. Of the cultivated trees the finest is the plane (*chinár*), which grows to a large size, and is of great beauty. The principal other trees of the valley are the poplar, willow, cypress, walnut, apple, pear, quince, apricot, cherry, mulberry. Vines are grown extensively, commonly trained up poplar trees. There are many kinds of grape. On the hills around are deodar, *Pinus excelsa* and *Gerardiana*, *Picea Webbiana*, hazel, birch, viburnum, juniper, rose, etc. The herbaceous plants and flowers are very numerous. The umbelliferous plant called *prangos*, growing on the drier hills, is much valued as winter food for sheep. In spring the bright orange-colored colchicum shows itself in great quantity; and in autumn are seen many acres of saffron with its beautiful light purple flowers, grown in large fields divided into small square beds. Saffron was among the articles of annual tribute to the Mughal emperors. The Dal lake at Srínagar is full of reeds and water plants, *Potamogeton*, *Nymphœa*, *Nelumbium*, etc. On this lake there are floating gardens: a shallow layer of soil on sheets of the great leaves of water lilies is made to grow quantities of vegetables. The curious *singhara*, or horned water nut (*Trapa bispinosa*), which grows in great quantity in all the lakes, is much used for food, prepared in various ways. Since 1874 hops have been grown experimentally for the Murree Brewery Company, with fair success, in five different parts of the valley.

Much has been said and written about the beauty of the vale of Kashmír. Spring encircles a fresh, green, smiling valley with a noble belt of glistening snow-capped ridges; autumn fills the eye with the wonderful richness of the many-colored foliage. At all times flows on the quiet glassy river, showing back the groves and avenues upon its banks, the strange tall shadowy wooden houses, and the craggy hills. There is no place or season which has not something to show of real beauty. The rapturous praises of Mohammedan writers, may be often extravagant; and it is with some of their materials, reproduced with more modern additions, that Moore has built up great part of his romance; still few will really think that here extravagance and fiction have left truth much too far behind.

Many Englishmen every year resort to Kashmír for shooting. The game is in consequence now only to be found within reduced areas of the more secluded little valleys and more difficult hill sides, and many sportsmen now cross over into Ládák. The animals chiefly sought in both countries are the *Ovis ammon*, *Ovis poli*, antelope, ibex, *már-khór* or wild goat, musk deer, Tibetan stag, brown and black bear, and leopard. In various parts of Kashmír are to be found the fox, lynx, weasel, marmot, and hare. The black and grey monkey (*langúr*) is common on the Panjál range. Kashmír has the snow pheasant, snow owl, wild goose, duck, and teal; and the eagle is also found.

The Kashmír valley has a large number of old buildings of the Hindu period, interesting from their style, which is peculiar to Kashmír, and from the traces which many of them bear of Greek art. Their ruinous condition is ascribed partly to Sikandar the idol-breaker, partly to earthquakes, which are frequent in Kashmír. The most ancient of these buildings (about 220 B.C.) is the temple of Shankar Acharya (or, as it was formerly called, of Jaiasht Iswar), on the hill at Srínagar, known as Takht-i-Sulimán, or Solomon's Throne,—a designation thought to be a Mohammedan adaptation of the name of Rájá Sandhaman, who repaired or rebuilt the temple. The other Hindu buildings mostly belong to the time from the 5th to the 10th century. The chief points which distinguish them from Hindu buildings in India are the trefoil-headed doorways and recesses, high pediments, high straight-lined pyramidal roofs, and fluted pillars.

The temple of the sun at Marttand or Matan has been one of the finest. It occupies a very striking position on a karéwa or natural terrace about 3 miles from Islámábád, and commands a splendid view of the valley of the Jhelum. Of the others the most worthy of notice are the remains of two of the four temples at Avantipúr, 15 miles southeast of Srínagar; the temple of Bhúmzo near Marttand, built in a cave; Páyach, on the karéwa of Naunagar near Avantipúr, a small temple, the whole superstructure built of six stones; Pandrétan, 3 miles southeast of Srínagar, standing with its floor below the water, in a tank; Bhániár (Bhawániár) and Kutrúi, a few miles west of Baramúla, both backed by fine wooded cliffs crowned with deodars. A mound, with masonry in and about it, at the village of Ushkara near Baramúla, is supposed to be the remains of a Buddhist tope (*stúpa*), the place taking its name from Hushka, one of the Tartar kings of Kashmír.

Srínagar, the capital (34° 4′ 6″ N., 74° 48′ 5″ E.), said to have been founded by Pravara Sén, in the beginning of the 6th century, is built on both banks of the Jhelum. It is a somewhat confused mass of houses, many of them built of wood, with balconies and carved lattice windows, and projecting upper stories propped on poles, and overhanging the narrow streets or the little canals which in some parts are the streets. The city has seven bridges across the river, built of beams laid on stone and timber piers. In the fort on the south side of the river is the palace. There are several small Hindu temples in the town. The two chief mosques are the Jámi' mosque and that of Shah Hamadán, the latter one of the most conspicuous buildings, with walls of stone and timber, low sloping wooden roof, and little wooden spire. On the shores of the Dal lake are the old pleasure-gardens of the Mughals.

The people of Kashmír are now mostly Mohammedan. Physically of fine form, a large proportion of the town-people are enfeebled by poverty and sedentary occupation in close rooms. A few years ago the shawl weavers of Srínagar were reckoned to be about 22 per cent. of the inhabitants. The proportion is now less, owing to the reduced demand for Kashmír shawls, both loom-made and hand-sewn. The maharájá has endeavored to meet the depression of the shawl trade by extension of silk manufactures; silk is successfully worked, and well dyed. The chief demand for shawls has generally been from France, and French patterns have somewhat interfered with native art. At Islámábád also many hands are employed in shawl and blanket weaving. A kind of coarse chintz is also made there. Embroidery on fine woollen cloths is the employment of many Kashmírís, both in their own country and in their Indian settlements, Amritsar, Núrpúr, and Ludhiána. The manufacture of a variety of articles in papier mâché and ornamental painted wood-work employs a number of people in Srínagar. The silversmiths do a good deal of business in ornamental vases, goblets, flower-holders, etc., silver and silver gilt. Engraved and embossed copper work employs a smaller number of people; also the manufacture of ornamental vessels of tinned copper, and some other minor kinds of work. A very good kind of paper is made in Kashmír. A museum of Kashmír products and manufactures was established at Srínagar in 1875. The people of the country, with more healthful occupations and surroundings than those of the towns, especially Srínagar, are robust and of active habits. The Kashmíris, both men and women, wear commonly a kind of loose gown with sleeves, called *phéran* (Pers. *pairáhan*, "a robe"). In cold weather they are in the habit of carrying, under this loose dress, a small portable brazier with heated charcoal. The country people and boatmen use a more close-fitting costume. The mountaineers, like those of neighboring hill countries, bandage the legs from the knee to the foot for protection in walking.

According to a report prepared by order of the maharájá in 1873, the population of the valley at that time was nearly 492,000. Of these about 64,000 were Hindus and the rest Moslems, about 4 per cent, of the latter being Shiites. The estimated population of Jamú was 861,000, of Púnch 77,500, of Ládák, Iskardo, and Gilgit, 104,500; total about 1,535,000:—Hindus, 507,000; Moslems, 919,000; Buddhists, 20,000; and "miscellaneous," 89,000. Of Srínagar the estimated population was about 132,000, of which number nearly 40,000 were Hindus. A great diminution, caused by deaths and emigration, has followed the famine of 1878. It was said that the towns of Islámábád and Sopúr lost nearly two-thirds of their inhabitants. The rice crop of 1879 was abundant, and the rains of the next year seasonable and plentiful. The shawl-weaving and carpet-making trades revived in 1880, and numbers of people who had left the country during the famine returned.

The language of Kashmír (which is spoken only in the valley itself, and in the few outlying settlements of Kashmíris in the neighboring hills and in northern India) is of the Aryan family. It is allied to the Hindí, Sindí, and Punjábí, and also to the current Urdú of India (Hindustání). It uses a form of the Sanskrit character like the Nágarí of the Punjab. It may be said to possess no literature, though Kashmír has produced many literary men. The Urdú is now very generally understood in Kashmír, among the better educated people and more intelligent artisans.

The chief articles of export from Kashmír are shawls and other woollen fabrics, rice, saffron, fruits. The chief imports are shawl wool, English piece goods, Indian cloths, metals, precious stones, skins, felts, dye-stuffs, tea, *charas* (hemp juice), groceries, and salt. The imports into Kashmír from British India are much below those into Jamú, except tea (of which the Kashmíris are extremely fond), indigo, and earthenware. Kashmír imports annually a very large amount of rock salt from the Punjab. The gross annual value of the imports is about £210,000, and of the exports about £172,000. This latter amount is less than formerly, owing chiefly to the reduced demand for shawls. The import duties, which used to be very heavy, were modified in 1864; the duty on piece goods was limited to 8 per cent. and on other imports to 12½ per cent. In April, 1870 a commercial treaty was entered into with the British Government for developing trade with eastern Turkestan, in which, among other things, the maharájá agreed to abolish all transit duties. Joint commissioners were appointed, on the part of the two Governments, to reside at Leh.

The gross annual revenue of Kashmír is believed to be about £550,000, and of the maharájá's whole territories a little over £800,000. The chief source of income is the land revenue. Of this there is now a cash settlement in place of the annual valuation of crops which was the practice till lately. The Government ordinarily takes one-half the gross produce. Grain is stored in public granaries, and sold at fixed rates to the army and the civil officials. Much grain is also purchased from the zamindárs, and stored by the Hindu merchants in Srínagar.

The maharájá's military force numbers 25,600 infantry (including police), 1400 cavalry, and 1200 artillery, with 78 field guns and 80 other pieces.

At Srínagar and elsewhere the maharájá has established dispensaries, with native medical men educated in India; and he has built at his own cost a large hospital for the medical mission at Srínagar.

The current rupee of Kashmír, called *chilkí* ("glittering"), has varied in value at different times from one-half to five-eighths of the rupee of British India. The latest issued bears the latter value.

The admission of British visitors to Kashmír each season is limited. To military officers, up to a fixed number, permission is granted by the commander-in-chief or by the Government of India. Others do not require previous permission, but must intimate their intention of going to Kashmír, and obtain a copy of the rules. In like manner, more than eight centuries ago, as we learn from the Arabic historian Al Birúní, the passes used to be watched, and few outsiders admitted. Connected with this long-cherished exclusiveness has been the general badness of the roads. A really improved road has been made by the present maharájá from Kohala to Baramúla, the easiest and best entrance to the valley. The author just referred to mentions the covered litters, in which people in Kashmír used to be carried, raised on men's shoulders. The same conveyances are in use now. To the present day there are no wheeled conveyances in Kashmír. For English visitors four routes are authorized by the Government of India, one by the Pír Panjál Pass and three by Baramúla,—from Púnch, from Murree, and from Muzzaffarábád.

In the government of his own territories the "maharájá of Jummoo and Kashmír" is independent. His relations with other states are subject to the supreme authority of the Government of India. The Government of India has no resident at either of the maharájá's capitals, but annually an "officer on special duty," as he is officially termed, is sent to Kashmír during the season from March to November. A native news-writer, employed by the British Government, remains in Kashmír. The annual tribute of the maharájá, presented in token of the supremacy of the British Government, in accordance with act X. of the treaty of March, 1846, is "one horse, twelve perfect shawl goats of approved breed (six male and six female), and three pairs of Kashmír shawls." The maharájá receives in British territory a salute of nineteen guns.

History.—The metrical history of the kings of Kashmír, called *Rájá Tarangini*, was pronounced by Professor H. H. Wilson (1825) to be the only Sanskrit composition yet discovered to which the title of history can with any propriety be applied. It first became known to the Mohammedans when, on Akbar's invasion of Kashmír in 1588, a copy was presented to the emperor. A translation into Persian was made by his order, and a summary of its contents, from this Persian translation, is given by Abu'l Fazl in the *Á'ín-i-Akbarí*. The *Rájá Tarangini* is a series of four histories. The first of the series, by Pandit Kalhana, was written about the middle of the 12th century. His work, in six books, which bears the name afterwards given to the whole, makes use of earlier writings now lost. Commencing with traditional history of very early times, it comes down to the reign of Sangrama Déva, 1006; and two more books attributed to the same author brings the history to the reign of Singha Déva (called Jai Singh in Abu'l Fazl's summary) about 1156. The second work, called *Rájá Vali*, by Júna Rája, takes up the history in continuation of Kalhana's, and, entering the Mohammedan period, gives an account of the reigns down to that of Zain-ul-áb-ad-dín, 1412. Then follows the *Srí Jaina Rájá Tarangini*, by Pandit Srí Vára, to the accession of Fattah Shah, 1477. And the fourth work, called *Rájá Vali Pataka*, by Prajnia Bhatta, completes the history to the time of the incorporation of Kashmír in the dominions of the Mughal emperor, 1588.

In the earliest of the four histories it is stated that the valley of Kashmír was formerly a lake, and that it was drained by the great *rishi* or sage, Kasyapa, son of Márichi, son of Brahma, by cutting the gap in the hills at Baramúla (Varáha-múla). When Kashmír had been drained, he brought in the Brahmans to occupy it. This is still the local tradition, and in the existing physical condition of the country we may see some ground for the story which has taken this form. Bernier suggested that earthquakes may have rent the gorge at Baramúla. M. Troyer considers it to have been the work of man, taking advantage of facilities pointed out by nature. It is possible that the river, having at one time flowed with more even fall than at present, may have been choked by land slips at the

Baramúla gorge. The Jhelum, stopped at Baramúla, would spread over the low wide valley with very slow and quiet rise, till, overtopping the barrier, the water would escape with a great descent to its old channel, having meantime raised the bed of the lake, by slow accumulation of deposit, to a nearly uniform high level. The name of Kasyapa, however, is by history and tradition connected with the draining of the lake, and the chief town or collection of dwellings in the valley was called Kasyapa-púr—a name which has been plausibly identified with the Κασπάπυρος of Hecatæus (Steph. Byz., *s. v.*) and Κασπάτυρος of Herodotus (iii. 102, iv. 44). Kashmír is the country meant also by Ptolemy's Κασπήρια. The ancient name Kasyapa-púr was applied to the kingdom of Kashmír when it comprehended great part of the Punjab and extended beyond the Indus. In the 7th century Kashmír is said by the Chinese traveller Hwen Tsang to have included Cabul and the Punjab, and the hill region of Gandhara, the country of the Gandaræ of classical geography. Then, under the Mughals, after the annexation of Kashmír to their empire in the end of the 16th century, the name of this newer possession was, for administrative purposes extended over a much larger area in Afghanistan, to which again it became united; and at one time Ghasni, at another time Cabul, was made the capital of the province of Kashmír.

At an early date the Sanskrit name of the country became *Kásmír*. The earliest inhabitants, according to the *Rájá Tarangini*, were the people called Nága, a word which signifies "snake." The history shows the prevalence in early times of tree and serpent worship, of which some sculptured stones found in Kashmír still retain the memorials. The town of Islámábád is called also by its ancient name Anant-nág (eternal snake). The source of the Jhelum is at Vir-nág (the powerful snake), etc. The other races mentioned as inhabiting this country and the neighboring hills are Gandhara, Khása, and Darada. The Khása people are supposed to have given the name Kásmír. In the *Mahábhárata* the Kasmíra and Darada are named together among the Kshattriya races of northern India. The question whether, in the immigration of the Aryans into India, Kashmír was taken on the way, or entered afterwards by that people after they had reached the Punjab from the northwest, appears to require an answer in favor of the latter view (see vol. ii. of Dr. J. Muir's *Sanskrit Texts*). The Aryan races of Kashmír and surrounding hills, which have at the present time separate geographical distribution, are given by Mr. Drew as *Kashmíri* (mostly Mohammedan), in the Kashmír basin and a few scattered places outside; *Dard* (mostly Mohammedan) in Gilgit and hills north of Kashmír; *Dogra* (Hindu) in Jamú; *Dogra* (Mohammedan, called *Chibáli*) in Púnch and hill country west of Kashmír; *Paһári* or mountaineers (Hindu) in Kishtwar, east of Kashmír and hills about the valley of the Chenab.

In the time of Asóka, about 245 B. C., one of the Indian Buddhist missions was sent to Kashmír and Gandhara. After his death Brahmanism revived. Then in the time of the three Tartar princes, Hushka, Jushka, and Hanishka, who reigned in Kashmír immediately before, and in the beginning of, the Christian era, Buddhism was to a great extent restorod. The kingdon of Kanishka (called also Kanerkes) included the Punjab and Cabul as well as Kashmír. Buddhism again declined, though for several centuries the two religions existed together in Kashmír, Hinduism predominating. Yet Kashmír, when Buddhism was gradually losing its hold, continued to send out its Buddhist teachers to other lands. In this Hindu-Buddhist period, and chiefly between the 5th and 10th centuries of our era, were erected the Hindu temples in Kashmír. In the 6th and 7th centuries Kashmír was visited by some of the Chinese Buddhist pilgrims to India. The country is called *Shie-mi* in the narrative of To Yeng and Sung Yan (578). One of the Chinese travellers of the next century was for a time an elephant-tamer to the king of Kashmír. Hwen Tsang spent two years (631–633) in Kashmír (*Kia-chi-mi-lo*). He entered by Baramúla and left by the Pir Panjál Pass. He describes the hill-girt valley and the abundance of flowers and fruits, and he mentions the tradition about the lake. He found in Kashmír many Buddhists as well as Hindus. In the following century the kings of Kashmír appear to have paid homage and tribute to China, though this is not alluded to in the Kashmír history. Hindu kings continued to reign till about 1294, when Udiána Déva was put to death by his Mohammedan visier, Amír Shah, who ascended the throne, taking the name of Shams-ud-dín. Two Hindus who reigned afterwards for a short time were the last kings of that race in Kashmír. The notices of Kashmír by Marco Polo belong to a time near the close of the Hindu rule, when the people were mostly Hindus and Buddhists.

Of the Mohammedan rulers mentioned in the second of the Sanskrit histories, one, who reigned about the close of the 14th century, has made his name prominent by his active opposition to the Hindu religion, and his destruction of the temples. This was Sikandar, known as *But-shikan*, or the "idol-breaker." It was in his time that India was invaded by Timúr, to whom Sikandar made submission and paid tribute. The country fell into the hands of the Mughals in 1588. In the time of Alamgír it fell to Ahmed Shah Abdáli, on his third invasion of India (1756); and from that time it remained in the hands of Afghans till it was wrested from them by Ranjít Singh, the Sikh monarch of the Punjab, in 1819. Eight Hindu and Sikh governors under Ranjít Singh and his successors were followed by two Mohammedans similarly appointed, the second of whom, Shékh Imám-ud-dín, was in charge when the battles of the Sutlej, 1845–46, brought about new relations between the British Government and the Sikhs, involving a change in the government of Kashmír.

Ghuláb Singh, a Dogra Rajpút, had from a humble position been raised to high office by Ranjít Singh, who conferred on him the small principality of Jamú. On the final defeat of the Sikhs at Sobráon (February, 1846), Ghuláb Singh was called to take a leading part in arranging conditions of peace. The treaty of Lahore (March 9, 1846), sets forth that, the British Government having demanded, in addition to a certain assignment of territory, a payment of a crore and a half of rupees (1½ millions sterling), and the Sikh Government being unable to pay the whole, the maharájá (Dhalíp Singh) cedes, as equivalent for one crore, the hill country belonging to the Punjab between the Biás and the Indus, including Kashmír and Hazára. The governor-general, Sir Henry Hardinge, considered it expedient to make over Kashmír to the Jamú chief, securing his friendship while the British Government was administering the Punjab on behalf of the young maharájá. Ghuláb Singh was well prepared to make up the payment in defect of which Kashmír was ceded to the British; and so, in consideration of his services in restoring peace, his independent sovereignty of the country made over to him was recognized, and he was admitted to a separate treaty. Ghuláb Singh had already, after several extensions of territory east and west of Jamú, conquered Ládák (a Buddhist country, and till then subject to Lassa), and had then annexed Iskardo, which was under independent Mohammedan rulers. He had thus by degrees half encircled Kashmír, and by this last addition his possessions attained nearly their present form and extent. Ghuláb Singh died in 1857, and was succeeded by his son, Ranbír Singh.

See *Asiatic Researches*, vol. xv.; *Rájá Tarangini* (Sanskrit text, Calcutta, 1835; text and translation of the books of Kalhana, by A. Troyer, Paris, 1840, 1852); *Á'ín-i-Akbari* (translated by Gladwin, Calcutta, 1783); *History of India told by its own Historians*, from posthumous papers of Sir H. M. Elliot, by Professor Dowson; Fred. Drew, *Jummoo and Kashmir Territories*; *Voyages de François Bernier;* H. H. Wilson, *Ariana Antiqua;* William Moorcroft and George Trebeck, *Travels in Ládák and Kashmir;* J. Martin Honigberger, *Thirty-Five Years in the East;* Dr. T. Thomson, *Western Himalaya and Tibet;* Hügel, *Travels in Kashmir and the Punjab;* A. Cunningham, *Ancient Geography of India;* Id., *Ládák;* D'Anville, *Antiquité Geographique de l'Inde;* Stanislas Julien, *Histoire de la Vie de Hiouen Thsang; Journ. of the As. Soc. of Bengal*, x. (Edgeworth), xiii. (Leech), xvii. (A. Cunningham), xxxv. Rev. W. G. Cowie), xxxix. (Elmslie), etc.; George Forster, *Journey from Bengal to England;* Vigne's *Kashmir;* Yule's *Marco Polo;* Rennell, *Memoir of a Map of Hindoostan;* Tieffenthaler, *La Géographie de l'Indoustan;* Punjab Administration Reports; R. H. Davies, *Report on the Trade and Resources of the Countries of the North-West Boundary of British India;* J. E. T. Aitchison, *Handbook of the Trade Products of Leh.* (R. M'L.*)

KÁSIMBÁZÁR, or COSSIMBAZAR, a decayed town in Murshidábád district, Bengal, 24° 7′ 40″ N. lat., °88 19′ E. long. Long before the days of Murshid Kulí Khán, who founded and gave his name to the city of Murshidábád, the trade of Bengal was centred at Kásimbázár. The different European nations who traded to India had factories there from very early times. An English commercial agent was appointed to Kásimbázár in 1658; and at the close of the century it had become the leading English commercial agency in Bengal. The decay of the town dates from the beginning of the present century, when its climate, which had previously been celebrated for its salubrity, underwent an unexplained change for the worse; and its ruin was completed in 1813 by a sudden change in the course of the Bhágirathi, on which it stood. The site is now a swamp, marked by a few ruins.

KASIMOFF, a town of Russia, in the Ryazan government, situated in 54° 56′ N. lat. and 41° 3′ E. long., 90 miles east-northeast of the government town, on the left bank of the Oka, a tributary of the Volga. It possesses a cathedral, and a mosque supposed to have been built by Kasim. Near the mosque stands a mausoleum built by Shah Ali in 1555. Lying on the direct road from Astrakhan to Moscow and Nizhni Novgorod, Kasimoff is a busy place, with numerous industrial establishments. Of special note are the Kasimoff bells, whose jingle may be heard on the post-horses throughout the country. The waiters in the best hotels of St Petersburg are mostly Kasimoff Tartars. Population, according to St. Petersburg Calendar for 1874, 12,027.

Kasimoff existed in the 14th century under the name of the Meshtchersk Gorodets or Gorodok (from the Meshtcheryaks, a Turko-Finnish tribe). It was laid completely waste by the Mongolians in 1376, but shortly afterwards rebuilt on a new site. About 1452 the place was bestowed by Basil the Dark on the Tartar prince Kasim who had come to assist him in his wars, and thus became the seat of a Tartar principality or kingdom, which lasted till 1677. The last of the line of Kasim accepted Christian baptism, and received the name of Jacob. On his death the principality was incorporated with the empire; and Peter I. sent a number of the Tartar inhabitants to Voronezh.

KASSA. See KASCHAU.

KASTAMUNI, sometimes COSTAMBONE, the chief town of a Turkish vilayet of the same name in Asia Minor, is situated on the Gök Irmak, about 250 miles east of Constantinople. It is the seat of a commercial court, consisting of two Mohammedan and two Christian members. The mosques are said to number thirty-six, and there are four dervish monasteries. Situated as it is in the Angora goat district, Kastamuni has a large trade in goat's hair (about 980,000 ℔ annually), and carries on the manufacture of mohair cloth. Copper is obtained in the neighborhood, and the copper wares of Kastamuni are well known in Asia Minor. Coal was for a time worked close to the town, but, the people objecting, it is said, to the smoke, the governor closed the mines. The population is estimated at 40,000. Kastamuni is the Castamon frequently mentioned by the Byzantine historians.

KASTORIA, a town of European Turkey, in the vilayet of Monastir and sandjak of Prisrend, about 33 miles south of Monastir (Bitolia), on the western banks of a lake (6 miles long and 4 broad) which drains into the Indjeh, Karasu, or Bistritza. It is the seat of a caimmacam, and the inhabitants carry on a good trade. Of the twelve quarters of the town three are occupied by Turks, two by Jews, and the rest by Christians. Kastoria is the ancient Celetrum, captured by Sulpicius during the first Macedonian campaign, 200 B.C., and better known for the defence maintained by Bryennius against Alexis I. in 1084 (see Anna Comnena's *Alexias*). A Byzantine wall with round towers runs across the peninsula on which part of the town is built. Population, 8000.

KATER, HENRY (1777–1835), a distinguished physicist of remarkable experimental skill, was born at Bristol, April 16, 1777. At first he purposed studying law; but this he abandoned on his father's death in 1794, and entered the army, obtaining a commission in the 12th regiment of foot, then stationed in India, where he rendered valuable assistance in the great trigonometrical survey. Failing health, however, obliged him to return to England; and in 1808, being then a lieutenant, he entered on a distinguished student career in the senior department of the Royal Military College at Sandhurst. Shortly after he was promoted to the rank of captain. In 1814 he retired on half-pay, and devoted the remainder of his life to scientific research. He died at London, April 26, 1835.

His first important contribution to scientific knowledge was the comparison of the merits of the Cassegrainian and Gregorian telescopes, from which (*Philosophical Transactions*, 1813 and 1814) he deduced that the illuminating power of the former exceeded that of the latter in the proportion of 5 : 2. This inferiority of the Gregorian he explained as being probably due to the mutual interference of the rays as they crossed at the principal focus before reflexion at the second mirror. His most valuable work, however, was the determination of the length of the second's pendulum, first at London and subsequently at various stations throughout the country (*Phil. Trans.*, 1818, 1819). In these researches he skilfully took advantage of the well-known property of reciprocity between the centres of suspension and oscillation of an oscillating body, so as to determine experimentally the precise position of the centre of oscillation; the distance between these centres was then the length of the ideal simple pendulum having the same time of oscillation. As the inventor of the floating collimator, Captain Kater rendered a great service to practical astronomy (*Phil. Trans.*, 1825, 1828). He also published memoirs (*Phil. Trans.*, 1821, 1831) on British standards of length and mass; and in 1832 he published an account of his labors in verifying the Russian standards of length. For his services to Russia in this respect he received in 1814 the decoration of the order of St. Anne; and the same year he was elected a fellow of the Royal Society. His attention was also turned to the subject of compass needles, his Bakerian lecture "On the Best Kind of Steel and Form for a Compass Needle" (*Phil. Trans.*, 1821) containing the results of many interesting and valuable experiments. The treatise on "Mechanics" in Lardner's *Cyclopædia* was partly written by him and partly by Dr. Lardner; and his interest in more purely astronomical questions was evidenced by two communications to the Astronomical Society's *Memoirs* for 1831–33—the one on an observation of Saturn's outer ring, the other on a method of determining longitude by means of lunar eclipses.

KÁTHIÁWÁR, or KATTYWAR, also SURÁSHTRA, a peninsula forming a collection of native states in Guzerat, western India, lying between 20° 41′ and 23° 8′ N. lat., and 68° 56′ and 72° 20′ E. long. It is bounded on the N. by the Runn or Gulf of Cutch, on the E. by Ahmedábád district and the Gulf of Cambay, and on the S. and W. by the Arabian Sea; the extreme length is 220 miles, the greatest breadth about 165 miles, the area about 22,000 square miles, and the estimated population 2,500,000. It is divided into one hundred and eighty-eight separate states, large and small, of which thirteen pay no tribute, ninety-six are tributary to the British Government, and seventy to the gáekwár as the representative of the Marhattás, while of these three classes of states one hundred and thirty-two pay a tax called *zortalabi* to the nawáb of Junágarh. The states are arranged in seven classes: the chiefs of the first and second classes exercise plenary jurisdiction, both civil and criminal; the judicial powers of the lesser chiefs are graded in a diminishing scale, the residuary jurisdiction being vested in four British officers, each superintending a group of states. The political agent controls the whole. As a rule, no appeal lies from the decision of a chief; but on presumption of maladministration his proceedings may be called for and reviewed. During the past twenty years the states have established civil and criminal courts and written codes. Justice is administered by the political officers on the non-regulation system over 2058 square miles, or about one-tenth of the whole area. Outlawry, political and predatory, has been suppressed, and life and property are as safe as in British districts. A village police has been established, and municipal funds are voted by the states. In 1878 there were 488 schools, with 28,171 scholars; while at the Rájkumar College and three high schools many of the chiefs receive a liberal education during their minority. There is railway communication with Wadhwán, and an extension is in progress to Dhoráji and Bhaunagar, while a network of good roads extend from Rájkot, the headquarters of the agency, over the greater part of the province. Káthiáwár is divided for administrative purposes into four *prants* or districts,—Jhaláwár, Hállár, Soráth, and Gohelwár; but the old territorial *prants* are ten, viz., Jhaláwár in the north, containing about fifty states; Machhukántá; Hállár, with twenty-six states; Okhamandal, belonging to Baroda; Baradá or Jaitwár, also known as Porbandar; Soráth; Babriáwár; Káthiáwár; Und-Sarviya; and Gohelwár. The last-named comprises the Gogo district, belonging to the Ahmedábád collectorate; Bhaunagar, probably the foremost state in Káthiáwár; and many others.

Generally speaking, the surface of the country is undulating, with low ranges running in very irregular directions; with the exception of the Tánghá and Mándhav hills, in the west of Jhaláwár, and some unimportant hills in Hállár, the northern portion of the country is flat; but in the south, from near Gogo, the Gir range runs nearly parallel with the coast, and at a distance of about 20 miles from it, along the north of Babriáwár and Soráth, to the neighborhood of Gírnár. Opposite this latter mountain is the solitary Osam hill, and then still farther west is the Baradá group, between Hállár and Baradá, running about 20 miles north and south from Gumti to Ránáwan. The Gírnár clump of mountains is an important granitic mass, the highest peak of which rises to 3500 feet. The principal river is the Bhádar, which rises in the Mándhav hills, and flowing southwest falls into the sea at Navi-Bandar, in Baradá; it is everywhere marked by highly cultivated lands adjoining its course of about 115 miles. Other rivers are the Aji, Machhu, and Satrúnji—the last remarkable for wild and romantic scenery. Four of the old races, the Jáitwas, Churásamas, Solunkis, and Wálás are now existing as proprietors of the soil who exercised sovereignty in the country prior to the immigration of the Jhalás, Járejas, Purmars, Kathis, Gohels, Játs, Mohammedans, and Marhattás, between whom the country is now chiefly portioned out.

The principal agricultural products consist of cotton, *bájrá*, and *joár*, and in some parts sugar-cane, turmeric, and indigo. Horse and sheep breeding is carried on to a great extent—these animals, together with food-grains, raw cotton, and wool, forming the chief exports. The principal imports are cotton manufactures, metals, and sugar. Iron is found in many parts of Baradá and Hállár. Many iron-mines have, however, had to be abandoned of late years owing to the scarcity of fuel for smelting the ore. The principal towns are Jámnagar, Bhaunagar, Júnágarh, Rájkot, Porbandar, and Mangrol. The last two, as also Verával, are thriving seaport towns. Káthiáwár has many notable antiquities, comprising rock inscriptions of Asoka, Buddhist caves, and fine Jain temples on the sacred hill of Gínár, and at Pálitana.

ḲAṬÍF, or El Ḳatif, a town of Arabia, in the maritime region which skirts the northern part of the Persian Gulf on the low muddy shore of the northmost of the secondary bays that break the outline of the Bay of Bahrein, in 26° 29′ N. lat. and 50′ E. long. Town and district are sometimes considered as part of El Ḥasa, sometimes as an independent province. The town lies embosomed amid luxuriant palm groves and gardens, but, according to Palgrave, is "crowded, damp, and dirty." As the seaport of Nejd, it has a considerable trade. The principal building is the fortress or palace,—a strong and spacious structure, whose erection is popularly assigned to Abu Sa'íd el Jannâby el Ḳarmaṭy, the founder of the Karmathians. Ḳaṭíf was the chief seat of the Karmathian power. About the middle of the 18th century we find it, along with El Ḥasa, in the hands of Ibn Muflik, whose influence was paramount throughout Nejd. In 1791 it was captured by Sa'úd, the leader of the Wahhâby revolution. In 1871 it was attacked, and according to their own account subjugated, by the Turks from Baghdad. The population of the town and district is given as from 90,000 to 100,000. Ḳaṭíf is not far from the probable site of the ancient Gerrha. which was inhabited by Chaldæan exiles from Babylon (Strabo, xvi. 766); in more modern times the population has been recruited from Persia.

See Captain G. F. Sadlier, in *Trans. Lit. Soc. Bombay*, 1823; Pelly, in *Journ. Roy. Geogr. Soc.*, 1865; Palgrave, *Central and Eastern Arabia*, 1873; Zehme, *Arabien und die Araber*, Halle, 1875.

KATSENA, Kassina, or Kashna, a town of Central Africa, situated about 170 miles to the east of Sokoto, the capital of the state to which it now pays tribute. The walls have a circuit of between 13 and 14 English miles, but at the time of Barth's visit only the northwestern quarter was inhabited, and he estimated the population at not more than 7000 or 8000. In the 17th and 18th centuries it appears to have been the largest town in the whole region, and its inhabitants cannot have numbered less than 100,000. The date of its foundation must be comparatively modern, for at the time of Leo Africanus there was no place of any considerable size in the province which bore the name now applied to the town. In the beginning of the present century it fell into the hands of the Fellatah, but only after a protracted and heroic defence.

KATTOWITZ, chief town of a circle in the government district of Oppeln and province of Silesia, Prussia, is situated on the Rawa, in a busy mining and manufacturing region near the Polish border. There are large iron-works, foundries, and machine shops in the town, and near it zinc and anthracite mines. The growth of Kattowitz, like that of many villages in the same circle, has been very rapid, owing to the development of the mineral resources of the district. In 1815 it was a mere village, in 1865 it became a town, and in 1875 it had a population of 11,352.

KATWÁ, or Cutwa, a town in Bardwán district, Bengal, India, situated at the confluence of the Bhágirathi and Ajái rivers, 23° 38′ 55″ N. lat., 88° 10′ 40″ E. long. It is one of the principal seats of district trade, and the residence of many wealthy native merchants. Now a purely commercial town, it was formerly regarded as the key to Murshidábád. The old fort, of which scarcely a vestige now remains, is noted as the scene of the defeat of the Marhattás by Alí Vardí Khán. Population in 1872, 7963.

KAUFBEUREN, an ancient town in the government district of Swabia and Neuburg, Bavaria, is situated on the Wertach, about 55 miles southwest of Munich by rail. The chief industry is cotton-spinning and weaving, and there is a tolerably active trade in cotton-stuffs and cheese. The population in 1875 was 5553.

Kaufbeuren is said to have been built in 842, and to have become a free imperial city by purchase in 1286 or 1288. In 1803 it passed to Bavaria. It was formerly a resort of pilgrims; and Roman coins have been found in the vicinity.

KAUFFMAN, or Kauffmann, Angelica (1740–1807). This once popular artist and Royal Academician was born at Coire in the Grisons, October 30, 1740 or 1741. Her baptismal name was Maria-Anne-Angelica-Catharine. Her father, John Joseph Kauffmann, was a poor man and mediocre painter, but apparently very successful in teaching his precocious daughter. She rapidly acquired several languages, read incessantly, and showed marked talents as a musician. Her greatest progress, however, was in painting, and in her twelfth year she had become a notability, with bishops and nobles for her sitters. In 1754 her father took her to Milan, where she diligently studied the great masters. Later visits to Italy of long duration appear to have succeeded this excursion, and in 1763 she visited Rome, returning to it again in 1764. From Rome she passed to Bologna and Venice, being everywhere fêted and caressed, as much for her talents as for her personal charms. Writing from Rome in August, 1764, to his friend Franke, Winckelman refers to her exceptional popularity. She was then painting his picture, a half length, of which she also made an etching. She spoke Italian as well as German, he says; and she also expressed herself with facility in French and English,—one result of the last-named accomplishment being that she painted all the English visitors to the Eternal City. "She may be styled beautiful," he adds, "and in singing may vie with our best virtuosi." While at Venice, she was induced by Lady Wentworth, the wife of the English ambassador, to accompany her to London, where she appeared in 1765. One of her first works was a portrait of Garrick, exhibited in the year of her arrival at "Mr. Moreing's great room in Maiden Lane." The rank of Lady Wentworth opened society to her, and she was everywhere well received, the royal family especially showing her great favor.

Her firmest friend, however, was Reynolds. In his pocket-book her name as "Miss Angelica" or "Miss Angel" appears frequently, and in 1766 he painted her, a compliment which she returned by the Portrait of Sir Joshua Reynolds, ætat. 46, which was exhibited by Lord Morley at the "Old Masters" in 1876. Another instance of her intimacy with Reynolds is to be found in the variation of Guercino's "Et in Arcadia ego" produced by her at this date, a subject which Reynolds repeated a few years later in his portrait of Mrs. Bouverie and Mrs. Crewe. When, in 1768 or thereabouts, she was entrapped into a marriage with an adventurer who passed for a Swedish count, Reynolds befriended her, and it was doubtless owing to his good offices that her name is found among the signatories to the famous petition to the king for the establishment of the Royal Academy. In its first catalogue of 1769 she appears with "R.A." after her name (an honor which she shared with another lady and compatriot, Mary Moser); and she contributed the Interview of Hector and Andromache, and three other classical compositions. From this time until 1782 she was an annual exhibitor, sending sometimes as many as seven pictures, generally classic or allegorical subjects. One of the most notable of her performances was the Leonardo expiring in the Arms of Francis the First, which belongs to the year 1778. In 1773 she was appointed by the Academy with others to decorate St. Paul's, and it was she who, with Biaggio Rebecca, painted the Academy's old lecture-room at Somerset House. It is probable that her popularity declined a little in consequence of her unfortunate marriage; but after her first husband's death (she had been long separated from him) she married Antonio Zucchi, a Venetian artist, then resident in England. This was in 1781. Shortly afterwards she retired to Rome, where she lived for twenty-five years with much of her old prestige. In 1782 she lost her father; and in 1795—the year in which she painted the picture of Lady Hamilton now at South Kensington—her husband. She continued at intervals to contribute to the Academy, her last exhibit being in 1797. After this she produced but little, and in November, 1807, she died, being honored by a splendid funeral under the direction of Canova. The entire Academy of St. Luke, with numerous ecclesiastics and virtuosi, followed her to her tomb in St. Andrea delle Frate, and, as at the burial of Raphael, two of her best pictures were carried in procession.

Popular as they were during her lifetime, the works of Angelica Kauffman have not retained their reputation. She had a certain gift of grace, and considerable skill in composition. But her drawing is weak and faulty; her figures lack variety and expression; and her men are masculine women. Her coloring, however, is fairly enough defined by Waagen's term "cheerful." Rooms decorated by her brush are still to be seen in various quarters. At Hampton Court is a portrait of the duchess of Brunswick; in the National Gallery an allegorical composition of Religion attended by the Virtues. There are other pictures by her at Paris, at Dresden, in the Hermitage at St. Petersburg, and in the Pinakothek at Munich. The Munich example is a portrait of herself; there is a second in the Uffizi at Florence, and a third in the National Portrait Gallery, South Kensington. A few of her works in private collections have also been exhibited among the "Old Masters" at Burlington House But she is perhaps best known by the numerous engravings from her designs by Schiavonetti, Bartolozzi, and others. Those by Bartolozzi especially still find considerable favor with collectors. Her life was written in 1810 by Giovanni de Rossi. It has also been used as the basis of a romance by Léon de Wailly, 1838; and it prompted the charming novelette contributed by Mrs. Richmond Ritchie to the *Cornhill Magazine* in 1875 under the title of "Miss Angel." (A. D.)

KAULBACH, WILHELM VON (1805–74), an acknowledged leader in modern art, was born in Westphalia, 15th October, 1805. His parentage was humble, and his father, who was poor, combined painting with the goldsmith's trade, but means were found to place Wilhelm, a youth of seventeen, in the art academy of Düsseldorf, then reorganized, and becoming renowned under the directorship of Peter von Cornelius. Young Kaulbach at the outset had to fight a hard battle: his circumstances were necessitous; he contended against hardships, even hunger. But his courage never failed; and, uniting genius with industry, he was ere long found foremost among the young national party which resolved that the arts of Germany should see a great revival.

Munich is the city most closely identified with Kaulbach. The large and ambitious works by which Louis I. sought to transform the capital of Bavaria into a German Athens afforded to the young painter an appropriate sphere. Cornelius had for some years been commissioned to execute the enormous frescoes in the Glyptothek, and his custom was in the winters with the aid of Kaulbach and others to complete the cartoons at Düsseldorf, and then in the summers, accompanied by his best scholars, to carry out the designs in color on the museum walls in Munich. But in 1824 Cornelius became director of the Bavarian academy. Kaulbach, not yet twenty, followed, took up his permanent residence in Munich, labored hard on the public works, executed independent commissions, and rose to such distinction that in 1849, when Cornelius left for Berlin, he succeeded to the directorship of the academy, an office which he held for a quarter of a century, up to the day of his death. The training, experience, and opportunity of Kaulbach had been extraordinary; he became a prime mover in one of the most signal of art manifestations known in modern times; he matured, after the example of the masters of the Middle Ages, the practice of mural or monumental decoration; he once more conjoined painting with architecture, and displayed a creative fertility and readiness of resource scarcely found since the era of Raphael and Michelangelo.

Early in the series of his multitudinous works came the famous Narrenhaus, the appalling memories of a certain madhouse near Düsseldorf; the composition all the more deserves mention for points of contact with Hogarth. Somewhat to the same category belong the renowned illustrations to *Reineke Fuchs*. These, together with occasional figures or passages in complex pictorial dramas, show how dominant and irrepressible were the artist's sense of satire and enjoyment of fun; character in its breadth and sharpness is depicted with keenest relish, and at times the sardonic smile bursts into the loudest laugh, regardless of the propriety and solemnity appropriate to high art. Thus occasionally the grotesque degenerates into the vulgar, the grand into the ridiculous, as in the satire on "the Pigtail Age" in a fresco outside the New Pinakothek. Yet the genius of Kaulbach was far too transcendent to be marred by these exceptional extravagances; such exaggerations came not of weakness but from excess of power; they are as the sturdy traits and lawless forces of the Teutonic and northern races whence the Westphalian painter had sprung. Kaulbach tried hard to become Grecian and Italian; but he never reached Phidias or Raphael; in short the blood of Dürer, Holbein, and Martin Schöngauer ran strong in his veins. The art products in Munich during the middle of this century were of a quantity to preclude first-rate quality, and Kaulbach contracted a fatal facility in covering wall and canvas by the acre. He painted in the Hofgarten, the Odeon, the Palace, and on the external walls of the New Pinakothek. His perspicuous and showy manner also gained him abundant occupation as a book-illustrator; in the pages of the poets his fancy revelled; he was glad to take inspiration from Wieland, Goethe, even Klopstock; among his engraved designs are the Shakespeare gallery, the Goethe gallery, and a folio edition of the Gospels. All these signal examples of what may be called "the Munich school," though by the many applauded to the skies, were yet subjected to censorious criticism. In a volume entitled *Social Life in Munich* it was with some show of reason urged that Kaulbach had been unfortunate alike in having found Cornelius for a master and King Louis for a patron, that he attempted "subjects far beyond him, believing that his admiration for them was the same as inspiration;" the lack of real imagination he supplied by "a compound of intellect and fancy;" he "thinks his feelings," and his creations are but "the triumph of intellect."

Nevertheless no one appreciating at their worth such master compositions as the Destruction of Jerusalem and the Battle of the Huns can deny to Kaulbach creative imagination. As a dramatic poet he tells the story, depicts character, seizes on action and situation, and thus as it were takes the spectator by storm. The manner may be occasionally noisy and ranting, but the effect after its kind is tremendous. Within the whole range of modern art no finer composition can be named than the Battle of the Huns, no bolder conception than the fierce fight in mid-air between the spirits of the warriors slain in combat. The drawing, the foreshortening, the grouping and lines of composition, are almost as a matter of course masterly. The cartoon, which, as usual in modern German art, is superior to the ultimate picture, was executed in the artist's prime at the age of thirty. At this period, as here seen, the knowledge was little short of absolute; subtle is the sense of beauty; playful, delicate, firm, the touch; the whole treatment artistic.

Ten or more years were devoted to what the Germans term a "cyclus,"— that is, a series of pictures which, as successive chapters or essays, illustrate one theme, as Raphael in the Vatican gave pictorial exposition to universal knowledge under the distinctive titles of Theology, Philosophy, Jurisprudence, and Poetry. The fundamental idea whereon Kaulbach discoursed was civilization or the progress of the human race as displayed in the following historic epochs:—the Tower of Babel, the Age of Homer, the Destruction of Jerusalem, the Battle of the Huns, the Crusades, and the Reformation. These major tableaux, severally 30 feet long, and each comprising over one hundred figures above life-size, are surrounded by minor compositions making more than twenty in all. The idea is to congregate around the world's historic dramas the prime agents of civilization; thus here are assembled allegoric figures of Architecture and other arts, of Science and other kingdoms of knowledge, together with lawgivers from the time of Moses, not forgetting Frederick the Great. The chosen situation for this imposing didactic and theatric display is the Treppenhaus or grand staircase in the new museum, Berlin; the surface is a granulated, absorbent wall, specially prepared; the technical method is that known as "water-glass," or "liquid flint," the infusion of silica securing permanence. The same medium was adopted in the later wall-pictures in the Houses of Parliament, Westminster.

The painter's last period brings no new departure; his ultimate works stand conspicuous by exaggerations of early characteristics. The series of designs illustrative of Goethe, which had an immense success, were melodramatic and pandered to popular taste. The vast canvas, more than 30 feet long, the Sea Fight at Salamis, painted for the Maximilianeum, Munich, evinces wonted imagination and facility in composition; the handling also retains its largeness and vigor; but in this astounding scenic uproar moderation and the simplicity of nature are thrown to the winds, and the whole atmosphere is hot and feverish. The painter verily had within him a fire which burnt fiercely; and when past the age of sixty he received visitors within his spacious studio, he looked the perfect impersonation of his art. On the walls, upon easels, even on the floor, were large cartoons, rolls of canvas, piles of drawings—fruits of a restless and inexhaustible intellect. Kaulbach in the midst moved to and fro impulsively and discoursed volubly on the creations he was about to call out of chaos. But his career was drawing to a close; seized by the cholera, he died in 1874, at the age of sixty-nine.

Kaulbach can scarcely be counted among religious painters; yet the range of his thought is most lofty. Whatever is noblest in humanity, whatever has raised the human race, freed or enlightened the mind, given dignity and beauty to life, or reared the body into godlike frame, falls within the province of his art. Nothing small or mean finds a place; the accidents and crudities of common nature are cast out; typical forms are selected and matured, and all is brought into harmony with beauty. Kaulbach's was indeed a beauty-loving art. He is not supreme as a colorist; he belongs in fact to a school that holds color in subordination; but he laid, in common with the great masters, the sure foundation of his art in form and composition. Indeed, the science of composition has seldom if ever been so clearly understood or worked out with equal complexity and exactitude; the constituent lines, the relation of the parts to the whole, are brought into absolute agreement; in modern Germany painting and music have trodden parallel paths, and Kaulbach is musical in the melody and harmony of his compositions. His narrative too is lucid, and moves as a stately march or royal triumph; the sequence of the figures is unbroken; the arrangement of the groups accords with even literary form; the picture falls into incident, episode, dialogue, action, plot, as a drama. The style is eclectic; in the Age of Homer the types and the treatment are derived from Greek marbles and vases; then in the Tower of Babel the severity of the antique gives place to the suavity of the Italian renaissance; while in the Crusades the composition is let loose into modern romanticism, and so the manner descends into the midst of the 19th century. And yet this scholastically compounded art is so nicely adjusted and smoothly blended that it casts off all incongruity and becomes homogeneous as the issue of one mind. But a fickle public craved for change; and so the great master in later years waned in favor, and had to witness, not without inquietude, the rise of an opposing party of naturalism and realism. Yet few men have had a brighter career, or enjoyed a reward better earned. Kaulbach's works are monumental, and will be handed down to future ages as the highest products of the renaissance of the arts in modern Germany. (J. B. A.)

KAUNITZ, Wenzel Anton (1711–1794), count of Rietberg, Austrian statesman, was born at Vienna, February 2, 1711. As the fifth and youngest son of an Austrian count, he was destined at first for the church, but on the death of his brother he turned his attention to statesmanship. He was sent by Maria Theresa on embassies to Rome and Florence, and was engaged at Turin in strengthening the alliance between Austria, Sardinia, and Great Britain against the Bourbons. In the meantime he had acquired the countship of Rietberg by marriage. In 1744 he was sent as minister to the court of the duke of Lorraine, governor-general of the Austrian Netherlands. During the duke's absence, Kaunitz administered affairs ably; and, when the French besieged Brussels in 1746, he secured a free retreat for the Austrian troops to Antwerp. After a brief retirement on account of his health, Kaunitz reappeared on the political stage at the congress of Aix-la-Chapelle in 1748, where he laid the foundation of his reputation, and earned the rank of minister of state. During his stay as ambassador at Paris, from 1750 to 1752, he concluded a secret alliance between Austria and France, a diplomatic stroke which involved the complete reversal of the former hostile attitude of the two powers, and which was rewarded by his appointment as chancellor of state or prime minister. In 1756 he was made chancellor of the

Netherlands and of Italy. For nearly forty years he continued in this capacity to direct the affairs of Austria, steadily cultivating the French and Russian alliances, and jealously watching the rising power of Prussia, against which he formed the coalition of 1756. At the partition of Poland in 1772 he secured Galicia for Austria; and it was during his ministry also that Bukowina (1776) and the so-called "Inn quarter" came under the Austrian crown. He enjoyed the unbounded confidence of Maria Theresa, and was an active agent in furthering the reforms under her and her son Joseph II. He showed himself a liberal patron of education and art as well as an accomplished statesman. Under Joseph II. and Leopold II. his influence waned, and he resigned all his offices at the accession of Francis II. in 1792. In 1764 he was created a prince of the empire. He died June 27, 1794.

See the life by Hormayr in the *Oesterreichischer Plutarch* and *Denkschriften des Fürsten Kaunitz*, Vienna, 1872, by Beer.

KAVA, an intoxicating drink used in the islands of the South Pacific from the Sandwich Islands to Fiji. In Hawaii it is called "kawa;" in the Marquesas "kava kava;" "ava," "ava-ava," and "evava" in Tahiti; and in Fiji "yaquona." It is made from the roots or leaves of *Piper methysticum*, Miq., a species of pepper indigenous in these islands; several varieties are also cultivated by the natives, those growing in a dry soil being considered to be the most active. To prepare the liquid the fresh roots or leaves, after being chewed by young girls or boys, with good teeth, clean mouths, and free from colds, are placed in a large wooden bowl ("umete") on three legs made of the wood of the vesi (*Afzelia bijuga*, Gray), and water or cocoa-nut milk poured over the mass. The liquid is then stirred up, and the woody matter of the root is removed by repeatedly drawing through the infusion long fibres prepared by crushing the green stems of the vau (*Hibiscus*, sp.), and passing them frequently between two pieces of wood. By this means a muddy-looking liquid resembling *café au lait* in appearance, or of a greenish hue if made from the leaves, is left in the bowl, a quantity of fæcula remaining suspended in the fluid. The drink is then distributed into cups made of plantain leaves, by dipping some of the vau fibre into it and squeezing the liquid into the cups, which are handed to the individuals present. As the process of infusion only takes about twenty minutes, it is obvious that no fermentation can take place. The taste of the liquid is at first sweet and then pungent and acrid. The usual dose is half a cupful, equal to about two mouthfuls of the root. Intoxication follows in about twenty minutes, or immediately if twice the usual quantity be taken.

The drunkenness produced by kava differs from that of alcohol in being of a melancholy, silent, and drowsy character, accompanied, if the drink be made from roots growing in a damp soil, with great irritability at the slightest noise. The fit lasts for about two hours, but in persons who only take it occasionally it may continue for six or twelve hours. At Nukahiva kava is said to be used as a daily beverage, probably in small quantities,—its use, however, being forbidden to women and children. In many of the Pacific islands kava is given at official receptions, being the offered and accepted token of hospitality. Formerly the drinking of it preceded warlike enterprises and religious festivals.

The daily use of the drug is sometimes followed by a kind of skin disease, called in Tahiti "arevareva." The effect on those who are addicted to the use of kava for any length of time is to produce obscurity of vision, red conjunctiva and yellow coloration of the teeth, while the skin where thick becomes dry, scaly, cracked and ulcerated, and the body becomes emaciated and decrepit. In Nukahiva it is given as a medicine in phthisis and in bronchitis, a small dose being taken before going to bed.

Mr. Collie, surgeon to the ship "Blossom," states that he observed the infusion of the root to be useful in certain skin diseases (Beachy, *Voyage of the "Blossom,"* vol. ii. p. 120). Some years ago it was introduced into France as a remedy for various diseases of the mucous membranes (*Annal. de Thérap.*, 1857, p. 61), and it has also been recommended in gout (*Med. Times and Gazette*, 1856, p. 591).

The root contains an essential oil of a yellow color and agreeable odor, 2 per cent. of a balsamic resin called kawin, and about 49 per cent. of starch; also a neutral crystalline principle discovered in 1844 by Mr. J. R. N. Morson, and called *kavahine*, or by Gobley *methysticin*. It is readily soluble in boiling alcohol, crystallizing out on cooling. Hydrochloric acid colors it red, this color changing to yellow on exposure to the air: concentrated sulphuric acid changes it to a rich purple violet, which on exposure to the air gradually becomes green, or immediately if diluted with water. These tests distinguish it from cubebin and piperin.

See *Pharm. Journ.* (1), iii. 474, (2) iv. 85, (2) ix. 219, (3) vii. 149; *Comptes Rendus*, l. 436, 598, lii. 206; and *Journ. de Pharm.*, 1860, p. 20, and 1862, p. 218; Seemann, *Flora Vitiensis*, p. 260.

KAVALA, or CAVALLO, a walled town of European Turkey in the vilayet of Saloniki, situated on a promontory stretching southwards into the bay of Kavala, opposite the island of Thaso. Numerous Roman remains have been found in the neighborhood, of which the chief is the large aqueduct on two tiers of arches, which still serves to supply the town and dilapidated citadel with water from Mount Pangeus. Kavala has a port on each side of its promontory, and exports cotton and tobacco. The Turkish college was founded by Mehemet Ali, pasha of Egypt, who was born in the town in 1769. The population is about 5000.

Kavala has been identified with Neapolis, at which St. Paul landed on his way from Samothrace to Philippi, 10 miles to the north (Acts xvi. 11). Neapolis was the port of Philippi, as Kavala now is of Seres; and in the bay on which it stands, the fleet of Brutus and Cassius was moored during the battle of Philippi. Some authorities identify Neapolis with Datum (Δάτον), mentioned by Herodotus as famous for its gold mines.

KAVANAGH, JULIA (1824–1877), novelist, was born at Thurles in Tipperary, Ireland, in 1824. She was the daughter of Morgan Kavanagh, author of various philological works, and she spent several years of her early life with her parents in Normandy, laying there the foundation of a perfect mastery of the French language and practical insight into French modes of thought, which was perfected by her later frequent and long residences in France. Miss Kavanagh's literary career began with her arrival in London about her twentieth year, and, beyond the publication of her successive works, her uneventful life with her widowed mother affords few incidents to the chronicler. On the outbreak of the Franco-German war, the two ladies removed from Paris, where they were living, to Rouen. Thence they subsequently passed to Nice, where on October 28, 1877, Julia Kavanagh died, in her fifty-fourth year. She is described as having been in person extremely small, with large, luminous, brown eyes, and a wealth of splendid hair. She was a devout Roman Catholic.

Julia Kavanagh's first book was *Three Paths*, 1847, a story for the young; but her first work to attract notice was *Madeleine, a Tale of Auvergne*, 1848. *A Summer and Winter in the two Sicilies*, 2 vols., 1858, was the fruit of a journey made about 1853, to France, Switzerland, and Italy. *French Women of Letters*, 2 vols., 1862, and *English Women of Letters*, 2 vols., 1863, are collections of slight biographical essays on lady novelists. She wrote also *Woman in France during the 18th century*, 2 vols., 1850, and *Women of Christianity*, 1852. But Miss Kavanagh is better known by her numerous novels and tales contributed to various magazines. The scenes of these are almost always laid in France, and the authoress handles her French themes with fidelity and skill. Her style is simple and pleasing rather than striking: her characters are interesting without being strongly individualized; and the paucity of incident in the unravelling of her plots sometimes seems to threaten monotony, Her most popular novels are perhaps *Adèle*, 1857; *Queen Mab*, 1863; and *John Dorrien*, 1875. Others are *Nathalie*, 1850; *Daisy Burns*, 1853; *Grace Lee*, 1855; *Rachel Gray*, 1855; *Seven Years*, etc., 1859; *Beatrice*, 1865; *Sibyl's Second Love*, 1867; *Dora*, 1868; *Silvia*, 1870; *Bessie*, 1872; *The Pearl Fountain*, etc. (written along with her mother), 1876; and *Two Lilies*, 1877. *Forget-me-nots*, 2 volumes of shorter tales, appeared after her death.

KÁVERI, or Cauvery, a great river of Southern India, famous for its traditional sanctity, its picturesque scenery, and its utility for irrigation. Rising in Coorg, high up amid the Western Gháts, in 12° 25′ N. lat. and 75° 34′ E. long., it flows with a generally southeastern direction across the plateau of Mysore, and finally pours itself into the Bay of Bengal through two principal mouths in Tanjore district. Its total length is about 475 miles; the estimated area of its basin, 28,000 square miles. It is known to devout Hindus as Dakshini Ganga, or the Ganges of the South, and the whole of its course is holy ground. According to the legend there was once born upon earth a girl named Vishnumáyá or Lopámudrá, the daughter of Brahma; but her divine father permitted her to be regarded as the child of a mortal, called Kávera-muni. In order to obtain beatitude for her adoptive father, she resolved to become a river whose waters should purify from all sin. Hence it is that even the holy Ganges resorts underground once in the year to the source of the Káveri, to purge herself from the pollution contracted from the crowd of sinners who have bathed in her waters. The course of the Káveri in Coorg is very tortuous. Its bed is generally rocky; its banks are high and covered with luxuriant vegetation. On entering Mysore it passes through a narrow gorge, but presently widens to an average breadth of from 300 to 400 yards. Its bed continues rocky, so as to forbid all navigation; but its banks are here bordered with a rich strip of cultivation. In its course through Mysore, the channel is interrupted by twelve anicuts or dams for the purpose of irrigation. From the most important of these, known as the Madadkatte, an artificial channel is led to a distance of 72 miles, irrigating an area of 10,000 acres, yielding a revenue of £7000, and ultimately bringing a water-supply into the town of Mysore. In Mysore state the Káveri forms the two islands of Seringapatam and Sivasamudram, which vie in sanctity with the island of Srírangam lower down in Trichinopoli district. Around the island of Sivasamudram are the celebrated falls of the Káveri, unrivalled for romantic beauty. The river here branches into two channels, each of which makes a descent of about 200 miles in a succession of rapids and broken cascades. After entering the Madras presidency, the Káveri forms the boundary between the Coimbatore and Salem districts, until it strikes into Trichinopoli district. Sweeping past the historic rock of Trichinopoli, it breaks at the island of Srírangam into two channels, which inclose between them the delta of Tanjore, the garden of Southern India. The northern channel is called the Coleroon (Kolidam); the other preserves the name of Káveri. On the seaward face of its delta are the open roadsteads of Negapatam and French Kárikal. The only navigation on any portion of its course is carried on in boats of basket-work. It is in the delta that the real value of the river for irrigation becomes conspicuous. The most ancient irrigation work is a massive dam of unhewn stone, 1080 feet long, and from 40 to 60 feet broad, across the stream of the Káveri proper, which is supposed to date back to the 4th century, is still in excellent repair, and has supplied a model to British engineers. The chief modern work is the anicut across the Coleroon, 2250 feet long, constructed by Sir Arthur Cotton between 1836 and 1838.

KAY, John (1742–1826), Scottish caricaturist, was born in April, 1742, near Dalkeith, where his father was a mason. At thirteen he was apprenticed to a barber, whom he served for six years. He then went to Edinburgh, where in 1771 he obtained the freedom of the city by joining the corporation of barber-surgeons. For some years he practised his craft with success; but in 1785, induced by the favor which greeted certain attempts of his to etch in aquafortis, he took down his barber's pole and opened a small print shop in Parliament Square. There he continued to flourish, painting miniatures, and publishing at short intervals his sketches and caricatures of local celebrities and oddities, who abounded at that period in Edinburgh society. He died on February 21, 1826. Kay's portraits were collected by Hugh Paton and published under the title *A Series of Original Portraits and Caricature Etchings by the late John Kay, with Biographical Sketches and Illustrative Anecdotes* (Edin., 2 vols. 4to, 1838; 8vo ed., 4 vols., 1842; new 4to ed., with additional plates, 2 vols., 1877), forming a unique record of the social life and popular habits of Edinburgh at its most interesting epoch. The caricatures have little strictly artistic merit beyond their graphic power; the drawing is always stiff and often false; but they are admitted to have been accurate likenesses, and they possess the evident recommendation of abundant and sly humor.

KAYE, Sir John William (1814–1876), historian, was born in 1814, the son of a solicitor. Educated at Eton and Addiscombe Royal Military College, he served as an officer in the Bengal artillery till 1841, when he exchanged his sword for the pen. In 1856 he entered the service of the East India Company in England; and when next year the crown assumed the government of India, Kaye succeeded John Stuart Mill as secretary in the political and secret department of the India office. In 1871 he was created a knight of the Star of India. In 1874 his failing health warned him to resign the post; and he died in London, July 24, 1876. To his historical and biographical writings Sir John Kaye brought an historical sagacity, an honesty of purpose, and a military knowledge that make them at once valuable and interesting.

His best known works are his *History of the Sepoy War*, 3 vols., 1864; *History of the War in Afghanistan*, 2 vols., 1851; and his *Life of Lord Metcalfe*, 2 vols., 1854. He was the author also of *Peregrine Pultney* (1844), and *Long Engagements* (1861), two Indian novels; *History of the Administration of the East India Company*, 1853; *Life of Henry Tucker*, 1854; *Life of Sir John Malcolm*, 2 vols., 1856; *History of Christianity in India*, 1859; *Lives of Indian Officers*, 2 vols., 1867; *Essays of an Optimist*, 1870; and numerous contributions to periodicals.

KAZALA, or Kazalinsk, a fort and town, at the point where the Kazala falls into the Jaxartes, about 47 miles from its mouth. It is situated in 45° 45′ N. lat. and 62° 7′ E. long., "at the junction," to quote Schuyler's description, "of all the trade routes in Central Asia, as the road from Orenburg meets here with the Khivan, Bukharan, and Tashkent roads;" and thus, besides carrying on a lively local trade with the Kirghiz of the surrounding country, it is a point of growing importance in the general current of commerce. In other respects the position of the place is far from attractive: the floods on the river make it an island in the spring; in summer it is parched by the sun and hot winds, and hardly a tree can be got to grow. The streets are wide, but the houses, as well as the fairly strong fort known as Fort No. 1, are built of mud bricks. The population, stated at 5000, is on the increase.

KAZAN, a government of European Russia, belonging to the basin of the Volga, and conterminous with the governments of Nizhni Novgorod, Vyatka, Orenburg, Samara, and Simbirsk. The area, according to the government survey, is 23,998 square miles. By the Volga and its tributary the Kama the surface of the government is divided into three regions of differing aspect; the first, to the right of the main river, is traversed by deep ravines sloping to the northeast and by two ranges of hills, one of which, keeping company with the river, has a height of 300 to 500 feet; the second, between the left bank of the Volga and the left bank of the Kama, is an open steppe; and the third, between the left bank of the Volga and the right bank of the Kama, resembles in its eastern part the first region, and in its western part is covered with forest. Marls, limestones, and sandstones, Permian or Triassic, are the main rocks; the Jurassic formation appears in a small part of the Tetyushi district; and Tertiary rocks stretch along the left bank of the Volga. There are no minerals of importance; but mineral springs (iron, sulphur, and naphtha) exist in several places. The Volga is navigable in all the 198 miles of its course through Kazan, as well as the Kama (120 miles); and the Vyatka, the Kazanka, the Rutka, the Tsivil, the Greater Kotshaga, the Ilet, and the Bezdna are not without value as waterways. About four hundred small lakes are enumerated within the government; the Upper and Lower Kaban supply the city of Kazan with water.

About 7,123,610 acres (more than 46 per cent. of the surface) are arable, upwards of 1,324,900 acres (over 8 per cent.) are meadow land, and 5,190,960 acres (nearly 34 per cent.) are under forest. Rye and oats form the principal crops; barley, wheat, buckwheat, and potatoes are also grown. In 1879 the official returns gave 1,048,092 as the number of sheep in the government, and of these 13,748 were of fine woolled breeds; the horned cattle amounted to 359,362, the horses to 426,564, the swine to 192,190, and the goats to 45,822. No fewer than 8066 persons were engaged in bee-keeping, and the produce of this department was valued at £29,945. Industrial activity is on the increase; the number of the smaller manufacturing establishments is diminishing, but those which remain (272 in 1879, employing 8399 hands) are greatly increasing in production. The total value of their manufacture in 1879 was £2,034,137. Apart from the regular factories, there is a large industrial activity. The weaving and dyeing of linen and hemp goods gave employment in 1879 to 13,485 men; wool-combing, etc., to 3428; flour and malt making to 3680, and the forest industries, wood-cutting, tar-boiling, etc., to 10,423. The aggregate commerce of the town is estimated at £3,695,000. Of the seventy-six annual fairs, the chief are the timber fair of Kozmodemyansk, and those of Tchistopol and Tcheboksarui. Administratively Kazan is divided into twelve districts:—Kazan, Sviyazhsk, Tcheboksarui, Tsivilsk, Yadrin, Kozmodemyansk, Tsarevokokshaisk, Mamaduish, Tchistopol, Laisheff, Spassk, Tetyushi. Besides the city of Kazan, the following are the largest towns:—Tchistopol (20,293 inhabitants in 1879), Laisheff (5098), Tcheboksarui (4560), Kozmodemyansk (4508), Mamaduish (4068). The total population of the government in 1879 was 1,872,437 (194,343 in the towns, 1,678,094 in the country districts). The males in the former case numbered 109,915, and the females 84,428; and in the latter the males 820,144, and females 857,950. An increase of 267,732 has taken place since 1862. More than half of the inhabitants are of non-Slavonic origin; and the Mohammedans number over half a million.

The formation of the Kazan government dates from the year 1708; at first it contained a large portion of South-eastern Russia, but in 1781 the present limits were determined. The division into twelve districts was made in 1802.

Kazan, chief town of the above government, is situated in 55° 48′ N. lat. and 49° 26′ E. long., 528 miles east of Moscow and 970 miles from St. Petersburg. The summer course of the Volga lies several miles to the southwest, and is gradually increasing its distance; but when the river is at its height in spring the intervening space is laid under water, and the steamers, which at other times stop at the mouth of the Kazanka, are able to approach the town. Though the hill on which the citadel stands is only about 40 feet high, it forms a striking relief to the level country in front. Contrary to what might be expected from its history, the town is almost completely destitute of Oriental coloring; but the number and brightness of the Greek churches helps to relieve the general air of modern and commonplace regularity. The cathedral of the Annunciation was founded in 1562 by Gury, the first bishop of the diocese of Kazan; and the Bogoroditskii convent was erected in 1579 for the reception of the "Black Virgin of Kazan," which was removed in 1821 to the famous Kazan cathedral in St. Petersburg. Of pre-Russian buildings there is hardly a trace; the red brick Sumbek tower, 245 feet high, is an object of great veneration to the Tartars, who consider it as the burial-place of one of their saints; but its similarity to the towers of Moscow proves its Muscovite origin. As an intellectual centre Kazan is the most important city of Eastern Russia in Europe. The gymnasium, founded in 1750, was the third national institution for secondary education established in the empire; and the university, which dates from 1801, has become a great seat of Oriental scholarship. It has four faculties, with fifty-six teachers and about seven hundred students. The library contains about 85,000 volumes; but the most valuable part of its manuscript collection has been removed to St. Petersburg. There is an astronomical observatory; and from the university press are issued a learned journal (*Izvyestiya i Zapiski*) and a very considerable number of works, especially in Oriental philology. The ecclesiastical academy founded in 1846 contains the old library of the Solovki monastery, of importance for the history of Russian sects. Schools are maintained by the Tartar population, which still occupies some of the suburbs; and Tartar text-books (by Radloff) after the European type have been introduced. As a seat of commerce and industry Kazan holds a respectable place. Its leather goods, especially those of the finer qualities, are in repute; and it also manufactures alcohol, flour, cotton and hemp goods, starch, stearine, tallow, and albumen. The trade connection of the Tartar merchants more particularly is a very extensive and important one. The population of the town, which was 63,084 in 1863, had increased in 1879 to 134,434, of whom 13,635 are Tartars.

The present government of Kazan was the centre of a great Bulgarian kingdom, the first historical monarchy of Northeastern Russia. On the ruins of this kingdom the Mongolian (Tartar) "kingdom of Kazan" was founded in the 15th century by Ulu-Mahmet, whose descendants continued to rule till the destruction of their city by Ivan the Terrible in 1552. Of the town of Kazan the early notices are of doubtful interpretation; but according to S. M. Shpilevski the Kazan mentioned in 1376 must be Bulgar (the present Bolgarui in the district of Spassk), the "Great Town" of the Bulgarians, the ruins of which are among the most notable in the Kazan region; and the Kazan of even some of the later chronicles is to be identified with Koshan on the Kama. Nor is the present the original of Kazan proper; on the banks of the Kazanka are extensive remains of *Iski* (Tartar for "Old") *Kazan*, near a modern village of the same name. Kazan was laid waste by Pugatcheff, and the conflagrations of 1815 and 1825 were especially destructive. During the French invasion the Moscow university took asylum in the town.

The name of Kazan Tartars is given, not only to those of the government of Kazan, but to those of Ufa, Samara, Vyatka, Saratoff, Penza, Nizhni Novgorod, Orenburg, and Tamboff. In 1870 they amounted altogether to 1,050,000. In many ways they differ considerably from those of Astrakhan, the Crimea, etc. They have pretty certainly incorporated a good deal of Bulgarian blood.

The history of Kazan has been written by Turnerelli (1841), Lepteff, Kurbski, and others. The evidence of Arabic, Tartar, and Russian writers in regard to the antiquities of town and government has been collected by Shpilevski (*Isv. i. Zap. Imp. Kas. Un.*, 1877, pp. 1-585). A bibliography of the Oriental books published in the town is given in the *Bull. of the St. Petersburg Academy*, 1867. Compare Louis Leger, "Kazan et les Tartares," in *Bibl. Univ. de Genève*, 1874.

KAZINCZY, **Ferencz** or **Francis** (1759–1831), an Hungarian author, known as the most indefatigable agent in the regeneration of the Magyar language and literature at the end of the 18th and the beginning of the 19th century, was born 27th October, 1759, at Ér-Semlyén, in the county of Bihar, Hungary. After passing through the gymnasium of Sáros-Patak, he studied law at Kassa and Eperies, and in Pest, where he also obtained a thorough knowledge of French and German literature, and made the acquaintance of

Gideon Ráday, who allowed him the use of his library, and encouraged him in literary pursuits. In 1784 Kazinczy became sub-notary for the county of Abaúj: and in 1786 he was nominated inspector of schools at Kassa. There he began to devote himself to the restoration of the Magyar language and literature by translations from classical foreign works, and by the augmentation of the native vocabulary from ancient Magyar sources. In 1788, with the assistance of Baróti Szabó and John Bacsányi, he started at Kassa the first Magyar literary magazine, *Magyar Muzeum;* the *Orpheus*, which succeeded it in 1790, was of his own creation. Although, upon the accession of Leopold II., Kazinczy, as a non-Catholic, was obliged to resign his post at Kassa, his literary activity in no way decreased, and he not only assisted Gideon Ráday in the establishment and direction of the first Magyar dramatic society, but also enriched the repertoire with several translations from foreign authors. His *Hamlet*, which first appeared at Kassa in 1790, is a rendering from the German version of Schröder. Having become implicated in the democratic conspiracy of the abbot Martinovics, Kazinczy was arrested on the 14th December, 1794, conveyed to Buda, tried, and condemned to death; but the sentence was commuted to imprisonment. He was released in 1801, and shortly afterwards married Sophia Török, daughter of his former patron, and retired to his small estate at Széphalom or "Fairhill," near Sátor-Ujhely, in the county of Zemplén. In 1828 he took an active part in the conferences held for the establishment of the Hungarian academy, in the historical section of which he became the first corresponding member. He died of Asiatic cholera, at Széphalom, on the 22d August, 1831, in the seventy-second year of his age.

Kazinczy, although possessing great beauty of style, cannot be regarded as a powerful and original thinker; his fame is chiefly due to the felicity of his translations from the masterpieces of Lessing, Goethe, Wieland, Klopstock, Ossian, La Rochefoucauld, Marmontel, Molière, Metastasio, Shakespeare, Sterne, Cicero, Sallust, Anacreon, and many others. He also edited the works of Baróczy (Pest, 1812, 8 vols.) and of the poet Zrinyi (1817, 2 vols.), and the poems of Dayka (1813, 3 vols.) and of John Kis (1815, 3 vols.). A collective edition of his works, consisting for the most part of translations, was published at Pest, 1814–1816, in 9 vols. His original productions, largely made up of letters, were edited by Joseph Bajza and Francis Toldy at Pest, 1836–45, in 5 vols. Editions of his poems appeared in 1858 and 1863. See Hungary, vol. xii. p. 392.

KEAN, Charles John (1811–1868), tragedian, son of Edmund Kean noticed below, was born at Waterford, Ireland, 18th January, 1811. In his fourteenth year he was sent to Eton College, where he remained three years. The name of Kean secured him an engagement at Drury Lane Theatre, where he made his debut 1st October, 1827, in the character of Norval, but failed to create a very favorable impression, his talents being such as required long practice and careful study for their development; and his continued failure to achieve popularity led him to leave London in the spring of 1828 for the provinces. After a visit to America in 1830, where he was received with much favor, he in 1833 appeared at Covent Garden as Sir Edmund Mortimer, but his success was not pronounced enough to encourage him to remain long in London, especially as he had already in the provinces won a high position. In January, 1838, he returned to Drury Lane, and played Hamlet with a success which gave him a place among the principal tragedians of his time. After his marriage with the actress Miss Ellen Tree in 1842, he paid a second visit to America. Returning to England in 1847, he entered on a successful engagement at the Haymarket, and in 1850, along with Mr. Kelly, he became lessee of the Princess Theatre. The most noteworthy feature of his management was a series of gorgeous Shakespearean revivals. Charles Kean cannot be called a great tragic actor. He did all that could be done by the persevering cultivation of his powers, and in many ways manifested the possession of high intelligence and refined taste; but his defects of person and voice made it impossible for him to give a representation at all adequate of the varying and subtle emotions characteristic of pure tragedy. In melodramatic parts such as Louis XI. and the Corsican Brothers his success was unequivocal and complete. From his "tour round the world" Kean returned in 1866 in broken health, and he died at London, January 22, 1868.

The Life and Theatrical Times of Charles Kean, by John William Cole, appeared in 1860 in two volumes.

KEAN, Edmund (1787–1833), an English actor, chiefly celebrated as the impersonator of Shakespearean characters, was born at Chancery Lane, London, November 4, 1787. His reputed father was Aaron Kean, stage carpenter, and his mother was a strolling actress, Ann Carey, granddaughter of Henry Carey, the author of the *National Anthem*, and the natural son of George Savile, marquis of Halifax. When only in his fourth year Kean made his first appearance on the stage as Cupid in one of Noverre's ballets at the opera-house. His fine black eyes, his bright vivacity and cleverness, and his ready affection to those who treated him with kindness, made him in childhood a universal favorite, but the harsh circumstances of his lot, and the want of proper restraint, while they developed strong self-reliance, fostered wayward tendencies. About 1794 a few persons benevolently provided the means of sending him to school, where he mastered his tasks with remarkable ease and rapidity; but finding its restraint intolerably irksome, he shipped himself as a cabin boy at Portsmouth. Soon discovering that he had only escaped to a more rigorous bondage, he counterfeited both deafness and lameness with a histrionic mastery which deceived even the physicians at Madeira. On his return to England he sought the protection of his uncle Moses Kean, mimic, ventriloquist, and general entertainer, who, besides continuing his pantomimic studies, introduced him to the study of Shakespeare. At the same time Miss Tidswell, an actress who had been specially kind to him from infancy, taught him the principles of acting. On the death of his uncle he was taken charge of by Miss Tidswell, and under her direction he began the systematic study of the principal Shakespearean characters, displaying even at this early period the peculiar originality of his genius by interpretations entirely different from those of Kemble. His brilliant talents and interesting countenance induced a Mrs. Clarke of Guildford Street, Russell Square, to adopt him, but the unlucky remark of a visitor so touched his sensitive pride that he suddenly left her house and went back to his old surroundings. In his fourteenth year he obtained an engagement to play leading characters for twenty nights in York Theatre, appearing as Hamlet, Hastings, and Cato. Shortly afterwards, while he was in the strolling troupe of Richardson, the rumor of his abilities reached the ear of King George III., who commanded him to recite at Windsor Castle. It is affirmed that this incident led some gentlemen to send him to Eton College; but the next three years of his life, from 1803–1806, are without authentic record. In 1807 he played leading parts in the Belfast theatre along with Mrs. Siddons, who said that he "played very, very well," but that "there was too little of him to make a great actor." An engagement in 1808 to play leading characters in Beverley's provincial troupe was brought to an abrupt close by his marriage with Miss Chambers, the leading actress, and for several years after his prospects were so dark that, when contemplating the possibility of a debut in London, he was in the habit of exclaiming, "If I succeed I shall go mad." In 1814, however, the committee of Drury Lane theatre, the fortunes of which were then so low that bankruptcy seemed inevitable, resolved to give him a chance among the "experiments" they were making to win a return of popularity. His debut there on the 26th January as Shylock roused the audience to almost uncontrollable enthusiasm, and successive appearances in Richard III., Hamlet, Othello, Macbeth, and Lear only served to demonstrate to the fullest the greatness of his powers and his complete mastery of the whole range of tragic emotion.

Probably the irregular habits of Kean, even from the period when he became famous, were prejudicial to the refinement of his taste, and latterly they tended to exaggerate his special defects and mannerisms. The adverse decision in the divorce case Cox *v.* Kean, and his consequent separation from his wife, roused against him such bitter feeling as almost compelled him to retire permanently into private life. Ultimately he was received with all the old favor, but the contest by its effects both on his bodily health and on his feelings had made him so dependent on the use of stimulants that the gradual deterioration of his gifts was inevitable. Still, even in their decay his great powers triumphed during the moments of his inspiration over the absolute wreck of his physical faculties, and compelled admiration when his gait had degenerated into a weak hobble, when the lightning brilliancy of his eyes had become dull and bloodshot, and the tones of his matchless voice were marred by rough and grating hoarseness. His last appearance on the stage was at Covent Garden, on the 25th March, 1833, when he played Othello to his son's Iago. At the words "Villain, be sure" in scene 3 of act iii. he suddenly broke down, and fell insensible into his son's arms. He died at Richmond, 15th May, 1833.

It was especially in the impersonation of the great creations of Shakespeare's genius that the varied beauty and grandeur of the acting of Kean were displayed in their highest form, although probably his most powerful character was Sir Giles Overreach, the effect of his first impersonation of which was such that the pit rose *en masse*, and even the actors and actresses themselves were overcome by the terrific dramatic illusion. His only personal disadvantage as an actor was his small stature. His countenance was strikingly interesting and unusually mobile; he had a matchless command of facial elocution; his fine eyes scintillated even the slightest shades of emotion and thought; his voice, though weak and harsh in the upper register, possessed in its lower range tones of penetrating and resistless power, and a thrilling sweetness like the witchery of the finest music; above all, in the grander moments of his passion, his intellect and soul seemed to rise beyond material barriers and to glorify physical defects with their own greatness. Kean specially excelled as the exponent of passion. In Othello, Iago, Shylock, and Richard III., characters utterly different from each other, but in which the predominant element is some form of passion, his identification with the personality, as he had conceived it, was as nearly as possible perfect, and each isolated phase and aspect of the plot was elaborated with the minutest attention to details, and yet with an absolute subordination of these to the distinct individuality he was endeavoring to portray. If the range of character in which Kean attained supreme excellence was narrow, no one except Garrick has been so successful in so many great impersonations. Unlike Garrick, he had no true talent for comedy, but in the expression of biting and saturnine wit, of grim and ghostly gayety, he was unsurpassed.

See Procter's *Life of Kean*, but especially the *Life of Edmund Kean*, by F. W. Hawkins, 2 vols., 1869, and the authorities therein mentioned. Some interesting details will also be found in Edward Stirling's *Old Drury Lane*, 1881.

KEATS, John (1795–1821), born October 29, 1795, published his first volume of verse in 1817, his second in the following year, his third in 1820, and died of consumption at Rome, February 23, 1821, in the fourth month of his twenty-sixth year. In his first book there was little foretaste of anything greatly or even genuinely good; but between the marshy and sandy flats of sterile or futile verse there were undoubtedly some few purple patches of floral promise. The style was frequently detestable—a mixture of sham Spenserian and mock Wordsworthian, alternately florid and arid. His second book, *Endymion*, rises in its best passages to the highest level of Barnfield and of Lodge, the two previous poets with whom, had he published nothing more, he might most probably have been classed; and this, among minor minstrels, is no unenviable place. His third book raised him at once to a foremost rank in the highest class of English poets. Never was any one of them but Shelley so little of a marvellous boy and so suddenly revealed as a marvellous man. Never has any poet suffered so much from the chaotic misarrangement of his poems in every collected edition. The rawest and the rankest rubbish of his fitful spring is bound up in one sheaf with the ripest ears, flung into one basket with the richest fruits, of his sudden and splendid summer. The *Ode to a Nightingale*, one of the finest masterpieces of human work in all time and for all ages, is immediately preceded in all editions now current by some of the most vulgar and fulsome doggerel ever whimpered by a vapid and effeminate rhymester in the sickly stage of whelphood. Shelley up to twenty had written little or nothing that would have done credit to a boy of ten; and of Keats also it may be said that the merit of his work at twenty-five was hardly by comparison more wonderful than its demerit at twenty-two. His first book fell as flat as it deserved to fall; the reception of his second, though less considerate than on the whole it deserved, was not more contemptuous than that of immeasurably better books published about the same time by Coleridge, Landor, and Shelley. A critic of exceptional carefulness and candor might have noted in the first book so singular an example of a stork among the cranes as the famous and noble sonnet on Chapman's Homer; a just judge would have indicated, a partial advocate might have exaggerated, the value of such golden grain amid a garish harvest of tares as the hymn to Pan and the translation into verse of Titian's Bacchanal which glorify the weedy wilderness of *Endymion*. But the hardest thing said of that poem by the *Quarterly* reviewer was unconsciously echoed by the future author of *Adonais*,—that it was all but absolutely impossible to read through; and the obscener insolence of the "Blackguard's Magazine," as Landor afterwards very justly labelled it, is explicable, though certainly not excusable, if we glance back at such a passage as that where Endymion exchanges fulsome and liquorish endearments with the "known unknown *from whom his being sips such darling* (*!*) *essence*." Such nauseous and pitiful phrases as these, and certain passages in his correspondence, make us understand the source of the most offensive imputations or insinuations levelled against the writer's manhood; and, while admitting that neither his love-letters, nor the last piteous outcries of his wailing and shrieking agony, would ever have been made public by merciful or respectful editors, we must also admit that, if they ought never to have been published, it is no less certain that they ought never to have been written; that a manful kind of man or even a manly sort of boy, in his love-making or in his suffering, will not howl and snivel after such a lamentable fashion. One thing hitherto inexplicable a very slight and rapid glance at his amatory correspondence will amply suffice to explain: how it came to pass that the woman so passionately beloved by so great a poet should have thought it the hopeless attempt of a mistaken kindness to revive the memory of a man for whom the best that could be wished was complete and compassionate oblivion. For the side of the man's nature presented to her inspection, this probably was all that charity or reason could have desired. But that there was a finer side to the man, even if considered apart from the poet, his correspondence with his friends and their general evidence to his character give more sufficient proof than perhaps we might have derived from the general impression left on us by his works; though indeed the preface to *Endymion* itself, however illogical in its obviously implied suggestion that the poem published was undeniably unworthy of publication, gave proof or hint at least that after all its author was something of a man. And the eighteenth of his letters to Miss Brawne stands out in bright and brave contrast with such as seem incompatible with the traditions of his character on its manlier side. But if it must be said that he lived long enough only to give promise of being a man, it must also be said that he lived long enough to give assurance of being a poet who was not born to come short of the first rank. Not even a hint of such a probability could have been gathered from his first or even from his second, appearance; after the publication of his third volume it was no longer a matter of possible debate among judges of tolerable competence that this improbability had become a certainty. Two or three phrases cancelled, two or three lines erased, would have left us in *Lamia*, one of the most faultless as surely as one of the most glorious jewels in the crown of English poetry. *Isabella*, feeble and awkward in narrative to a degree almost incredible in a student of Dryden and a pupil of Leigh Hunt, is overcharged with episodical effects of splendid and pathetic expression beyond the reach of either. *The Eve of St. Agnes*, aiming at no doubtful success, succeeds in evading all casual difficulty in the line of narrative; with no shadow of pretence to such interest as may be derived from stress of incident or depth of sentiment, it stands out among all other famous poems as a perfect and unsurpassable study in pure color and clear melody—a study in which the figure of Madeline brings back upon the mind's eye, if only as moonlight recalls a sense of sunshine, the nuptial picture of Marlowe's Hero and the sleeping presence of Shakespeare's Imogen. Beside this poem should always be placed the less famous but not less precious *Eve of St. Mark*, a fragment unexcelled for the simple perfection of its perfect simplicity, exquisite alike in suggestion and in accomplishment. The triumph of *Hyperion* is as nearly complete as the failure of *Endymion;* yet Keats never gave such proof of a manly devotion and rational sense of duty to his art as in his resolution to leave this great poem unfinished; not, as we may gather from his correspondence on the subject, for the pitiful reason assigned by his publishers, that of discouragement at the reception given to his former work, but on the solid and reasonable ground that a Miltonic study had something in its very scheme and nature too artificial, too studious of a foreign influence, to be carried on and carried out at such length as was implied by his original design. Fortified and purified as it had been on a first revision, when much introductory allegory and much tentative effusion of sonorous and superfluous verse had been rigorously clipped down or pruned away, it could not long have retained spirit enough to support or inform the shadowy body of a subject so little charged with tangible significance. The faculty of assimilation as distinguished from imitation, than which there can be no surer or stronger sign of strong and sure original genius, is not more evident in the most Miltonic passages of the revised *Hyperion* than in the more Shakespearean passages of the unrevised tragedy which no radical correction could have left other than radically incorrigible. It is no conventional exaggeration, no hyperbolical phrase of flattery with more sound than sense in it, to say that in this chaotic and puerile play of *Otho the Great* there are such verses as Shakespeare might not without pride have signed at the age when he wrote and even at the age when he rewrote the tragedy of *Romeo and Juliet.* The dramatic fragment of *King Stephen* shows far more power of hand and gives far more promise of success than does that of Shelley's *Charles the First.* Yet we cannot say with any confidence that even this far from extravagant promise would certainly or probably have been kept; it is certain only that Keats in these attempts did at least succeed in showing a possibility of future excellence as a tragic or at least a romantic dramatist. In every other line of high and serious poetry his triumph was actual and consummate; here only was it no more than potential or incomplete. As a ballad of the more lyrical order, *La belle Dame sans Merci* is not less absolutely excellent, less triumphantly perfect in force and clearness of impression, than as a narrative poem is *Lamia.* In his lines on Robin Hood, and in one or two other less noticeable studies of the kind, he has shown thorough and easy mastery of the beautiful metre inherited by Fletcher from Barnfield and by Milton from Fletcher. The simple force of spirit and style which distinguishes the genuine ballad manner from all spurious attempts at an artificial simplicity was once more at least achieved in his verses on the crowning creation of Scott's humaner and manlier genius—Meg Merrilies. No little injustice has been done to Keats by such devotees as fix their mind's eye only on the more salient and distinctive notes of a genius which in fact was very much more various and tentative, less limited and peculiar, than would be inferred from an exclusive study of his more specially characteristic work. But within the limits of that work must we look of course for the genuine credentials of his fame; and highest among them we must rate his unequalled and unrivalled odes. Of these perhaps the two nearest to absolute perfection, to the triumphant achievement and accomplishment of the very utmost beauty possible to human words, may be that to Autumn and that on a Grecian Urn; the most radiant, fervent, and musical is that to a Nightingale; the most pictorial and perhaps the tenderest in its ardor of passionate fancy is that to Psyche; the subtlest in sweetness of thought and feeling is that on Melancholy. Greater lyrical poetry the world may have seen than any that is in these; lovelier it surely has never seen, nor ever can it possibly see. From the divine fragment of an unfinished ode to Maia we can but guess that if completed it would have been worthy of a place beside the highest. His remaining lyrics have many beauties about them, but none perhaps can be called thoroughly beautiful. He has certainly left us one perfect sonnet of the first rank; and as certainly he has left us but one.

Keats, on high and recent authority, has been promoted to a place beside Shakespeare; and it was long since remarked by some earlier critic of less note that as a painter of flowers his touch had almost a Shakespearean felicity,—recalling, a writer in our own day might have added, the hand of M. Fantin on canvas. The faultless force and the profound subtlety of this deep and cunning instinct for the absolute expression of absolute natural beauty can hardly be questioned or overlooked; and this is doubtless the one main distinctive gift or power which denotes him as a poet among all his equals, and gives him right to a rank forever beside Coleridge and Shelley. As a man, the two admirers who have done best service to his memory are, first and far foremost, Lord Houghton, and secondly Mr. Matthew Arnold. These alone, among all who have written of him without the disadvantage or advantage of a personal acquaintance, have clearly seen and shown us the manhood of the man. That ridiculous and degrading legend which imposed so strangely on the generous tenderness of Shelley, while evoking the very natural and allowable laughter of Byron, fell to dust at once forever on the appearance of that admirable and unsurpassed biography which gave perfect proof to all time that "men have died and worms have eaten them," but not for fear of critics or through suffering inflicted by reviews. Somewhat too sensually sensitive he may have been in either capacity, but the nature of the man was as far as was the quality of the poet above the pitiful level of a creature whose soul could "let itself be snuffed out by an article;" and in fact, owing doubtless to the accident of a death which followed so fast on his early appearance and his dubious reception as a poet, the insolence and injustice of his reviewers in general have been comparatively and even considerably exaggerated. Except from the chief fountain head of professional ribaldry then open in the world of literary journalism, no reek of personal insult arose to offend his nostrils; and then as now the tactics of such unwashed malignants were inevitably suicidal; the references to his brief experiment of apprenticeship to a surgeon which are quoted from *Blackwood* in the shorter as well as in the longer memoir by Lord Houghton could leave no bad odor behind them save what might hang about men's yet briefer recollection of his assailant's unmemorable existence. The false Keats, therefore, whom Shelley pitied and Byron despised would have been, had he ever existed, a thing beneath compassion or contempt. That such a man could have had such a genius is almost evidently impossible; and yet more evident is the proof which remains on everlasting record that none was ever further from the chance of decline to such degradation than the real and actual man who made that name immortal. (A. C. S.)

Subjoined are the most important facts in the life of Keats. He was born, as already stated, in London on October 29, 1795. At an early age he was sent to school at Enfield, and in 1810 he was apprenticed to a surgeon at Edmonton. On the completion of his apprenticeship, in 1815, he removed to London for the purpose of walking the hospitals, and soon made the acquaintance of Leigh Hunt, and subsequently that of Haydon, Hazlitt, Shelley, and others. After having published some sonnets in the *Examiner*, of which Hunt was at that time editor, he was encouraged by the praise of his friends to give to the world a volume of *Poems* in 1817, and a second, entitled *Endymion, a Poetic Romance*, in the following year. Meanwhile, symptoms of hereditary lung-disease having shown themselves, he spent some months in visiting the English lake district and portions of Scotland and Ireland, but without re-establishing his failing health; on his return to London the despondency which had fallen upon him on this account was deepened by the death of his younger brother. Soon after this event he first became acquainted with Miss Brawne, and the friendship rapidly grew into a passion which combined with straitened circumstances and the steady progress of the disease to give a tragical cast to all that remained of his brief career. In 1820 the results of his literary activity during the two preceding years were published in *Lamia, Isabella, The Eve of St. Agnes, and other Poems*. In autumn of the same year, having been advised to winter in a more genial climate, he sailed for Italy. The voyage proved of little advantage, and after some months of suffering he died at Rome on February 23, 1821. *The Life, Letters, and Literary Remains* of Keats were published in two volumes by R. Monckton Milnes in 1848; *The Letters of John Keats to Fanny Brawne*, with introduction and notes by Harry Buxton Forman, appeared in 1878.

KEBLE, JOHN (1792–1866), the poet of the *Christian Year*, was born on St. Mark's Day (April 25), 1792, at Fairford, Gloucestershire. He was the second child and eldest son of the Rev. John Keble and Sarah Maule; three sisters and one brother completed the family circle. Descended from a family which had attained some legal eminence in the time of the Commonwealth, John Keble, the father of the poet, was vicar of Coln St. Aldwyn, but lived at Fairford, about 3 miles distant from his cure. He was a clergyman of the old High Church school, whose adherents, untouched by the influence of the Wesleys, had moulded their piety on the doctrines of the non-jurors and the old Anglican divines. Himself a good scholar, he did not send his son to any school, but educated him and his brother at home so well that both obtained scholarships at Corpus Christi College, Oxford. John was elected scholar of Corpus in his fifteenth, and fellow of Oriel in his nineteenth year, April, 1811. In Easter term 1810 he had obtained double first class honors, a distinction which had been obtained only once before, and that by Sir Robert Peel. After his election to the Oriel fellowship, Keble gained the University prizes, both for the English essay and also for the Latin essay. But he was more remarkable for the rare beauty of his character than even for academic distinctions. Sir John Taylor Coleridge, his fellow scholar at Corpus and his life-long friend, says of him, looking back on his youth, after their friendship of five and fifty years had closed, "It was the singular happiness of his nature, remarkable even in his undergraduate days, that love for him was always sanctified by reverence—reverence that did not make the love less tender, and love that did but add intensity to the reverence." Oriel College was, at the time when Keble entered it, the centre of all the finest ability in Oxford. Copleston, Davison, Whately, were among the fellows who elected Keble; Arnold, Pusey, Newman, were soon after added to the society. In 1815 Keble was ordained deacon and priest in 1816. His real bent and choice were towards a pastoral cure in a country parish; but he remained in Oxford, acting first as public examiner in the schools, then as tutor in Oriel, till 1823. In summer he sometimes took clerical work, sometimes made tours on foot through various English counties, during which he was composing poems, which afterwards took their place in the *Christian Year*. He had a rare power of attracting to himself the finest spirits, a power which lay not so much in his ability or his genius as in his character, so simple, so humble, so pure, so unworldly, yet wanting not that severity which can stand by principle and maintain what he holds to be the truth. In 1823 he left Oxford, and returned to Fairford, there to assist his father, and with his brother to serve one or two small and poorly endowed curacies in the neighborhood of Coln. He had made a quiet but deep impression on all who came within his influence in Oxford, and during his five years of college tutorship had won the affection of his pupils, some of whom afterwards rose to eminence. But it was to pastoral work, and not to academic duty, that he thenceforth devoted himself, associating with it, and scarcely placing on a lower level, the affectionate discharge of his duties as a son and brother. Filial piety influenced in a quite unusual degree his feelings and his action all life through. It was in 1827, a few years after he settled at Fairford, that he published the *Christian Year*. The poems which make up that book had been the silent gathering of years. Keble had purposed in his own mind to keep them beside him, correcting and improving them, as long as he lived, and to leave them to be published only "when he was fairly out of the way." This resolution was at length overcome by the importunities of his friends, and above all by the strong desire of his father to see his son's poems in print before he died. Accordingly they were printed in two small volumes in Oxford, and given to the world in June, 1827, but with no name on the title-page. The book continued to be published anonymously, but the name of the author soon transpired. Probably no book of poetry in this century has had a wider circulation. Between 1827 and 1872 one hundred and fifty-eight editions had issued from the press, and since the latter date it has been largely reprinted both by the original publishers and by others. The author, so far from taking pride in this widespread reputation, seemed all his life long to wish to disconnect his name with the book, and "as if he would rather it had been the work of some one else than himself." This feeling arose from no false modesty. It was because he knew that in these poems he had painted his own heart, the best part of it; and he doubted whether it was right thus to exhibit himself, and by the revelation of only his better self, to win the good opinion of the world, on which he knew that a woe had been pronounced.

Towards the close of 1831 Keble was elected to fill the chair of the poetry professorship in Oxford, as successor to his friend and admirer, Dean Milman. This chair he occupied for ten years, probably the most eventful ten years which Oxford has seen since the Reformation. The professor is required by statute to deliver at least one lecture during each of the three terms that make up the academic year; and during Keble's tenure these lectures were still required to be in Latin. In the course of his professorship he delivered a series of lectures, clothed in excellent idiomatic Latin, in which he expounded a theory of poetry which was original and suggestive, and which grew naturally out of his own character and habits of mind. He looked on poetry as a vent for overcharged feeling, or a full imagination, or some imaginative regret, which had not found their natural outlet in life and action. It was a relief provided for those feelings which are apt to fill the mind too full, and to overburden the heart. This suggested to him a distinction between what he called primary and secondary poets,—the first employing poetry to relieve their own hearts; the second, poetic artists, composing poetry from some other and less impulsive motive. Of the former kind were Homer, Lucretius, Burns, Scott; of the latter were Euripides, Dryden, Milton. This view is set forth in an article contributed to the *British Critic* in 1838 on the life of Scott, and was more fully developed in two volumes of *Prælectiones Academicæ*.

His regular visits to Oxford kept him in intercourse with his old friends in Oriel common room, and made him familiar with the currents of feeling which swayed the University. Catholic emancipation and the Reform bill had deeply stirred not only the political spirit of Oxford, but also the church feeling, which had long been stagnant. Cardinal Newman writes: "On Sunday, July 14, 1833, Mr. Keble preached the assize sermon in the University pulpit. It was published under the title of *National Apostasy*. I have ever considered and kept the day as the start of the religious movement of 1833." The occasion of this sermon was the suppression, by Earl Grey's Reform ministry, of ten Irish bishoprics. Against the spirit which would treat the church as the mere creature of the state Keble had long chafed inwardly, and now he made his outward protest, asserting the claim of the church to a heavenly origin and a divine prerogative. About the same time, and partly stimulated by Keble's sermon, some leading spirits in Oxford and elsewhere began a concerted and systematic course of action to revive High Church principles and the ancient patristic theology, and by these means both to defend the church against the assaults of its enemies, and also to raise to a higher tone the standard of Christian life in England. This design embodied itself in what is known as the Tractarian movement—a name it received from the once famous *Tracts for the Times*, which were the vehicle for promulgating the new doctrines. If Keble is to be reckoned, as Dr. Newman would have it, as the primary author of the movement, it was from Dr. Pusey that it received one of its best-known names, and in Dr. Newman that it soon found its genuine leader. To the tracts, which did so much to spread High Church views, Keble made only four contributions:—No. 4, containing an argument, in the manner of Bishop Butler, to show that adherence to apostolical succession is the safest course; No. 13, which explains the principle on which the Sunday lessons in the church service are selected; No. 40, on marriage with one who is unbaptized; No. 89, on the mysticism attributed to the early fathers of the church. Besides these contributions from his own pen, he did much for the series by suggesting subjects, by reviewing tracts written by others, and by lending to their circulation the weight of his personal influence.

In 1835 Keble's father died at the age of ninety, and soon after this his son married Miss Clarke, left Fairford, and settled at Hursley vicarage in Hampshire, a living to which he had been presented by his friend and attached pupil, Sir William Heathcote, and which continued to be Keble's home and cure for the remainder of his life.

In 1841 the tracts were brought to an abrupt termination by the publication of Newman's tract No. 90. All the Protestantism of England was in arms against the author of the obnoxious tract. Keble came forward at the time, desirous to share the responsibility and the blame, if there was any; for he had seen the tract before it was published, and approved of it. The same year in which burst this ecclesiastical storm saw the close of Keble's tenure of the professorship of poetry, and thenceforward he was seen but rarely in Oxford. No other public event ever affected Keble so deeply as the secession of his friend Mr. Newman to the Church of Rome in 1845. It was to him both a public and a private sorrow, which nothing could repair. But he did not lose heart; at once he threw himself into the double duty, which now devolved on himself and Dr. Pusey, of counselling the many who had hitherto followed the movement, and who, now in their perplexity, might be tempted to follow their leader's example, and at the same time of maintaining the rights of the church against what he held to be the encroachments of the state, as seen in such public acts as the Gorham judgment and the decision on *Essays and Reviews*. In all the ecclesiastical contests of the twenty years which followed 1845 Keble took a part, not loud or obtrusive, but firm and resolute, in maintaining those High Anglican principles with which his life had been identified. These absorbing duties, added to his parochial work, left little time for literature. But in 1846 he published the *Lyra Innocentium;* and in 1863 he completed a life of Bishop Wilson.

In the late autumn of the latter year Keble left Hursley for the sake of his wife's health, and sought the milder climate of Bournemouth. There he had an attack of paralysis, from which he died on the 29th of March, 1866. He was buried in his own churchyard at Hursley; and in little more than a month his wife was laid by her husband's side.

It is as a poet that Keble was best known during his life, and it is as a poet that he will be remembered. His poetical works are the *Christian Year* (1827), *A Metrical Version of the Psalter* (1839), *Lyra Innocentium* (1846), and a volume of poems published posthumously.

Keble, though himself childless, was a special lover of children; and the *Lyra Innocentium* expresses this characteristic. It is a book "about children, their ways, and privileges." It begins with their baptism, follows them through their cradle life and infancy, their childhood sports, troubles, encouragements, warnings, the lessons taught them by nature, those taught them by grace, dwells on their sicknesses, and their deaths. It is a book for parents, especially for mothers. The range of subjects is too limited, and the turn of thought often too subtle, to allow it to be widely popular. But Judge Coleridge pronounced it, if not equal to the *Christian Year* as a whole, yet more than equal to it in parts; and Dean Stanley thinks that "it has more of the true fire of genius, more of the true rush of poetic diction." However this may be, it is by the *Christian Year* that Keble won the ear of the religious world, and will retain it. It was a happy thought that dictated the plan of the book, to furnish a meditative religious lyric for each Sunday of the year, and for each saint's day and festival of the English Church. The subject of each poem is generally suggested by some part of the lessons, or the gospel, or the epistle for the day. One thing which gives these poems their strangely unique power is the sentiment to which they appeal, and the saintly character of the poet who makes the appeal illumining, more or less, every poem. That to which the *Christian Year* appeals is the religious and devotional sentiment which, however hidden, exists more or less in most men. In the words of Sir J. T. Coleridge, "to this feeling it makes its unceasing appeal, with a voice so earnest, so sincere, so sad in its hopefulness, so unpretending as to the speaker, yet so authoritative and confident as to the cause it pleads, that for the time it seems irresistible."

The preface begins with observing how important is "a sober standard of feeling in matters of practical religion," and indicates that the object of the book is to calm excitement, and to exhibit the soothing tendency which pervades the Book of Common Prayer. The motto on the title-page, "In quietness and confidence shall be your strength," is the keynote to which the whole book is set. The main characteristics which go to make up the charm of this small volume are these:—

1. The peculiar tone of religious feeling that pervades it, at once deep, pure, and tender, sober, and severely self-denying. The undertone of the book comes out in verses like this:

"The eye in smiles may wander round,
  Caught by earth's shadows as they fleet;
But for the soul no help is found,
  Save Him who made it, meet."

Closely connected with this there is a more personal feeling towards our Lord, in His whole nature at once human and divine, than had ever before appeared in English poetry,—even in that of Charles Wesley or Cowper. This runs through all the poems; it comes out especially in such verses as these:

> "Our Saviour's face benign,
> Bent on us with transforming power,
> Till we, too, faintly shine."

And again,

> "Who loves the Lord aright
> No soul of man can worthless find;
> All will be precious in his sight,
> Since Christ on all hath shined;
> But chiefly Christian souls; for they,
> Though worn and soiled with sinful clay,
> Are yet, to eyes that read them true,
> All glistening with baptismal dew."

2. A second note of the *Christian Year* is reverence for the church, and for the pastoral office within it,—a solemn sense of its dignity and its awful responsibility.

3. A third note is the strong and tender affection for home and friends, the filial and fraternal piety, which everywhere pervades it. This appears notably in the poem for St. Andrew's Day, in the two opening stanzas of the poem on Whit Monday, in some verses of the poem for the 4th Sunday in Advent, and in many more.

4. A prevailing spirit of modesty and of delicate reserve, very unlike the vanity with which poets are often credited. Combined with this is a special tenderness for those persons and things which the world thinks least of—for those who pine forgotten in hidden nooks, for the downtrodden and the despised. These sympathies appear at every turn of the book,—especially, perhaps, in such poems as that for the 4th Sunday in Lent, that for Visitation of the Sick, and in two well-known stanzas in the poem for St. Matthew's Day, not to mention many other like passages.

5. Besides these qualities of Keble's heart as a man, there are others which belong to him especially as a poet. Prominent among these is his love of nature, particularly for the more ordinary and unnoticed features of English landscape. In these he seemed most to delight, as interwoven with home thoughts and sentiments, and because, as he expresses it,

> "Homely scenes and simple views
> Lowly thoughts may best infuse."

Many a scene from the neighborhood of Fairford and Oxford, many a fleeting image caught there in casual walks, has been inwrought, naturally and beautifully, into the web of his devout meditations.

6. The intimacy with the Bible which is manifest in the pages of the *Christian Year*, and the unobtrusive felicity with which Biblical sentiments and language are introduced, have done much to endear these poems to all Bible readers; nor this only, but the fidelity with which Biblical scenery is rendered. "The exactness of the descriptions of Palestine, which Keble had never visited, have been noted, and verified on the spot," by Dean Stanley. He points to features of the lake of Gennesareth, which were first touched in the *Christian Year;* and he observes that throughout the book "the Biblical scenery is treated graphically as real scenery, and the Biblical history and poetry as real history and poetry."

As to its style, the *Christian Year* is calm and grave in tone, and subdued in color, as beseems its subjects and sentiments. The contemporary poets whom Keble most admired were Scott, Wordsworth, and, we may add, Southey; and of their influence traces are visible in his diction. Yet he has a style of language and a cadence of his own, which steal into the heart with strangely soothing power. Some of the poems are faultless, after their kind, flowing from the first verse to the last, lucid in thought, vivid in diction, harmonious in their pensive melody. In others there are imperfections in rhythm, conventionalities of language, obscurities or over-subtleties of thought, which mar the reader's enjoyment. Yet even the most defective poems commonly have at least a single verse, expressing some profound thought or tender shade of feeling, for which the sympathetic reader willingly pardons artistic imperfections in the rest.

The real power of the *Christian Year* lies in this, that it brings home to the readers, as few poetic works have ever done, a heart of rare and saintly beauty. We may well believe that ages must elapse ere another such character shall again concur with a poetic gift and power of expression which, if not of the highest, are still of a high order.

Keble's life was written by his life-long friend, the late Mr. Justice Coleridge. The following is a complete list of his writings:—(1) Works published in Keble's lifetime: *Christian Year*, 1827; *Psalter*, 1839; *Prælectiones Academicæ*, 1844; *Lyra Innocentium*, 1846; *Sermons Academical*, 1848; *Argument against Repeal of Marriage Law*, and *Sequel*, 1857; *Eucharistical Adoration*, 1857; *Life of Bishop Wilson*, 1863; *Sermons Occasional and Parochial*, 1867. (2) Posthumous publications: *Village Sermons on the Baptismal Service*, 1868; *Miscellaneous Poems*, 1869; *Letters of Spiritual Counsel*, 1870; *Sermons for the Christian Year, etc.*, 11 vols., 1875-80; *Occasional Papers and Reviews*, 1877; *Studia Sacra*, 1877; *Outlines of Instruction or Meditation*, 1880. (J. C. S.)

KECSKEMÉT (Lat. *Egopolis*), a royal free town in the county of Pest-Pilis-Solt-Kis-Kun, Hungary, is situated in an extensive plain, on the railway between Szeged (Szegedin) and Budapest, 52 miles southeast of the latter, in 46° 54′ N. lat., 19° 44′ E. long. Kecskemét is a poorly built and straggling town. It contains Roman Catholic, Lutheran, and Calvinist churches, as also a synagogue. Among the educational and other establishments are a Calvinist upper gymnasium (since 1860) and juridical lyceum (1862), possessing a library and collection of pictures, a Roman Catholic (Piarist) upper gymnasium, founded in 1714, a Government technical school dating from 1874, monasteries belonging to the Piarist and Franciscan orders, a royal court of law, a hospital, orphan asylum, and theatre. The soil of the surrounding district, known as the Kecskemét heath, though generally arenaceous, is rendered productive by careful tillage. Soap is manufactured; and trade, promoted by the periodical fairs, is generally thriving. Joseph Katona, the author of the famous historical drama *Bánk Bán*, was born at Kecskemét in 1792. The population in 1880 was 46,505, chiefly Magyars by nationality.

KEELING ISLANDS, or COCOS ISLANDS, also called by Horsburgh the Borneo Coral Islands, a group in the Indian Ocean, about 600 miles south of the coast of Sumatra, in 12° 5′ S. lat. and 90° 55′ E. long., well known as having furnished Mr. Darwin with the typical example of an atoll or lagoon island.[1] There are altogether twenty-three small islands, 9½ miles being the greatest width of the whole atoll.[2] The lagoon is very shallow, and the passages between many of the islands of such trifling depth that it is possible to "walk at low tide, with some slight wading, all the way from Direction Island to West Island." An opening on the northern side of the reef permits the entrance of vessels into the northern part of the lagoon, which forms a good harbor, known as Port Refuge or Port Albion. Since Mr. Darwin's visit, some of the minor passages have become completely filled up.

The cocoanut (as the name Cocos Islands indicates) is the characteristic production, and is cultivated on all the islands. There are a few other trees (Sir E. Owen described seven kinds in 1830) and lesser plants; but the whole flora, exclusive of recent introductions, comprises less than thirty species. Of the twenty species, however, represented in Mr. Darwin's collection, "nineteen belonged to different genera, and these again to no less than sixteen families." With the exception of man and the domestic pig, the rat appears to be the only mammal in the islands; and there are no true land birds, except domestic poultry. One of the commonest living creatures is a monstrous crab which lives on the cocoanuts; and in some places also there are great colonies of the pomegranate crab, which, to quote Mr. Forbes, is "laboring assiduously to make the soft pure white calcareous mud into tree-inhabitable land." The climate is temperate and extremely healthy. Terrific storms sometimes break over the island; and it has been more than once visited by earthquakes. The inhabitants "are well developed, strong, and of a wonderfully healthy appearance;" they belong originally to various parts of the Indian archipelago, Borneo, Sumatra, Celebes, etc.

The Keeling Islands were discovered in 1609 by William Keeling on his way home from the Moluccas.[3] In 1823 Alexander Hare, an English adventurer, settled on the southmost island with a number of slaves. Some two or three years after, a Scotchman, J. Ross, who had commanded a brig during the English occupation of Java, settled with his family on Direction Island, and his little colony was soon strengthened by Hare's runaway slaves. The Dutch Government had in an informal way claimed the possession of the islands since 1829; but they refused to allow Ross to hoist the Dutch flag, and accordingly the place was taken under British protection in 1856. In 1878 it was attached to the government of Ceylon.

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[1] *Geological Observations on Coral Reefs*, London, 1851; new ed., 1874.

[2] The names of the more important are as follows:—Horsburgh or North Island (the most northern of the group); Direction Island or in Malay Pulu Tikus (Mouse Island); Prison Island; Rice (Rijst) or Water Island, in Malay Pulu Tuwan; South Island (Selima or Fairlee) Long, West, or Ross Island.

[3] His narrative is given by Purchas, and epitomised in Astley's *Collection*.

Besides Mr. Darwin's *Journal of the Voyages of the Beagle* (1860) and the work already mentioned, see Henry O. Forbes in *Proc. Roy. Geog. Soc.*, December, 1879 (with a good map); Koner in *Proc. Roy. Geog. Soc.*, 1881; A. van der Jagt in *Verh. Bat. Gen. van K. en W.*, xiii.; J. J. Duintjer in Tindal and Swaart's *Zeewezen*, iv.; *Voyage of Swedish Frigate "Eugenie"* (Berlin, 1856), and Bleeker's papers on ichthyology in *Natuurk. Tijdschr. van Ned. Ind.*, vii., viii., xv., etc.

KEFF, more correctly El-Keff (El Kaf), a town of the regency of Tunis, about 95 miles southwest from the capital, and 75 miles southeast of Bône in Algeria, "on the western declivities of a rocky range of bold hills," 5 or 6 miles to the east of the course of the Wady Medjardak. It is considered the third in importance of the Tunisian towns, ranking after Tunis and Kairwân; and, though distant some twenty-two miles from the Algerian frontier, it is practically a frontier post, and its walls and citadel are kept in a state of defence. Keff is identified with the ancient Roman colony of Sicca Veneria, which appears from the character of its Venus worship (Val. Max., ii. 6, § 15) to have been a Phœnician settlement. Remains of ancient buildings (as, for example, of a temple of Hercules), and a considerable number of ancient Latin inscriptions tend to confirm the identification. Population about 12,000.

See Barth, *Die Küstenländer des Mittelmeeres*, 1849; *Corpus Inscript. Lat.*, vol. viii.; Sombrun in *Bull. de la Soc. de Géog. de Bordeaux*, 1878.

KEIGHLEY, locally Keithley, anciently Keigheley, a market and manufacturing town in the northern division of the West Riding of Yorkshire, is beautifully situated in a deep valley near the junction of the Worth with the Aire. By the Midland Railway it is 95 miles southeast of Carlisle and 222 north of London. A canal between Liverpool and Hull affords it water communication with both west and east coasts. The town is rather irregularly built, and a considerable portion of it consists of workmen's cottages. Its growth has of late years been very rapid. Large reservoirs have been constructed for supplying water to the town. The principal buildings are the parish church of St. Andrew in the late Perpendicular (dating from the time of Henry I., modernized in 1710, rebuilt with the exception of the tower in 1805, and again rebuilt in 1878), the Craven bank, the court-house, the mechanics' institute and school of art, the theatre (in the Gothic style, completed in 1870, at a cost of £5000), the baths, the union workhouse, and the Liberal and Conservative clubs. The educational institutions are the Drake and Tonson's school for girls, the trade school for boys, the national schools, and several board schools. The manufactures consist chiefly of worsted and woollen goods, machinery, machine tools, and sewing and wringing machines. Iron-founding is also extensively carried on. The population of the local board district in 1871 was 19,775, and in 1881 had increased to 25,245.

Henry Kigheley, who in the reign of Edward I. possessed the manor of Keighley, obtained for it from that monarch the privilege of a market, a fair, and a free warren. The town in 1645 was the scene of a skirmish between the royal and parliamentary troops.

KEI ISLANDS, a group in the East Indian archipelago, consisting of one large and several smaller islands, situated about 5° 30′ S. lat. and 133° E. long., some 90 miles to the south of the western end of New Guinea, and between the southern Moluccas and the Aru islands. The name, which appears in a great variety of spellings—Kee, Ke, Key, Ki, etc.,—has been in use among Europeans from the days of Valentijn downwards, and may be the Spanish Cayo, a rocky island. The natives call the group Evar, the chief island Iut.

The Kei islands have been very frequently visited, but in such a cursory fashion for the most part that there is considerable doubt in regard even to their general cartography. Of Great Kei the outline and extent are known, but as to the other islands—often lumped together under the name of Lesser Kei—even the number of the more important has yet to be determined. Cape Borang, the northern point of Great Kei, lies in 5° 17′. Dullah-Darat, Dullah-Laut, Letman, and Hodjan are believed to be separate islands, though Dullah-Darat and Letman are parted only by a very narrow passage, and Letman and Hodjan may possibly be one. The seat of the rajah recognized by the Dutch Government as the chief authority in the group is Dullah, on the west coast of Dullah-Darat.

The inhabitants of the Kei islands are supposed to number 18,000 or 20,000. A certain proportion of them (distinguished by the use of a special language and by the profession of Mohammedanism) are known to be descendants of natives of the Banda islands who had fled eastward before the encroachments of the Dutch. The great bulk of the people are still pagan, with rude statues of local deities and places of sacrifice indicated by flat-topped cairns. In physique the Kei islander is like the Aru islander, but more strongly built.

Cocoanuts, sago, fish, limestone, trepang, and timber are the chief productions of the islands. At Eli, on the east coast of Great Kei, there are extensive potteries which furnish earthenware for export as well as for local use. The native proas are well built, after the shape of a whale-boat.

See C. Bosscher in *Tijdschr. van het Bat. Gen.*, iv.; J. B. J. van Doren in *Bijdr. tot de Taelkunde, etc., van N. I.*, new series, iv.; C. B. H. von Rosenberg, *Reis naar de Zuidooster-eilanden*; Guido Cora's *Cosmos*, vol. iii.; Veth, "Geogr. Anteek." (with map), in *Tijdschr. van het. Aardr. Gen.*, ii., 1876.

KEIM, Theodor (1825–1878), a prominent German theologian of the "mediation" school, was born December 17, 1825, at Stuttgart, where he attended the gymnasium, proceeding in 1843 to Tübingen, at which university he continued to study until 1848, F. C. Baur being the teacher who exercised the greatest influence over his thinking. For some time he held a private tutorial appointment, and in 1850 he attended classes at Bonn, returning in 1851 to his alma mater as "repetent." In 1857 he became diaconus at Esslingen, and two years afterwards rose to the rank of archdeacon. From 1860 to 1873 he held the office of professor ordinarius of theology in Zürich, and from 1873 until shortly before his death in November, 1878, he occupied a similar post at Giessen.

He wrote *Reformationsgeschichte der Reichsstadt Ulm*, 1851; *Schwäbische Reformationsgeschichte bis zum Reichstage von Augsburg*, 1855; *Reformationsblätter der Reichsstadt Esslingen*, 1860; *Ambrosius Blarer, der Schwäbische Reformator*, 1860; *Der Uebertritt Konstantin's d. Gr. zum Christenthum*, 1862; two volumes of sermons entitled *Freundesworte zur Gemeinde*, 1861–62; and *Celsus' wahres Wort*, 1873. But the works to which he owes the considerable celebrity he possesses among Protestant theologians even outside of Germany are those in which he has investigated, with much patience of independent research and acuteness of discernment as well as with unusual power of noble appreciation, the narrative of the life of Christ contained in the gospels. *Die menschliche Entwickelung Jesu Christi* (1861), *Die geschichtliche Würde Jesu* (1864), and *Der geschichtliche Christus* were followed by what without exaggeration may be called the truly great work, *Geschichte Jesu von Nazara* (3 vols., 1867–72; English translation, 1873–77), of which the *Geschichte Jesu nach den Ergebnissen heutiger Wissenschaft, für weitere Kreise übersichtlich erzählt*, 1873, is a popular abridgment.

KEITH, an old Scotch family which takes its name from the barony of Keith in East Lothian, bestowed, it is said, by Malcolm II. on a member of the house along with the office of hereditary grand marischal in reward of bravery shown in a battle against the Danes. The importance of the family was increased by a grant in 1320 of part of the forfeited estates of the earl of

Buchan to Sir Robert Keith for his valor in support of the cause of Robert the Bruce, and by the inheritance in the next century of the lands of the Frasers of Kincardineshire through the marriage of Sir William Keith, who in 1458 was created Lord Keith and Earl Marischal of Scotland. William, earl marischal, great grandson of the first of the line, distinguished himself at the battle of Pinkie, in 1547, and was a member of the council of the kingdom during the minority of Queen Mary. By his marriage with his cousin Margaret, daughter of Sir William Keith, of Inverugie, he nearly doubled his estates, but, becoming involved in money embarrassments, he lived for some time in seclusion in his castle of Dunnottar, obtaining on that account the sobriquet of "William that kept the tower." He was succeeded in 1581 by his grandson George, fifth earl, who, besides having studied under the direction of Beza, at Geneva, had acquired a comprehensive knowledge of the politics and customs of most of the courts of Europe. Probably for this reason he was chosen by King James to negotiate his marriage with Queen Anne of Denmark and bring her to Scotland. Throughout life he showed a keen interest in the advancement of learning. He was one of the commissioners appointed in 1582 to inquire into the management of King's College, Aberdeen, and out of his own private fortune he founded and endowed Marischal College in that city, which received a charter in 1593. He died at Dunnottar, April 5, 1623. The estates of the Keiths were forfeited on account of the part taken by George Keith, tenth earl, and his brother Francis (see next article) in the rebellion of 1715. Through the influence of his brother with Frederick the Great, the earl became governor of Neufchatel. After the reversal of the attainder he returned to Scotland, but soon made his way back to Berlin, where he died in April, 1788. Through his death without issue the male line of the house became extinct. From the female line descended the Keith Elphinstones, one of whom, Sir George, was on account of his brilliant naval services created an Irish peer with the title of Baron Keith of Stonehaven Marischal. Sir John Keith, third son of the sixth earl marischal, was created Earl Kintore and Lord Keith of Inverurie and Keith Hall, on account of the part he was supposed to have taken in saving the regalia of Scotland when Dunnottar Castle, where they were deposited, was besieged by Cromwell.

See *Account of the Ancient and Noble Family of Keith*, by P. Buchan, 1828; and Douglas's *Scotch Peerage*.

KEITH, Francis Edward James (1696–1758), generally known as Marshal Keith, son of William the ninth earl marischal (see last article), was the most notable member of the house of Keith. Through his careful education under Bishop Keith, and his subsequent university curriculum at Edinburgh in preparation for the legal profession, he acquired that taste for literature which afterwards secured him the esteem of the most distinguished savants of Europe; but at an early period his preference for a soldier's career was decided and enthusiastic. The rebellion of 1715, in which he displayed qualities that gave some augury of his future eminence, compelled him to seek safety on the Continent. After spending two years in Paris, chiefly in studying at the university, he in 1719 took part in the ill-starred expedition of the Pretender to the Highlands of Scotland. He then passed some time at Paris and Madrid in obscurity and poverty, until he obtained the pay of a colonel from the king of Spain. Finding his Protestantism a barrier to promotion, he obtained from the king of Spain a recommendation to the emperor Peter II. of Russia, from whom he received the command of a regiment of the guards. In several Russian campaigns the calm, intelligent, and watchful valor which was his chief characteristic was displayed to such advantage that he obtained the rank of general and the reputation of being one of the ablest officers in the Russian service. Judging, however, that his rewards were not commensurate with his merits, he in 1747 offered his services to king Frederick of Prussia, who at once gave him the rank of field marshal, and gradually came to cherish towards him a strong personal affection and regard. In the subsequent wars of Frederick he displayed conspicuous ability, manifesting in critical contingencies a remarkable union of circumspection and promptitude. He was killed, 14th October, 1758, at the battle of Hochkirch. Keith is described by Carlyle as "sagacious, skilful, imperturbable, without fear and without noise, a man quietly ever ready;" and also as "not given to talk unless there is something to be said, but well capable of it then."

See Varnhagen von Ense, *Leben des Feldmarschalls Jakob Keith*, 1844; *Fragment of a Memoir of Field Marshal James Keith, written by himself*, 1714–1734, edited by Thomas Constable for the Spalding club, 1843; and Carlyle's *Frederick the Great*.

KEJ, the capital of the province of Mekran (the Gedrosia of the Greeks) in Baluchistan, is situated in 26° N. lat. and 62° 50′ E. long. There exists really no town, but a number of small villages dominated by a fort built upon a rock, on the eastern bank of the Kej river. This fort, like many others similarly placed throughout the country, is supposed to be impregnable, but is in fact of no strength except against the matchlocks of the surrounding tribes. Kej in former days was considered of very great importance by the rulers of Khelat, who have at various times marched large armies into the province with a view to maintaining their supremacy. At the commencement of the present century it had the reputation of being a town of considerable commercial importance, trading through Panjgur with Kandahar, with Kurrachee *via* Beyla, and with Muscat and the Persian Gulf by the seaport of Guader, distant about 80 miles. The present ruler of Khelat is able to exert but a feeble sway over this portion of his dominion, although he appoints a governor to the province. The principal tribe residing around Kej is that of the Gitchki, who claim to be of Rajput origin, and to have settled in Mekran during the 17th century, having been driven out of Rajputana. There are numerous other tribes having very curious traditions as to the time and manner of their settling in the country. The climate during summer is almost unbearable for Europeans. During winter, however, it is temperate. The principal exports consist of dates, which are considered of the finest quality. There is little chance of Kej resuming its former prosperity.

KELAT. See Khelat.

KELLERMANN, François Christophe (1735–1820), duke of Valmy and marshal of France, was born near Rothenburg, in Bavaria, in May, 1735. He entered the French army as a volunteer, and served in the Seven Years' War and in Louis XV.'s Polish Expedition of 1771. By 1785 he had attained the rank of maréchal-de-camp. In 1789 Kellermann enthusiastically embraced the cause of the Revolution, and in 1791 he become general of the army in Alsace. In August, 1792, he received command of the army of the centre, with orders to effect a junction with Dumouriez in Champagne. The day after he had succeeded in this operation (September 20), he was forced to give battle to the allies on the heights of Valmy. General Kellermann's dash and bravery led his troops to a decisive victory, whose moral effects were of the utmost importance. Transferred next to the army on the Moselle, Kellermann was accused by General Custine of neglecting to support his operations on the Rhine; but from this, as from a similar charge in 1793, he was acquitted at the bar of the Convention in Paris, and was placed at the head of the army of the Alps and of Italy. Shortly afterwards he received instructions to reduce Lyons, then in open revolt against the Convention. The hesitation he displayed in executing that order brought him again into suspicion;

and he was imprisoned in Paris for thirteen months. Once more honorably acquitted, he was reinstated in his command, and did good service in maintaining the southeastern border against the Austrians. When Napoleon came to power Kellermann was named successively senator, marshal of France, and duke of Valmy. In 1814 he voted for the deposition of the emperor, and became a peer under the royal government. After the "Hundred Days" he sat in the high chamber and voted with the Liberals. He died September 12, 1820.

KELLGREN, Johan Henrik (1751–95), Swedish poet and critic, was born at Floby in West Gothland, December 1, 1751. He studied at the university of Åbo, and had already some reputation as a poet when in 1774 he there became a "docent" in æsthetics. Three years after this he removed to Stockholm, where in conjunction with Lenngren he began in 1778 the publication of the journal *Stockholmsposten*, whose chief contributor he continued to be almost throughout the remainder of his life. Kellgren was private librarian to Gustavus III. from 1780, and from 1785 his private secretary. On the institution of the Swedish Academy in 1786 he was appointed by the king one of its first members. He died at Stockholm after a severe illness of two years, April 20, 1795. Early familiar with the models of the French school of Voltaire, Kellgren did not till late in life awake to a sense of the value of the works of Lessing and Goethe. His strong satiric tendency led him into numerous controversies, the chief that with Thorild, against whom he directed his satire *Nyt försök till orimmad vers*, where he sneers at the "raving of Shakespeare" and "the convulsions of Goethe." His lack of humor detracts from the interest of his polemical writings. His poetical works are partly lyrical, partly dramatic, but of the latter only the versification belongs to him, all the rest being due to Gustavus III. The songs interspersed in the four operas which they produced in common, viz., *Gustaf Vasa*, *Gustaf Adolf och Ebba Brahe*, *Æneas i Kartago*, and *Drottning Kristina*, are wholly the work of Kellgren. From about the year 1788 a higher and graver feeling pervades Kellgren's verses, partly owing to his increased knowledge of the newer German and English literature, but probably more directly due to his controversy with Thorild. Of his minor poems written before that date the most important are the charming spring-song *Vinterns välde lyktar*, and the satirical *Mina löjen*, and *Man eger ej snille för det man är galen*. The best productions of what is called his later period are the satire *Ljusets fiender*, the comic poem *Dumboms lefverne*, the warmly patriotic *Kantat d. 1 jan.* 1789, the ode *Till Kristina*, the fragment *Sigwart och Hilma*, and the beautiful song *Nya skapelsen*, both in thought and form the finest of all his works. Among the lyrics of Kellgren are the choicest fruits of the Gustavian age of Swedish letters. His earlier efforts, indeed, express with great completeness the superficial doubt and pert frivolousness characteristic of his time; but in the works of his riper years he is no mere "poet of pleasure," as Thorild contemptuously styled him, but a worthy exponent of earnest moral feeling and wide human sympathies in the most felicitous and melodious verse. His *Samlade skrifter* (3 vols., 4th ed., Örebro, 1860), revised by himself, were, in accordance with his own direction, published by his friends after his death. His prose works were translated into German by Lappe (Neustrelitz, 1801).

See Wieselgren, *Sveriges sköna literatur*, 1833–49; Atterbom, *Svenska siare och skalder*, 1841–55; C. W. Böttiger, in *Transactions of the Swedish Academy*, xlv. 107 *sq.*, 1870; and Gustaf Ljunggren's *Kellgren, Leopold, och Thorild*, and his *Svenska vitterhetens häfder*, 1873, 1877.

KELLS, a market and municipal town of Meath county, Ireland, is situated on the Blackwater and on the Dublin and Meath Railway, 39 miles northwest of Dublin. The prosperity of the town depends chiefly upon its interesting antiquarian remains. The most notable is St. Columba's house, originally an oratory, but afterwards converted into a church, the chancel of which was in existence in 1752. The present church is modern, with the exception of the bell-tower, rebuilt in 1578. Near the church there is a very perfect specimen of the ancient round tower, and there are also several ancient crosses, one being situated in the market-place.

Kells was originally a royal residence, whence its ancient name *Ceanannus*, meaning the dun or circular northern fort, in which the king resided, and the intermediate name *Kenlis*, meaning head fort. The other places in Ireland named Kells are probably derived from *Cealla*, signifying church. In the 6th century Kells, it is said, was granted to St. Columba. The statement that he founded a monastery at it is probably incorrect; at any rate the town owes its ecclesiastical importance to the bishopric founded about 807, and united to Meath in the 13th century. Until the Act of Union Kells returned two members to parliament. Population of urban sanitary district in 1881, 2820.

KELP (Fr., *varech*) is produced by the incineration of various kinds of sea-weed (*Algæ*) obtainable in great abundance on the west coasts of Ireland and Scotland, and the coast of Brittany in France. It is prepared from the deep-sea-tangle (*Laminaria digitata*), sugar wrack (*L. saccharina*), knobbed wrack (*Fucus nodosus*), black wrack (*F. serratus*), and bladder wrack (*F. vesiculosus*). The Laminarias yield what is termed drift-weed kelp, obtainable only when cast up on the coasts by storms or other causes. The species of *Fucus*, on the other hand, growing within the tidal range, are cut from the rocks at low water, and are therefore known as cut-weeds. In the preparation of kelp, the weeds are first dried in the sun, and are then collected into shallow pits on the ground and burned till they become a fused mass, which while still hot is sprinkled with water in order to break it up into convenient pieces. A ton of kelp is obtained from 20 to 22 tons of wet sea-weed. The average composition may vary as follows:—sulphate of potash, 10 to 12 per cent.; potassium chloride, 20 to 25 per cent.; sodium carbonate, 5 per cent.; other soda and magnesia salts, 15 to 20 per cent.; and insoluble ash from 40 to 50 per cent. The relative richness in iodine of different samples varies largely, good drift kelp yielding as much as 10 to 15 ℔ per ton of 22½ cwts., whilst cut-weed kelp will not give more than 3 to 4 ℔. The rude manner in which kelp is prepared causes much of the iodine to be volatilized; but Mr. E. C. C. Stanford has successfully introduced a process for treating sea-weeds by destructive distillation, whereby the whole of that valuable body is saved. See Iodine.

Previous to the introduction of the Leblanc process for the manufacture of sodium carbonate, kelp was the principal source of that substance, as well as a source of potassium salts, and consequently was a raw material of much importance in chemical industries. About the beginning of the 19th century the value of the kelp prepared on the coast and islands of the west of Scotland was not less than £400,000 per annum, representing 20,000 tons of kelp. With the gradual introduction and improvement of the Leblanc process, and the reduction of the duty on salt and other causes, the value of kelp decreased from £20 and upwards to about £2 a ton, a price altogether unremunerative. Towards the middle of the century, however, a new impetus was given to the trade by the rise of the manufacture of iodine, of which kelp was at first the only commercial source. The introduction of Chili saltpetre (*caliche*) as a source of iodine, and the development of the Stassfurth salt-mines for the production of potash salts, have in their turn had a depressing influence on the kelp manufacture, and it is only by the most careful utilization of all the salts contained in the kelp, and the use of most approved methods of preparing the material, that the industry is continued as a remunerative undertaking The production of kelp in the British Islands varies greatly from year to year. It may be stated to average about 7000 tons, at a value of about £4 per ton. Two-thirds of this quantity is produced in Ireland, and the remainder on the Scottish coast and islands. The quantity produced in France is probably now somewhat less than the British yield.

KELSO, a burgh of barony and market-town of Roxburghshire, Scotland, is situated on the north side of the Tweed near its junction with the Teviot, 45 miles southeast of Edinburgh and 23 southwest of Berwick by rail. The town is embosomed among woods in a pleasantly undulating and fine agricultural country. The principal streets branch out in four directions from the spacious square, where are the principal shops and hotels. From the bridge of five arches, designed by Rennie, a fine view is obtained of the course of the river. Near it stand the picturesque ruins of the ancient abbey church, founded by David I., but demolished by the English in 1545, one of the finest extant examples in Scotland of the Early Norman style. A mile west of Kelso, on the north bank of the river, is Floors Castle, the seat of the duke of Roxburghe, nearly opposite which, on the south bank, stand the ruins of the old fortress of Roxburgh Castle. Kelso possesses a town-hall, a corn exchange, an auction mart, and a collegiate school. About a mile north of the town there is a race course; the fine cemetery and the spacious public park also deserve mention. The trade of the town is chiefly connected with agriculture. There are large nurseries, corn-mills, manure works, coach works, a foundry, and two engineering shops. Kelso was made a burgh of barony in 1634. It is now under the General Public Act. The population in 1881 was 4563.

KEMBLE, CHARLES (1775–1854), a younger brother of John Philip Kemble noticed below, was born at Brecknock, South Wales, 25th November, 1775. Like his brother he was educated at Douai. After returning to England in 1792, he obtained a situation in the post-office, but this he soon resigned for the stage, making his debut at Sheffield as Orlando in *As You Like It*. During the early period of his career as an actor, chiefly on account of the great abilities of his sister and brother, he made his way only slowly to public favor. For a considerable time he played along with them, chiefly in secondary parts, and this with a grace and finish which received scant justice from the critics. Ultimately he won independent fame, especially in *comédie larmoyante*. His gifts had been disciplined to the utmost degree of perfection of which they were capable, by his liberal mental culture and by refined social intercourse; and such characters as Archer, Doricourt, Charles Surface, and Ranger he played with an airy grace and polished humor that have never been excelled; while he had sufficient fire and energy to give adequate effect to romantic passion and pathos. In genteel comedy he was ably supported by Miss De Camp, whom he married in 1806. His imposing person, classical countenance, and tuneful voice also enabled him to be highly successful in historical drama, some of his principal parts being Alcibiades, Antony, Henry V., and Orestes. The latter period of his career was clouded by money embarrassments in connection with his joint proprietorship in Covent Garden Theatre. He formally retired from the stage in December, 1836, but his final appearance was on April 10, 1840. For some time he held the office of examiner of plays. He died November 12, 1854.[1]

See *Gentleman's Magazine*, January, 1855; and *Records of a Girlhood*, by his daughter Frances Ann Kemble, who has achieved distinction both as a tragedienne and an authoress.

KEMBLE, JOHN MITCHELL (1807–1857), Anglo-Saxon scholar and historian, eldest son of Charles Kemble noticed above, was born in 1807. He received his education partly from Dr. Richardson, author of the *Dictionary of the English Language*, and partly at the grammar school of Bury St. Edmunds, where he obtained in 1826 an exhibition to Trinity College, Cambridge. At school he was distinguished for his miscellaneous knowledge, and at the university his essays on historical subjects gained him high reputation. The historical bent of his studies was confirmed and turned more especially towards the Anglo-Saxon period through the influence of the brothers Grimm, under whom he studied at Göttingen. His thorough knowledge of the Teutonic speeches was shown in his *Beowulf* (1833–37), *Ueber die Stammtafel der Westsachsen* (1836), *Codex Diplomaticus Ævi Saxonici* (1839), and in many contributions to reviews; while his *History of the Saxons in England* (1849) was the first attempt at a thorough examination of the original sources of the early period of English history. He was also for some time editor of the *Foreign Quarterly Review*. In 1857 he published *State Papers and Correspondence illustrative of the Social and Political State of Europe from the Revolution to the Accession of the House of Hanover*. He died at Dublin 26th March, 1857. His *Horæ Ferales, or Studies in the Archæology of Northern Nations*, was completed by Dr. Latham, and published in 1864.

KEMBLE, JOHN PHILIP (1757–1823), tragedian, was the second child of Roger Kemble, a strolling player, and his wife Sarah Ward, the eldest child being Sarah, known as Mrs. Siddons. He was born at Prescot, Lancashire, February 1, 1757. In his eleventh year he became an inmate of Sedgely Park Catholic seminary, near Wolverhampton, and after remaining there four years entered the college of Douai with the view of becoming a priest. At the conclusion of the course, however, he discovered that he had no vocation for the priesthood, and, arriving in England in the end of 1775, he joined the theatrical company of Crump and Chamberlain, his first appearance being in the character of Theodosius at Wolverhampton, 8th January, 1776. Various stories more or less apocryphal are told of his early hardships, until in 1778 he joined the York company of Wilkinson, where he appeared in Hamlet and other leading parts, besides contributing a drama of his own on the subject of Belisarius. In 1781 he made a decided step in advance, obtaining a "star" engagement in Smock Alley Theatre, Dublin, and achieved astonishing success in the *Count of Narbonne* by Captain Jephson. Gradually he won for himself a high reputation as a careful and finished actor, and this, combined with the greater fame of his sister Mrs. Siddons, led to an engagement in Drury Lane Theatre, where he made his debut 30th September, 1783, in the part of Hamlet. His appearance was successful, but rather by awakening interest and discussion than enthusiastic approval. His reading of the part, though highly intellectual and elaborated with the most minute care, was stiff and labored, especially until he acquired the familiarity with the personation obtainable by repetition. In Edward the Black Prince, Richard III., King John, Sir Giles Overreach, and other characters he did not materially advance his reputation. His first decided success was in the character of Macbeth for his own benefit, when he shared in the enthusiasm aroused by Mrs. Siddons, and established for himself a reputation among living actors second to hers only. In December, 1787, he married Mrs. Brereton, the widow of a young actor. His appointment as manager of the theatre in October of the following year gave him full opportunity to experiment with whatever parts might strike his fancy, and of this he took advantage with greater courage than discretion. His smile, as was wittily said, "resembled the plating on a coffin," and it was only in cases where his gravity gave a certain piquancy to the character that his comedy parts were redeemed from failure, notwithstanding his clever mastery of smart repartee. In Coriolanus, however, which was revived during his first season, the character of the "noble Roman" was so exactly suited to his powers that he not only played it with a perfection that has never been approached, but, it is said, unconsciously allowed its influence to color his private manner and modes of speech. His tall and imposing person, noble countenance, and solemn and grave demeanor were uniquely adapted for the Roman characters in Shakespeare's plays; and when in addition he had to depict the gradual growth and development of one absorbing passion, his representation gathered a momentum and majestic force that were irresistible. His defect was in flexibility, variety, rapidity; the characteristic of his style was method, regularity, precision, elaboration even of the minutest details, founded on a thorough psychological study of the special personality he had to represent. His elocutionary art, his fine sense of rhythm and emphasis, enabled him to excel in declamation, but physically he was incapable of giving expression to impetuous vehemence and searching pathos. In Coriolanus and Cato he was beyond praise, and possibly he may have been superior to both Garrick and Kean in Macbeth, although it must be remembered that in it part of his inspiration must have been caught from Mrs. Siddons. In all the other great Shakespearean characters he was, according to the best critics, inferior to them, least so in Lear and Hamlet, and most so in Shylock and Richard III. On account of the eccentricities of Sheridan, the proprietor of Drury Lane Theatre, Kemble withdrew from the management, and, although he resumed his duties at the beginning of the season 1800–1, he at the close of 1802 finally resigned connection with it. In 1803 he became manager of Covent Garden, of which he was also part proprietor. The theatre was burnt down in 1808, and the raising of the prices after the opening of the new theatre in 1809 led to a persevering succession of riots, which practically suspended the performances for three months. Kemble took his final leave of the stage in the part of Coriolanus, June 23, 1817, his retirement being probably hastened by the increasing popularity of Kean. The remaining years of his life were spent chiefly abroad, first at Toulouse, and after a short stay in London at Lausanne, where he died February 20, 1823.

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[1] [His daughter, Frances Anne (born 1811), tragedienne and elocutionist, married Pierce Butler of Georgia in 1834, divorced 15 years later, wrote reminiscences and poetry, resided long near Philadelphia. Her younger sister, Adelaide, married Edward Sartoris, and their son, in 1874, married the only daughter of Gen. U. S. Grant.—AM. ED.]

See Boaden's *Life of John Philip Kemble*, 1825; Fitzgerald, *The Kembles*, 1871.

KEMPIS, THOMAS A (c. 1380–1471), is the name by which Thomas Hammerken (Hammerchen, Malleolus) is commonly known. He was born in 1379 or 1380 in the town of Kempen, lying about 15 miles northwest of Düsseldorf, in one of the many patches of territory between the Meuse and the Rhine belonging to the archiepiscopal principality of Cologne. "Ego Thomas Kempis," he says in his chronicle of the monastery of Mount St. Agnes, "scholaris Daventriensis, ex diocesi Coloniensi natus." His father was a poor hard-worked peasant; his mother "ad custodiam rei domesticæ attenta, in opere alacris, in victu sobria, in potu abstemia, in verbo pauca, in factis pudica," as her son fondly says, kept a dame's school for the younger children of the town. John and Gertrude Hammerken had two sons, John and Thomas, both of whom found their way to Deventer, and thence to Zwolle and to the convent of Mount St. Agnes. Thomas reached Deventer when he was barely twelve years old, was taught by a dame the beginnings of his learning, and in a few months to his great joy, entered the classes of Florentius Radewyn. After the fashion of the time he was called Thomas from Kempen, and the school title, as was often the case then, pushed aside the family name. Thomas Hammerken was forgotten; Thomas a Kempis has become known to the whole Christian world.

This school at Deventer had become famous long before Thomas a Kempis was admitted to its classes. It had been founded by Gerhard Groot, a wealthy burgher (see GROOT), who had been won to pious living mainly through the influence of Ruysbroeck, the Flemish mystic. It was at Deventer, in the midst of this mystical theology and hearty practical benevolence, that Thomas a Kempis was trained. Gerhard Groot was his saintly ideal. Florentius Radewyn and Gerhard's other early disciples were his heroes; their presence was his atmosphere, the measure of their lives his horizon. But he was not like them; he was not an educational reformer like Radewyn, nor a man of affairs like Gerhard. He liked books and quiet corners all his days, he says; and so, when conviction of sin and visions of God's grace came to him in the mediæval fashion of a dream of the anger and forgiveness of the Virgin, Florentius told him that a monk's life would suit him best, advised him to join the Augustinian order, and sent him to Zwolle to the new convent of Mount St. Agnes, where his brother John was prior. Thomas was received there in 1399, he professed the vows in 1407, received priest's orders in 1413, became sub-prior in 1425, and died on the 8th of August, 1471, being ninety-one years old.

The convent of Mount St. Agnes was poor, and most of the monks had to earn money to support their household by copying MSS. Thomas was a most laborious copyist: missals, books of devotion, and a famous MS. Bible were written by him; and the weightiest argument of those who deny that he is the author of the *Imitatio Christi* is that he was a copyist. He also wrote a large number of original writings, most of them relating to the convent life, which was the only life he knew. He wrote a chronicle of the monastery and several biographies—the life of Gerhard Groot, of Florentius Radewyn, of a Flemish lady St. Louise, of Groot's original disciples; a number of tracts on the monastic life—*The Monk's Alphabet*, *The Discipline of Cloisters*, *A Dialogue of Novices*, *The Life of the Good Monk*, *The Monk's Epitaph*, *Sermons to Novices*, *Sermons to Monks*, *The Solitary Life*, *On Silence*, *On Poverty*, *Humility, and Patience;* two tracts for young people —*A Manual of Doctrine for the Young*, and *A Manual for Children;* and books for edification—*On True Compunction*, *The Garden of Roses*, *The Valley of Lilies*, *The Consolation of the Poor and the Sick*, *The Faithful Dispenser*, *the Soul's Soliloquy*, *The Hospital of the Poor*. He has also left behind him three collections of sermons, a number of letters, some hymns, and the *Imitatio Christi*, if that be his. These writings help us to see the man and his surroundings, and contemporary pious records make him something more than a shadow. We see a real man, but a man helpless anywhere save in the study or in the convent,—a little fresh-colored man, with soft brown eyes, who had a habit of stealing away to his cubiculum whenever the conversation became too lively; somewhat bent, for it is on record that he stood upright when the psalms were chanted, and even rose on his tiptoes with his face turned upwards; genial, if shy, and occasionally given to punning, as when he said that he preferred Psalmi to Salmones; a man who perhaps led the most placid, uneventful life of all men who ever wrote a book or scribbled letters. It was not that he lived in uneventful times: it is impossible to select a stormier period of European history, or a period when the stir of the times made its way so well into the obscurest corners. Bohemia, Huss leading, was ablaze in revolt at one end of Europe; France and England, then France and Burgundy, were at death-grips at the other. Two popes anathematized each other from Avignon and from Rome, and zealous churchmen were at their wit's end to concoct ways and means, by general councils of Constance and Basel and otherwise, to restore peace to a distracted church, and to discipline the clergy into decent living. But Thomas knew nothing about all this. He was intent on his copying, on his little books, and on his quiet conversations. His very biographies are colorless. He had not even the common interest in the little world coming up to the convent gate which most monks may be supposed to have. His brethren made him œconomiæ prefectus, but he was too "simple in worldly affairs" and too absent-minded for the post, and so they deposed him and made him sub-prior once more. And yet it is this placid, kindly fresh-colored old man who is commonly said to be the author of that book the *Imitation of Christ*, which has been translated into more languages than any other book save the Bible, and which has moved the hearts of so many men of all nations, characters, and conditions of life.

Did Thomas a Kempis write the *Imitation of Christ?* Had it not been for his connection with this famous little book, Thomas would have been no better known than Gerhard Groot, Florentius Radewyn, or Jan van Ruysbroeck. The problem of authorship has given rise to the most interminable controversy the history of literature has ever seen, and one which seems to be still as fresh as it was in the 17th century. It arose in this way. The author of the *Imitatio* sent it forth anonymously. If Thomas was the author he must have written it when he was about forty-five years of age, and it must have found its way into England and France within a very short space of time. Then Thomas was a copyist, a man who spent his life in copying for sale books which he had not composed. These are the only presumptions which make it likely that the *Imitatio Christi* had another author. But down till the beginning of the 17th century Thomas was almost universally esteemed the author of the *Imitatio*. Some MSS. undoubtedly bore the name of St. Bernard, and others that of John Gerson; but the great majority of MSS. testified to the authorship of Thomas. In 1604, however, a Spanish student of the *Imitatio* found a sentence from it quoted in what was believed to be a sermon of Bonaventura, who died in 1273, long before either Gerson or Thomas was born. It was afterwards proved that the sermon was not by Bonaventura, but belonged to the end of the 15th century; still for the time it was supposed that Thomas could not have written the *Imitatio*, and learned men looked anxiously for a clue to an earlier author. Just then, in 1605, Bernardin Rossignoli, superior of the Jesuit college at Arona, discovered in the college library a MS. of the *Imitatio* without date, and bearing the title Incipiunt capitula primi libri Abbatis Johannis Gersen, De Imitatione Christi. The college had formerly belonged to the Benedictines, and it was supposed, wrongly as it turned out, that the MS. had been in the old Benedictine library, and was therefore ancient. Here then was an author, Gersen, and a MS. of the date required. The facts were, however, that the MS. was of the beginning of the 16th century, and had been brought to Arona from Genoa in 1579. Constantine Cajetan, famous for his insane devotion to the order of St. Benedict, got the Arona MS. printed at Rome, declaring that the author was John Gersen, an abbot of the order of St. Benedict. Cajetan next discovered in a copy of the printed Venice edition of the *Imitatio* of 1501 a note in an unknown hand: "This book was not written by John Gerson, but by John, abbot of Vercelli." He also found a MS. bearing the name of John of Canabaco. Weaving these unconnected details together, Cajetan declared that the author of the *Imitation of Christ* was John Gerson of Canabaco, Benedictine abbot of Vercelli. Thus began the famous controversy. It has been a controversy really between the supporters of Thomas a Kempis and the Benedictines, who advocate the claims of John Gersen, a mythical personage whose very existence has been taken for granted and never proved. But, while this is the crux of the dispute, the authorship has been claimed for a great variety of writers:—John Scotus Erigena, Bernard of Clairvaux, Giovanni Gerso (an Italian monk and philanthropist of the close of the 12th century), Pope Innocent III., Scoto Giovanni and Thomas Gallus, both abbots of Vercelli, David of Augsburg, Bonaventura, Ubertin of Cassalis, Peter de Corbario, Ludolf of Saxony, Kalkar, Humbert, Martinus Carthus, Giovanni Michele, Joannes Paumerii (the last four probably transcribers—their names are appended to single MSS. in an early printed edition), John Gerson a brother of the famous chancellor of Paris, John Gerson the famous chancellor himself, John Gersen the supposed Benedictine abbot, Walter Hilton an English monk, Thomas a Kempis, John a Kempis the elder brother of Thomas, and John of Canabaco, probably John of Tambacho, a professor in the university of Prague. It will be sufficient to examine the claims of four of these candidates.

Walter Hilton, a monk of Schene (Sheen) in Surrey, who wrote several devotional books, notably *Scala Perfectionis Christianæ*, is said by Bale (*Illustri. Maj. Brit. Summarium*, published in 1559) to have written a treatise called *De Musica Ecclesiastica*, and this is confirmed by Pits, who wrote much later. The earlier MSS. of the *De Imitatione* are called *De Musica Ecclesiastica*, and the earliest English MS., now in Magdalen College, Oxford, and dated 1438, bears that title. The inference has been drawn that Hilton wrote the first three books of the *Imitation* in England, and that Thomas copied them and added the fourth book (see *Notes and Queries*, March, 1881). We have no *contemporary* evidence, however, that Hilton did write a treatise called *De Musica Ecclesiastica*, and this work may have been attributed to him because the MS. copies have been found in volumes also containing some of his devotional writings.

John Gerson, chancellor of Paris (1363–1429, see GERSON), is called the author of the *Imitation* in several undated MSS., and more especially in two MSS. dated 1441 and 1460. His claims have been supported on the ground of MS. evidence, the presence of Gallicanisms in the Latin of the treatise, and the common tradition in France. The evidence to the contrary is so strong, however, that his cause has been given up by all save by Frenchmen who, like Vert, consider it patriotic to declare themselves "pour Gerson, Gerson, et pour la France."

John Gersen, abbot of Vercelli, is supported by the Benedictine order and by others. The first requisite here is to show that such a man ever lived, and this in spite of the pains taken has not yet been done.[1] In all probability Gersen is a mistake of early copyists for Gerson. The MS. evidence is as follows. The earliest *dated* MS. claimed for Gersen gives the author J. Gers., and is dated 1441; the second gives the author's name in the same contracted fashion, J. Gers., and is dated 1464; while two of the earlier undated MSS., those of Florence and Padolirone, call the author J. Gersen, chancellor of Paris. The other MSS. which write the author's name J. Gersen are all late or undated. In short, there is not a vestige of early evidence to connect the *Imitatio* with a John Gersen, and there is no contemporary evidence whatever. Gersen is a creation of Cajetan's for the renown of the Benedictine order, and the motive which has prompted Gersen's supporters finds fitting expression in the dedication to St. Benedict of the latest contribution to the controversy, that of Wolfsgruber (Augsburg, 1880).

Thomas a Kempis is acknowledged to be the author by most of the earliest dated MSS., by most of the earliest printed editions of the book, by a great mass of contemporary evidence, and by a great deal of internal evidence, some of the most interesting kind. Of MSS. may be mentioned the Kirchheim MS. of 1425, the autograph of Thomas (1441,) the MS. of Innersdorf (1441), and that of Liége (1444). Twenty-two printed editions in the 15th century attributed the *Imitatio* to Thomas. The contemporary witnesses are numerous and convincing. John Buschius of the canons regular of Windesheim, scarcely a league from Mount St. Agnes, who had met and conversed with Thomas, calls him the author of the *Imitation*. Brother Herman, living in a monastery of the canons regular near Halle, who had met Thomas at Windesheim, declared that Thomas was the author of the *Imitatio*. Similar testimony is borne by Matthias Farinator, a transcriber of the book, by Peter Schott, by Johann Lambert, either during the lifetime of Thomas or a few years after his death. And Hirsche has produced a new contemporary witness from an old Belgian chronicle ("Chronique de Jean Brandon, avec les additions d'Adrien de But," p. 547, published in *Collect. de Chroniques Belges inèdites*), which says that Thomas wrote the *Qui sequitur me* in metre. The proof from internal evidence has been set on quite a fresh basis by the studies of Carl Hirsche, who has discovered from a careful examination of the MS. of 1441 (Bibliothèque de Bourgogne, Brussels, Nos. 5855 and 5861) that the *Imitation* was written and pointed for the purpose of chanting. This discovery has enabled him to compare the book with other writings of Thomas as to punctuation, rhythm, and rhymes, with the result that he has incontestably proved the great similarity between the *Imitation* and the undisputed works of Thomas.

The *Imitatio Christi* is commonly classed among the mystical writings of the 15th century, and in the opinion of writers of the most opposite schools of thought it sums up all that is best of that side of Latin Christianity which includes the theology of the Victorines, of Bernard and Bonaventura, of Eckhart, Tauler, and Ruysbroeck. Mediæval Christianity shows two ideas of the Christian life struggling for the mastery, each with the common watchword of separation from the world. The one was modelled on Augustine's *City of God*, and was fulfilled in Hildebrand's conception of a spiritual empire to be raised on the ruins of political society; the other came to light in the aspirations of Francis of Assisi, and the assimilation of Anselm's maxim that sinners can appropriate the benefits won for them by Christ by imitating the Saviour. Francis's idea of imitation was rudely picturesque. The Bible shows Christ obedient, poor, unmarried; we can imitate the Master by keeping the vows of obedience, poverty, and chastity. This crass idea of an imitation of Christ gave new force to the monastic movement, and put new meaning into its vows, and it spread in various ways through Fratricelli, Spirituales, Wycliffe's poor preachers, etc., far beyond the Franciscan order. This idea of imitation by "evangelical poverty" was almost spent by the 14th century, and was succeeded by the more refined conception of imitation by "renunciation," the watchword of the mystical movement of the 14th and 15th centuries. But by this time the conflict of the Franciscan ideal of the Christian life with Hildebrand's ideal had thoroughly rent mediæval Christendom, and there were two Christianities facing each other, a religious and a political. The breach became wider by the degradation of the papacy, and by the great schism. The "universal" of the church was lost, and had not been discovered again. The new idea of obedience was not obedience to ecclesiastical superiors, but the subordination of the lower part of man's nature to the higher, and of the whole to God. This "renunciation," cut off from practical sympathy with the visible church, feeding itself on a vague idea of union with Christ, might easily have fallen a prey to Buddhist and Averroist notions floating in the European atmosphere (some of the mystics did so fall away) had it not been saved by its clinging to the sacraments, the one mediæval means of grace, and by its contact with practical Christian work. And gradually out of Eckhart through Tauler two schools arose, both of which use "renunciation" as their watchword—imitation by renunciation. The one school, that of Henry Suso, saw Christ's renunciation best exhibited in His passion, and therefore held that men can imitate by suffering; they too have a body to mortify. The other, that of Ruysbroeck, saw Christ's renunciation in His incarnation; so that men can renounce by contemplation, which gives us initiation into the incarnation. Ruysbroeck was Groot's teacher, and Groot taught Thomas, in whom we see the gathered wisdom of that idea of a quest for pardon by imitation of Christ which began with Anselm and came down through Franciscan revivals and mystical movements to him in the 15th century. But Thomas is far more than Ruysbroeck or Groot. He is wider and more sympathetic. He includes Ruysbroeck, Tauler, Eckhart, Bonaventura, the Franciscans, and even the old Victorines. He sums up in his little book the heart religion of Latin Christianity.

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[1] This mythical personage has been photographed, see *Auteurs présumés de l'Imitation*, by Abbé Delaunay.

For the life of Thomas a Kempis see the Nuremberg edition of 1494, *Opera et libri vitæ Thomæ a Kempis;* Heribertus Rosweide, *Vita Thomæ a Kempis*, 1616. The best edition of the collected works is that of Sommalius, *Ven. Viri Thomæ Malleoli a Kempis . . . Opera Omnia . . . in tres tomos distributa*, 1759. The best edition of the *Imitatio* is that of Hirsche, Berlin, 1874. A very complete list of the principal writers in the controversy may be found in Wolfsgruber, *Giovanni Gersen, sein Leben und sein Werk de Imitatione Christi*, 1880, p. 254 *sq.* For authorship by Gerson, see G. Ch. Vert, *Cause de l'Imitation de Jésus-Christ, réplique et conclusions*, Toulouse, 1861. For Thomas as author, see Malou, *Recherches historiques et critiques sur le véritable auteur du livre de l'Imitation de Jésus-Christ*, Tournay, 3d ed., 1858; Carl Hirsche, *Prolegomena zu einer neuen Ausgabe der Imitatio*, Berlin, 1873; and Samuel Kettlewell, *The Authorship of the De Imitatione Christi*, London, 1877. (T. M. L.)

KEMPTEN, a town in the government district of Swabia and Neuburg, Bavaria, is situated on the Iller, about 65 miles southwest of Munich. It is the seat of numerous local and special tribunals, and contains a castle, a gymnasium and a grammar school, two hospitals, and other educational and benevolent institutions. There is a handsome town-house, and the aqueduct is noteworthy. The industries include wool-spinning and weaving on a large scale, and the manufacture of paper, beer, machines, hosiery, matches, and wooden wares. As a commercial centre of the Algau, Kempten carries on active trade in linen, timber, and dairy produce. In 1875 the population, including the garrison, was 12,681.

Kempten, identified with the Roman Campodunum, consisted in early times of two towns, the old and the new. The continual hostility that existed between these was intensified by the welcome given by the old town to the Reformed doctrines,—the new town, built round the Benedictine abbey erected in the 8th century, keeping the old faith. The abbot in 1360 had been promoted to the dignity of a prince of the empire by the emperor Charles IV., and the princely abbacy only passed to Bavaria in 1803.

KEN, THOMAS (1637-1711), the most eminent of the non-juring bishops, and one of the fathers of modern English hymnology, was born at Little Berkhampstead, Herts, in 1637. He was the son of Thomas Ken of Furnival's Inn, who belonged to an ancient stock,—that of the Kens of Ken Place, in Somersetshire; his mother was a daughter of the now forgotten poet John Chalkhill, who is called by Walton an "acquaintant and friend of Edmund Spenser." It may be mentioned that Ken's stepsister, Anne, was married to Izaak Walton, in 1646, a connection which brought Ken from his boyhood under the refining influence of this gentle and devout man. In 1652 he entered Winchester College, and in 1656 became a student of Hart Hall, Oxford. He gained a fellowship at New College in 1657, and proceeded B. A. in 1661 and M. A. in 1664. He was for some time tutor of his college; but the most characteristic reminiscence of his university life is the mention made by Anthony Wood that in the musical gatherings of the time "Thomas Ken of New College, a junior, would be sometimes among them, and sing his part." Ordained in 1662, when he was twenty-five years old, he successively held the livings of Little Easton in Essex, Brighstone (sometimes called Brixton) in the Isle of Wight, and East Woodhay in Hampshire; in 1672 he resigned the last of these, and returned to Winchester, being by this time a prebendary of the cathedral, and chaplain to the bishop, as well as a fellow of Winchester College. He remained there for several years, acting as curate in one of the lowest districts, and fulfilling other duties in the city, but, above all, preparing his *Manual of Prayers for the use of the Scholars of Winchester College*, which was first published in 1674, and composing hymns. It was at this time that he wrote, primarily for the same body as his prayers, his morning, evening, and midnight hymns, the first two of which, beginning "Awake, my soul, and with the sun," and "Glory to Thee, my God, this night," are now household words wherever the English tongue is spoken. The latter is often made to begin with the line "All praise to Thee, my God, this night," but in the earlier editions over which Ken had control, the line is given as above.[1] In 1674 Ken paid a visit to Rome in company with young Izaak Walton, and this journey seems mainly to have resulted in confirming his regard for the Anglican communion. In 1679 he was appointed by Charles II. chaplain to the Princess Mary, wife of William of Orange. While with the court at the Hague, he incurred the displeasure of William by insisting that a promise of marriage made to an English lady of high birth by a relative of the prince should be kept; and he therefore gladly returned to England in 1680, when he was immediately appointed one of the king's chaplains. He was once more residing at Winchester in 1683 when Charles came to the city with his doubtfully composed court, and his residence was chosen as the home of Nell Gwynne; but Ken stoutly objected to this arrangement, and succeeded in making the favorite find quarters elsewhere. We find him in August of this same year accompanying Lord Dartmouth to Tangiers as chaplain to the fleet, and Pepys, who was one of the company, has left on record some quaint and kindly reminiscences of him and of his services on board. The fleet returned in April, 1684, and a few months after, upon a vacancy occurring in the see of Bath and Wells, Ken, now Dr. Ken, was appointed bishop. It is said that, upon the occurrence of the vacancy, Charles, mindful of the high and pure spirit he had shown at Winchester, exclaimed, "Where is the good little man that refused his lodging to poor Nell?" and determined that no other should be bishop. The consecration took place at Lambeth, January 25, 1685; and one of Ken's first duties was to attend the death-bed of Charles, where his wise and faithful ministrations won the admiration of everybody except Bishop Burnet. In this year he published his *Exposition on the Church Catechism*, which is perhaps better known by its sub-title, *The Practice of Divine Love.* His public life as bishop is mainly remembered from the stand he took upon two memorable occasions. In 1688, when James reissued his "Declaration of Indulgence," Ken was one of the "seven bishops" who refused to publish it. He was probably influenced by two considerations:—first, by his profound aversion to Roman Catholicism, to which he felt he would be giving some episcopal recognition by compliance; but, second and more especially, by the feeling that James by his arbitrary action was compromising the spiritual freedom of the church. Along with his six brethren, Ken was committed to the Tower, June 8, 1688, on a charge of high misdemeanor; the trial, which took place on the 29th and 30th of the month, and which resulted in a verdict of acquittal, is matter of history. With the revolution which speedily followed this impolitic trial, new troubles encountered Ken; for, having sworn allegiance to James, he thought himself thereby precluded from taking the oath to William of Orange. Accordingly, he took his place among the non-jurors, and, as he stood firm to his refusal, he was, in August, 1691, superseded in his bishopric by Dr. Kidder, dean of Peterborough. From this time he lived mostly in retirement, finding a congenial home with Lord Weymouth, his friend from college days, at Longleat in Somersetshire; and though pressed to resume his diocese in 1703, upon the death of Bishop Kidder, he declined, partly on the ground of growing weakness, but partly no doubt from his love for the quiet life of devotion which he was able to lead at Longleat. His death took place there upon the 19th of March, 1711.

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[1] The fact, however, that in 1712—only a year after Ken's death—his publisher, Brome, published the hymn with the opening words "All praise" has been deemed by such a high authority as Lord Selborne sufficient evidence that the alteration had Ken's authority.

Although Ken wrote much poetry, besides his hymns, he cannot be called a great poet; but he had that fine combination of spiritual insight and feeling with poetic taste which marks all great hymn-writers. As a hymn-writer he has had few equals in England; it can scarcely be said that even Keble, though possessed of much rarer poetic gifts, surpassed him in his own sphere (see HYMNS, vol. xii. p. 612). In his own day he took high rank as a pulpit orator, and even royalty had to beg for a seat amongst his audiences; but his sermons are now forgotten. He lives in history, apart from his three hymns, mainly as a man of unstained purity and invincible fidelity to conscience, weak only in a certain narrowness of view which is a frequent attribute of the intense character which he possessed. As an ecclesiastic he was a High Churchman of the old school.

Ken's poetical works were published in collected form by W. Hawkins, his relative and executor, in 1721, and extended to four volumes; his prose works were issued in 1838 in one volume, under the editorship of J. T. Round. A brief memoir was prefixed by Hawkins to a selection from Ken's works which he published in 1713; and a life, in two volumes, by the Rev. W. L. Bowles, appeared in 1830. But the standard biography of Ken is that of J. Lavicount Anderdon (*The Life of Thomas Ken, Bishop of Bath and Wells, by a Layman*, 1851; 2d ed., 1854).

KENDAL, KIRKBY-KENDAL, or KIRKBY-IN-KENDAL, a market-town and parliamentary and municipal borough of Westmoreland, is picturesquely situated in a pleasant valley on the east bank of the Kent or Ken, 44 miles south of Carlisle (50 by rail), and 241 miles from London. The town, which is the largest and most populous in the county, is very irregularly built, but the white-walled houses with their blue-slated roofs, and the numerous trees, give it a very attractive appearance. There are four leading streets, two of which together form a spacious thoroughfare a mile in length. The church of the Holy Trinity, whose oldest part dates from about 1200, is a Gothic edifice with five aisles and a square tower 72 feet high. Kendal contains numerous other churches, a town-hall, a mechanics' institution, a literary and scientific institution, a museum, and a chamber of commerce. Its charities include a hospital (founded 1870), an old maids' hospital, a girls' orphanage, almshouses, etc. The free grammar school is well endowed; and there are also in the town a well-endowed blue-coat school and hospital, a large national school, a school of science and art, and several Sunday schools, among which is the Greencoat Sunday school, founded in 1813. On an eminence to the east of the town are the ruins of Kendal Castle, attributed to the first barons of Kendal. It was the birthplace of Catherine Parr, Henry VIII.'s last queen. On the Castle-law hill, an obelisk was raised in 1788 in memory of the revolution of 1688. The woollen manufactures of Kendal have been noted since the 14th century, when Edward III. established a colony of Flemish weavers in the town; and although the coarse cloth known to Shakespeare as "Kendal green" is no longer made, its place is more than supplied by active manufactures of tweeds, linsey-woolsey, railway rugs, horse clothing, knitted woollen caps and jackets, worsted and woollen yarns, and similar goods. Other manufactures of Kendal are machine-made boots and shoes, cards for wool and cotton, agricultural and other machinery, paper, and, in the neighborhood, gunpowder. There are also important marble-works. There is a large weekly market for grain, and annual horse and cattle fairs. The population in 1881 was 13,696, an increase of only 250 from 1871.

Kendal was the head of a barony given by William the Conqueror to Ivo de Talbois. It has given the title of earl to various royal and other personages of English history. The town received its charter from Queen Elizabeth in 1575. A second, granted by Charles I., and confirmed by Charles II., was superseded by the Municipal Act of 1835, according to which the town is governed by six aldermen and eighteen councillors, who select a mayor from among themselves. Quarter Sessions are held alternately at Appleby and Kendal. The Reform Act of 1832 assigned one member of parliament to Kendal.

KENILWORTH, a small town of Warwickshire, is pleasantly situated on a tributary of the Avon, on the railway from Coventry to Leamington, 5 miles distant from both towns, and 99 miles north from London. The town is only of importance from its antiquarian interest and the magnificent ruins of its old castle. The most probable derivation of its name, which in Domesday is written *Chinewrde*, is from *Cenwulf*, king of the Mercians, and *werthe*, a dwelling-place. The old royal residence of the Saxon kings was destroyed in the wars between Edward and Canute. The manor of Kenilworth was bestowed by Henry I. on Geoffrey de Clinton, afterwards lord chief-justice, who erected the earlier portion of the present castle. By his grandson Henry de Clinton it was given to King John, and it remained a royal residence until the time of Henry III., who granted it to Simon de Montfort, earl of Leicester. After the battle of Evesham, 14th August, 1265, at which Simon de Montfort was slain, the rebel forces rallied at the castle, when it sustained a siege of six months, but finally capitulated to Henry III., who bestowed it on his son Edmund. After being used as the prison of Edward II. previous to his removal to Berkeley, it came into the possession of John of Gaunt, by whom it was greatly enlarged. On his son becoming king as Henry IV., it was made a royal residence, and it remained in the possession of the crown until Queen Elizabeth in 1562 granted it to Robert Dudley, Earl of Leicester, who spent a large sum in restoring it, and whose splendid entertainments there to Elizabeth are described in Scott's novel of *Kenilworth*. During the civil war it was dismantled by the soldiers of Cromwell, and it was thenceforth abandoned to decay. Since the Restoration it has belonged to the house of Clarendon. The walls of the castle originally inclosed an area of 7 acres. The principal portions of the building still remaining are the gatehouse, now used as a dwelling-house; Cæsar's tower, the only portion built by Geoffrey de Clinton now extant, with massive walls 16 feet thick; the Merwyn's tower of the novel of *Kenilworth*; the great hall built by John of Gaunt with windows of very beautiful design; and Leicester buildings, which are in a very ruinous condition. Not far from the castle are the remains of an Augustinian monastery founded in 1122, and afterwards made an abbey. Adjoining the abbey is the parish church of St. Nicholas, restored in 1865, an old structure of mixed architecture, and containing a fine Norman doorway, which is supposed to have been the entrance of the former abbey church. The town, which possesses large tanneries, is under the government of a local board. Population in 1871, 3880; in 1881, 4150.

KENNEDY, THOMAS FRANCIS (1788–1879), a distinguished Scottish Liberal politician, was born near Ayr in 1788. He studied for the bar and passed advocate in 1811. But having been elected M.P. for the Ayr burghs in 1818, he devoted the greater part of his life to the promotion of those political reforms which the long misgoverment of Scotland by the Tory party had rendered necessary. In this patriotic work he was greatly assisted by Lord Cockburn, then Mr. Henry Cockburn, and a volume of correspondence published by Kennedy in 1874 forms a curious and interesting record of the consultations of the two friends on measures which they regarded as requisite for the political regeneration of their native country. One of the first measures of improvement to which he directed his attention was the withdrawal of the power of nominating juries from the judges, and the imparting of a right of peremptory challenge to prisoners. It cost Kennedy several years of persistent urgency upon the legislature before this most reasonable demand was conceded, but at length his energy and perseverance succeeded. Among other subjects he directed his attention to the improvement of the parish schools, of pauper administration, and of several of the corrupt forms of legal procedure which then prevailed. To him also was in a great measure due the freedom which the Scottish people obtained from the domination of certain aristocratic families which had long proved a dead weight on the progress of the Liberal principles in Scotland. In the construction of the Scottish Reform Act Kennedy took a very prominent part, and indeed he and Lord Cockburn may almost be regarded as its authors. After the accession of the Whigs to office in 1832 he held various important offices in the ministry, and most of the measures of reform for Scotland, such as burgh reform, the improvements in the law of entail, and the reform of the sheriff courts owed much to his sagacity and energy. In 1837 he went to Ireland as paymaster of civil services there, and immediately set himself with his accustomed energy to the promotion of various measures of reform. One or two of the blue books published during the period of his administration exhibit with an amusing vividness the sleuthhound-like keenness and tenacity, characteristic of the man, with which he hunted out several of the abuses and scoundrelisms that he found prevailing. Kennedy retired from public life in 1854, but he never ceased to take the keenest interest in political affairs, and up to the time of his death took a great part in both county and parish business. One of the chief features of his character was a strong, almost stern, love of justice and a determined hatred of everything savoring of jobbery or dishonesty. All through his career he preserved the simple straightforwardness and unselfishness of the earlier Liberalism. He died in 1879, having attained the almost patriarchal age of ninety-one. He had married in 1820 the only daughter of Sir Samuel Romilly.

KENNET, WHITE (1660–1728), bishop of Peterborough, a theological writer and learned antiquarian, was born at Dover in 1660. He was educated at Westminster school and at Oxford, where, while still an undergraduate, he published several translations of Latin works, including Erasmus *On Folly*, Pliny's *Trajan*, and Cornelius Nepos. About the year 1685 he became vicar of Amersden. A few years afterwards he returned to Oxford as tutor and vice-principal of St. Edmund's Hall, where he gave considerable impetus to the study of antiquities. In 1695 he published *Parochial Antiquities*. In 1700 he resigned the vicarage of Amersden to take charge of the parish of St. Botolph, Aldgate, London, and in the following year he was preferred to the archdeaconry of Huntingdon. On account of his eulogistic sermon on the duke of Devonshire he was in 1707 recommended to the deanery of Peterborough. Although he afterwards changed to the Low Church party, strenuously opposed the Sacheverel movement, and in the Bangorian controversy supported with great zeal and considerable bitterness the side of Bishop Hoadly, his intimacy with the bishop of Norwich, who was high in favor with the king, secured him in 1718 promotion to the bishopric of Peterborough. He died at Westminster in September, 1728. Kennet published in 1698 an edition of Sir Henry Spelman's *History of Sacrilege*, and he was the author of as many as fifty-seven printed works, chiefly tracts and sermons. His principal publication was a *Compleat History of England*, 3 vols., 1706 (enlarged edition, 3 vols., 1719), chiefly a compilation from other authors, but the part from Charles I. to Queen Anne was written by himself.

The *Life of Bishop White Kennet*, by the Rev. William Kennet, appeared in 1730. See also Nicol's *Literary Anecdotes*, Dibdin's *Quarrels of Authors*, and Disraeli's *Calamities of Authors*.

KENNICOTT, BENJAMIN (1718–1783), an eminent Hebraist, was born at Totnes, Devonshire, on April 4, 1718. His father was parish clerk and master of a charity school, in which latter situation Benjamin was chosen to succeed him at an early age. His talents and acquirements interested some rich friends in his behalf, and by their liberality he was provided with the means of studying at Oxford. Entering himself of Wadham College in 1744, he soon distinguished himself in Hebrew and divinity; and while still an undergraduate published two dissertations, *On the Tree of Life in Paradise, with some Observations on the Fall of Man*, and *On the Oblations of Cain and Abel*, which came to a second edition in 1747, and procured him the honor of a bachelor's degree before the statutable time. Shortly afterwards he was elected fellow of Exeter College, and in 1750 he took his degree of M.A. In 1767 he was appointed keeper of the Radcliffe library, and made D.D. He was also canon of Christ Church and rector of Culham in Oxfordshire, and was subsequently presented to the living of Mynhenyote, Cornwall, which however, being unable to visit it, he resigned two years before his death. He died of a lingering illness at Oxford, on September 18, 1783.

The great work with which his name continues to be associated in the annals of Biblical scholarship is the *Vetus Testamentum Hebraicum cûm variis Lectionibus*, 2 vols., fol., Oxford, 1776–80. The course of the studies which resulted in it may be gathered from the nature of the publications by which it was preceded. Two dissertations entitled *The State of the Printed Hebrew Text of the Old Testament Considered*, published respectively in 1753 and 1759, were expressly designed to combat the then current ideas as to the "absolute integrity" of the received Hebrew text. The first contains "a comparison of 1 Chron. xi. with 2 Sam. v. and xxiii., and observations on seventy MSS., with an extract of mistakes and various readings;" the second defends the claims of the Samaritan Pentateuch, assails the correctness of the printed copies of the Chaldee paraphrase, gives an account of Hebrew MSS. of the Bible known to be extant, and catalogues one hundred MSS. preserved in the British Museum and in the libraries of Oxford and Cambridge. His labors provoked severe animadversion in some quarters, and even from such men as Warburton and Horne; but they at least had the effect of drawing public attention to the subject to which they related, and in 1760 he issued his proposals for collecting all Hebrew MSS. of date prior to the invention of printing which could be discovered either at home or abroad. Subscriptions to the amount of nearly £10,000 were obtained, and many learned men addressed themselves to the work of collation, Bruns of Helmstadt making himself specially useful as regarded MSS. in Germany, Switzerland, and Italy. Between 1760 and 1769 ten "annual accounts" of the progress of the work were given; in its course six hundred and fifteen MSS. and fifty-two printed editions of the Bible were either wholly or partially collated, and use was also made (but often very perfunctorily) of the quotations in the Talmud. The materials thus collected, when properly arranged and made ready for the press, extended to 30 vols. fol. The text finally followed in printing was that of Van der Hooght,—unprinted however, the points having been disregarded in collation,—and the various readings were printed at the foot of the page. The Samaritan Pentateuch stands alongside the Hebrew in parallel columns. The *Dissertatio Generalis*, appended to the second volume, contains an account of the MSS. and other authorities collated, and also a review of the Hebrew text, divided into periods, and beginning with the formation of the Hebrew canon after the return of the Jews from the exile. Kennicott's great work was in one sense a failure. It yielded no materials of value for the emendation of the received text, and by disregarding the vowel points overlooked the one thing in which some result (grammatical if not critical) might have been derived from collation of Massoretic MSS. But the negative result of the publication and of the *Variæ Lectiones* of De Rossi, published some years later, was important. It showed that the Hebrew text can be amended only by the use of the versions aided by conjecture.

KENOSHA, chief city of Kenosha county, Wisconsin, U. S., is situated in a fertile district on Lake Michigan, about 30 miles south of Milwaukee, with which it is connected by rail. It contains numerous schools, and carries on the manufacture of hardware, wooden wares, machines, and carriages. There are also in the city breweries, foundries, tanneries, planing mills, and other industrial establishments. It possesses a good harbor, and carries on trade in its manufactures and in country produce. The population in 1880 was 5039.

KENSINGTON, a western suburb of London in the parish of Kensington, parliamentary borough of Chelsea, and county of Middlesex, a mile and a half west of Hyde Park Corner. The parish includes the suburbs of Brompton, Earl's Court, part of Little Chelsea, the Gravel Pits, Notting Hill, and part of Kensal Green. Kensington palace and Kensington gardens, however, lie in the parish of St. Margaret's, Westminster. The suburb of Kensington, which has developed out of the village of Kensington, lies to the west of Kensington gardens, and consists principally of a long and in places narrow street, the modern improvements of which with the surrounding additions have almost entirely obliterated all traces of the "old court suburb" associated with the distinguished personages of former times. From the High street others branch off at intervals, and the elevated ground to the north is almost wholly occupied with villas embosomed in woods. To the south of the High street is Kensington square, where at one time were the residences of many of the principal attendants on the court. The principal public buildings in the suburb are the parish church in the Decorated style, erected in 1869 at a cost of £35,000, the elegant new town-hall, the vestry-hall, the grammar school, the Roman Catholic college, opened in 1874, several monasteries and convents, and various schools and charities. The site of Old Gore House, at one time the residence of Mr. Wilberforce and afterwards of the Countess of Blessington, is now occupied by the Royal Albert Hall and the gardens of the Horticultural Society. These as well as Kensington gardens and the South Kensington museum, with its national training schools, fall to be noticed under the article LONDON. Kensington palace, a plain and irregular brick structure, originally surrounded by grounds extending to about 350 acres, was at one time the residence of Lord Chancellor Finch, afterwards earl of Nottingham, of whom it was bought by William III. Additions were made to it by William III., George I., George II., and the duke of Sussex. The palace was the birthplace of Queen Victoria. Kensington house, which stood near the palace gate, and was at one time the residence of the duchess of Portsmouth, mistress of Charles II., was pulled down in 1873 to make way for the mansion of Baron Albert Grant. The population of the registration subdistrict in 1871 was 91,664, which in 1881 had increased to 120,125. The population of the parish in 1881 was 162,924.

The manor of Kensington, which is written in Domesday book *Chenesitun*, has an area of 1140 acres. Some trace the origin of the word to the old Saxon name for king, others to a family of the name of Chenesi, others to "Caen," the old name for wood. The manor was originally occupied by the great Middlesex forest, the trees of which were abundant in the time of Henry VIII. In Domesday it is mentioned as being held by Aubrey de Vere of the bishop of Coutances. Soon after this it became the absolute property of the De Veres, who were afterwards created earls of Oxford. In the reign of Elizabeth it passed into the possession of Argylls, by whom it was sold to Sir Walter Cope, whose daughter married Henry Rich, earl of Holland. Holland House, in the Elizabethan style, the original mansion of the manor of Kensington, was erected by Sir Walter Cope in 1697, and enlarged and adorned by the third Lord Holland (see vol. xii. p. 103). The manor is at present held by Lord Kensington. See Faulkner, *History and Antiquities of Kensington*, 1820; Leigh Hunt, *The Old Court Suburb*.

Plate I.

KENT, a maritime county in the southeastern corner of England, lies between 50° 54′ and 51° 31′ N. lat., and between 0° 3′ W. long. and 1° 27′ E. long. It is bounded on the N. by the estuary and mouth of the Thames, E. and S. E. by the English Channel, S. W. by Sussex, and W. by Surrey. Its greatest breadth north and south from Sheerness to Dungeness is 35 miles, its length northwest to southeast from London to Dungeness about 60 miles, and its length west to east from Surrey to North Foreland in Thanet 65 miles. The area is 1,004,984 acres, or 1570 square miles.

Coast Line.—About two-thirds of the boundary line of Kent is formed by tidal water. The estuary of the Thames may be said to stretch from London Bridge to Sheerness in the Isle of Sheppey, to the northwest of which the estuary of the Medway cuts off a tongue of land whose extremity is termed the Isle of Grain. Along the banks of the Thames the coast is low and marshy, embankments being in several places necessary to prevent inundation. In the estuary of the Medway there are a number of low marshy islands, but Sheppey presents to the sea a range of chalk cliffs from 80 to 90 feet in height. The marshes extend along the estuary of the Swale to Whitstable, whence stretches a low line of clay and sandstone cliffs, succeeded at the Isle of Thanet by the white chalk cliffs which extend southwards to Pegwell Bay. The coast from Sheppey round to the South Foreland is skirted by numerous flats and sands, the most extensive of which, the Goodwin sands, forming the breakwater of the well-known anchorage of the Downs, are said to have formed part of the estate of Earl Godwine, and to have been submerged as late as 1097. From Pegwell Bay to near Deal the outline of the coast is flat, but thence it rises again into chalk cliffs, which continue round the South Foreland to Folkestone, where they are succeeded by the flat shingly shore bordering Romney Marsh. A considerable portion of Romney Marsh has been reclaimed from the sea since the time of Julius Cæsar, but in nearly every other portion of the coast the sea has been gaining on the land.

Surface and Geology.—Kent abounds in beautiful and finely-wooded valleys with undulating and picturesque uplands. A tract from 7 to 8 miles broad lying to the south of the estuary of the Thames, and extending eastward as far as Thanet, belongs to the London Tertiary basin, and is formed chiefly either of London or of plastic clay. The London Clay occupies the tongue of land between the estuaries of the Thames and Medway, as well as Sheppey and a district of country about 8 miles wide stretching southward from Whitstable to Canterbury, and extending eastward to the Isle of Thanet. It reappears at Pegwell Bay, and in the neighborhood of London it rises above the plastic clay into the elevation of Shooter's Hill, with a height of about 450 feet, and a number of smaller eminences. The thickness of the formation near London is about 400 feet, and at Sheppey it reaches 480 feet. At Sheppey it is rich in various kinds of fossil fish and shells. The plastic clay, which rests chiefly on chalk,

occupies the remainder of the estuary of the Thames, but at several places it is broken through by outcrops of chalk, which in some instances run northward to the banks of the river. The Lower Tertiaries are represented by three different formations known as the Thanet beds, the Woolwich and Reading beds, and the Oldhaven and Blackheath beds. The Thanet beds resting on chalk form a narrow outcrop rising into cliffs at Pegwell Bay and Reculvers, and consist (1) of a constant base bed of clayey greenish sand, seldom more than 5 feet in thickness; (2) of a thin and local bed composed of alternations of brown clay and loam; (3) of a bed of fine light buff sand, which in West Kent attains a thickness of more than 60 feet; (4) of bluish gray sandy marl containing fossils, and almost entirely confined to East Kent, the thickness of the formation being more than 60 feet; and (5) of fine light gray sand of an equal thickness, also fossiliferous. The middle series of the Lower Tertiaries, known as the Woolwich and Reading beds, rests either on the Thanet beds or on chalk, and consists chiefly of irregular alternations of clay and sand of very various colors, the former often containing estuarine and oyster shells and the latter flint pebbles. The thickness of the formation varies from 15 to 80 feet, but most commonly it is from 25 to 40 feet. The highest and most local series of the Lower Tertiaries is the Oldhaven and Blackheath beds lying between the London Clay and the Woolwich beds. They consist chiefly of flint pebbles or of light-colored quartzose sand, the thickness being from 20 to 30 feet, and are best seen at Oldhaven and Blackheath. To the south the London basin is succeeded by the North Downs, an elevated ridge of country consisting of an outcrop of chalk which near Westerham on the borders of Surrey reaches an elevation of 812 feet above sea-level, and at several other places more than 600 feet. It extends from Westerham to Folkestone, with an irregular breadth generally of from 3 to 6 miles, but expanding to nearly 12 miles at Dartford and Gravesend and also to the north of Folkestone. After dipping below the London Clay at Canterbury, it sends out an outcrop which forms the greater part of Thanet, and towards the sea is often broken off into precipitous escarpments. To the south of the Downs there is a narrow valley formed by the Gault, a fossiliferous blue clay. This is succeeded by an outcrop of the Lower Greensand, which extends across the country from west to east with a breadth of from 2 to 7 miles, and rises into the picturesque elevations of the Ragstone hills. These in several cases reach a height of over 600 feet, and have a steep slope southward, overlooking the valley which extends from the borders of Sussex to Hythe. This low ground is occupied chiefly by the Weald clays, which contain a considerable number of marine and freshwater fossils. Along the borders of Sussex there is a narrow strip of country consisting of picturesque sandy hills, whose highest elevation is nearly 400 feet; and the southwest corner of the county is occupied by Romney Marsh, which within a comparatively recent period has been recovered from the sea.

The London Clay is much used for bricks, coarse pottery, and Roman cement. Lime is obtained from the chalk and Greensand formations. Ironstone is found in the Wealden clays and calcareous ironstone in the Ashdown sand, but the industry has long been discontinued. The last Wealden furnace was put out in 1828.

Rivers.—The Thames, which forms the northern boundary of the county, receives the Ravensbourne at Deptford, and the Darent or Dart, which has a course of 18 miles, and becomes navigable at Dartford. The Medway, which has a course of over 50 miles, and with its tributaries drains a basin having an area of 680 square miles, is formed of several streams that rise in the neighborhood of Tunbridge Wells, and of East Grinstead in Sussex. After passing Ashurst and Penshurst it receives the Eden from the west, and at Yalding in the Weald the Teise and Beult. At Chatham it widens into an estuary, the greater portion of its waters ultimately joining the Thames at Sheerness, and the other portion passing southward to the sea through the Swale Channel. The river is tidal as high as Maidstone. The Stour, which has a course of nearly 50 miles, and with its tributary the Little Stour drains an area of about 380 square miles, has its origin in several streams which spring from the Lower Greensand and the Chalk, the two main branches, which have their source near Lenham and near Hythe respectively, uniting at Ashford. At Sarre the Stour separates into two branches which insulate the Isle of Thanet, the smaller portion flowing northward to the sea near Reculver, the other and main portion flowing eastward to Pegwell Bay. The stream is tidal and navigable to Fordwich, near Canterbury. The Little Stour rises in the Lower Chalk near Lyminge, and joins at Stourmouth that branch of the Stour which falls into the sea at Pegwell Bay. The Dour, a small stream which gives its name to Dover, has a course of little more than 3 miles from Ewell to the sea. The Rother, which has its source in Sussex, forms for some distance the boundary between that county and Kent, and along with several of its branches insulates the Isle of Oxney.

The only canals at all in use are that which runs along the borders of Romney Marsh, connecting the Rother with the sea at Hythe, but now partly filled up; and that between Gravesend and Rochester, which is partly occupied by a line of railway.

Climate, Soil, and Agriculture.—The insalubrity of certain portions of the county caused by extensive marshes has been almost wholly removed by draining. In the northeastern districts the climate is a little uncertain, and damage is often done to early fruit blossoms and vegetation by cold easterly winds. In the large portion of the county sheltered by the Downs the climate is milder and more equable, and vegetation is somewhat earlier. The soil is very various in character, but on the whole rich and under high cultivation. The methods of culture and the kinds of crop produced are perhaps more widely diversified than those of any other county in England. Upon the London Clay the land is generally heavy and stiff, but very fruitful when properly manured and cultivated. The marsh lands along the banks of the Thames, Medway, Stour, and Swale consist chiefly of rich chalk alluvium. The Chalk formation is in some cases overlaid by London Clay, alluvium, or brick earth, but in the higher chalk districts the soil is often poor and thin, and in some places much mixed with flints. In the Isle of Thanet a light mould predominates, which has been much enriched by fish manure. The valley of the Medway, especially the district round Maidstone, which has been called the garden of England, is the most fertile part of the county, the soil being a deep loam with a subsoil of brick-earth. On the ragstone the soil is occasionally thin and much mixed with small portions of sand and stone; but in some situations the ragstone has a thick covering of clay loam, which is most suitable for the production of hops and fruits. In the district of the Weald marl prevails, with a substratum of clay. The soil of Romney Marsh is a clay alluvium.

According to the agricultural returns for 1881, the total area under crops comprehended 745,215 acres, a percentage of 73.9 instead of 71.7 in 1870; corn crops had an area of 224,211 acres, a percentage of 22.3 instead of 25.1 in 1870; green crops 85,614 acres, a percentage of 8.5 instead of 7.4; rotation grasses 53,421 acres, a percentage of 5.3 instead of 6.2; permanent pasture 327,079 acres, a percentage of 31.8 instead of 28.2. The area under permanent pasture thus exceeds that under corn crops by nearly a third. The area under woods in 1881 was 82,849 acres, under orchards 16,673, under market gardens 4221, and under nursery grounds 670. Of the corn crops the most largely grown is wheat, which in 1881 occupied 84,388 acres, oats coming next with 52,177 acres, and barley and bere occupying only a little less, 50,010 acres. Beans and pease were grown on 17,453 and 19,762 acres respectively, and rye on only 421 acres. In Thanet mustard, spinach, canary seed and a variety of other seeds are raised. Of green crops, turnips and swedes were grown on 27,254 acres, vetches and similar crops on 22,179 acres, potatoes 17,815, mangolds 12,070, cabbage 5843, and carrots 452. Part of the area under green crops is occupied by market gardens, which are very numerous in the neighborhood of London. The principal orchard districts are the valleys of the Darent and Medway, and the Tertiary soils overlying the Chalk, between Rochester and Canterbury. The county is specially famed for cherries and filberts, but apples, pears, plums, gooseberries, and currants are also largely cultivated. In some cases apples, cherries, filberts, and hops—the special crop of the county—are grown in alternate rows. 41,476 acres were under hops in Kent in 1881, and in the United Kingdom only 64,943 acres. The principal hop districts are the country in East Kent lying between Canterbury and Faversham, the valley of the Medway in Mid Kent, and the district of the Weald. The area under hops in these several districts in 1881 was 11,718, 17,353, and 11,986 acres respectively,—other districts contributing only 419 acres. Much of the Weald, which originally was occupied by a forest, is still densely wooded. There are many fine woods scattered throughout the county, especially in the valley of the Medway, oak and beech being the trees principally grown. A large extent of woodland is ash and chestnut plantations—maintained for the growth of hop-poles.

The following table gives a classification of holdings according to size as returned on the 25th June, 1875, and the 4th June, 1880, with the acreage of each class of holding for these years:

Class of holding.......	50 Acres and under.		50 to 100 Acres.		100 to 300 Acres.		300 to 500 Acres.		500 to 1000 Acres.		1000 Acres and upwards.		Total.	
Years.........................	1875.	1880.	1875.	1880.	1875.	1880.	1875.	1880.	1875.	1880.	1875.	1880.	1875.	1880.
Number........................	6,760	7,281	1,285	1,801	1,814	1,848	368	375	119	108	15	13	10,361	10,926
Area in Acres............	92,657	98,228	92,758	93,511	311,188	320,974	136,379	142,269	76,545	70,646	18,587	18,920	728,114	744,548

About two-thirds of the holdings are less than 50 acres in extent, but the largest area—about two-fifths of the whole—is in farms between 100 and 300 acres.

The number of horses in 1881 was 29,450, an average of 3.9 to every 100 acres under cultivation, the average for England and also for Great Britain being 4.4. The number of horses used for agricultural purposes was 24,177. The total number of cattle in 1881 was 73,409, an average of 19.9 (England 16.9, Great Britain 18.4) to every 100 acres under cultivation. The number of cows in milk or in calf was 29,485, and of other cattle 43,924. Cattle are grazed in large numbers in the marsh lands along the estuaries of the rivers, and of course dairy farms are very numerous in the neighborhood of London. The number of sheep in 1881 was 952,311, an average of 128.9 (England 62.4, Great Britain 76.3) to every 100 acres under cultivation. The number one year old and upwards was 627,124, and below one year 325,187. A breed of sheep peculiar to the district, known as Kents, is grazed on Romney Marsh, but Southdowns are the principal breed raised on the uplands. Pigs in 1881 numbered 55,896, or an average of 7.5 (England 7, Great Britain 6.6) to every 100 acres under cultivation.

According to the landowners' return, 1872–73, the land, exclusive of that in the metropolis, was divided between 34,683 proprietors, and its gross annual value was £3,357,057. Of the owners, 26,925, or more than 77 per cent., possessed less than 1 acre, and the average value per acre over all was £3 10s. 7¼d. There were four proprietors possessing above 10,000 acres each, viz., Viscount Holmsdale, 15,162 acres; Lord Sondes, 14,446; Sir H. Tufton, 13,639; and the Ecclesiastical Commissioners, Whitehall, 10,591. Other seventeen possessed more than 5000 acres each.

Manufactures and Trade.—At one time there were extensive ironworks in the Weald of Kent, and woollen cloth was also largely manufactured, but the former industry is now wholly extinct, and the latter is only prosecuted to a very small extent. Next to the occupations connected with the Government establishments at Deptford, Woolwich, Chatham, and Sheerness (see DOCKYARDS, vol. vii. p. 269), the most important industry of the county is that of paper, which is carried on on the banks of the Cray, Darent, Medway, and other streams in the west of the county. Shipbuilding by private firms is also prosecuted at Greenwich, Gravesend, Dover, Northfleet, and Ramsgate. At Greenwich there are engineering works, soap works, and chemical works; and the carriage and engine works of the Southeastern Railway are situated at Ashford. Manufactories of silk, cotton, linen, wool, and ribbons give employment in various towns and villages. Bricks, tiles, pottery, and cement are fabricated, especially on the banks of the Swale and Medway. Lime-burning and whiting-making are also carried on. There are powder-mills at Dartford, Faversham, and Tunbridge. The principal ports besides those on the Thames and Medway are Whitstable, Herne Bay, Margate, Broadstairs, Ramsgate, Sandwich, Deal, Dover, and Folkestone. The watering-places are Erith, Greenhithe, Northfleet, Gravesend, Herne Bay, Margate, Westgate, Broadstairs, Ramsgate, Deal, Dover, Folkestone, and Sandgate. Tunbridge Wells is a favorite spa.

Fishing.—Deep-sea fishing is largely prosecuted all round the coast of Kent. Shrimps, soles, and flounders are caught in great numbers in the estuaries of the Thames and Medway and along the coast of Whitstable and Margate as well as at Ramsgate. The principal oyster beds are at Queenborough, Rochester, Milton, Faversham, and Whitstable, and whitebait frequent the Thames in immense shoals below Greenwich.

Railways.—As the main pathway of communication between London and the Continent lies through Kent to Dover, the county at a very early period enjoyed the advantage of railway intercourse; and it is now very completely intersected with railway lines.

Administration.—Kent is divided into five lathes—a partition peculiar to the county, and dating from Anglo-Saxon times. The lathes are St. Augustine, Shepway, Scray, Aylesford, and Sutton-at-Hone. The county comprises 61 hundreds, the lowey of Tunbridge, the franchise and barony of Bircholt, the liberty of the Isle of Sheppey, the liberty of New Romney; two cities, Canterbury (21,701) and Rochester (21,590), which are also municipal and parliamentary boroughs; one parliamentary borough, Chatham (46,806); five boroughs which are both municipal and parliamentary, viz., Dover (28,486), Gravesend (m. 23,375, p. 31,355), Hythe (m. 4069, p. 28,066), Maidstone (m. 29,638, p. 39,662), Sandwich (m. 2846, p. 15,566); part of the parliamentary borough of Greenwich and five municipal boroughs, viz., Deal (8422), Faversham (8627), Folkestone (18,887), Margate (15,889), and Tenterden (3620). The liberty of New Romney and all the municipal boroughs except Gravesend and Maidstone are included among the Cinque Ports. The Cinque Port districts in Kent are those of Sandwich, partly in Essex, Dover, Hythe, New Romney, and a portion of Rye, namely, Tenterden (see CINQUE PORTS, vol. v. p. 687). Until 1867 Kent was for parliamentary purposes formed into only two divisions, East and West Kent, but by the Reform Act of that year West Kent was divided into West and Mid Kent. The city of Canterbury, which returns two members, Dover and Sandwich, which return two members each, and Hythe, which returns one member, are included in East Kent, which returns in all nine members. In Mid Kent are included the city of Rochester, returning two members, Maidstone, returning two members, and Chatham and Gravesend, returning one member each; it returns in all eight members. West Kent, which returns two members, includes part of the borough of Greenwich, which returns two members. The total representation of the county, including Greenwich, is thus twenty-one members. The county has one court of general sessions and two of quarter sessions; the number of sessional divisions is sixteen, exclusive of the liberty of Romney Marsh, which has petty and general sessions under its charters. The central criminal court has jurisdiction over certain parishes in the county. The city of Canterbury (a county in itself), the city of Rochester, and the boroughs of Gravesend and Maidstone have commissions of the peace and separate courts of quarter sessions, as have also the ports and boroughs of Deal, Dover, Faversham, Folkestone, Hythe, Margate, Sandwich, and Tenterden. The ancient borough of Queenborough, governed by an old charter, has a recorder and a court of quarter sessions with a separate jurisdiction limited to misdemeanors. Summary cases are dealt with by the mayor and magistrates in petty sessions. With the exception of the portion included in the metropolitan police district, the shire for judicial purposes belongs to the southeastern circuit, and for police purposes is divided into twelve districts, which are generally identical with the petty sessional divisions. The cities of Canterbury and Rochester, the boroughs of Deal, Dover, Faversham, Folkestone, Gravesend, Hythe, Maidstone, Margate, Sandwich and Tenterdon, and the towns of Ramsgate (22,605) and Tunbridge Wells (24,309) have their own police. Ecclesiastically, with the exception of portions of two parishes, Kent is within the dioceses of Canterbury and Rochester; and it contains thirty-seven civil parishes or places, as well as parts of other parishes extending into adjoining counties.

Population.—Since 1801, when it numbered 308,667, the population has been rapidly and uninterruptedly increasing. In 1821 it was 427,224, and in 1841 it had increased to 549,353, in 1861 to 733,381, in 1871 to 848,294, and in 1881 to 977,585, of whom 477,715 were males and 499,870 females.

History and Antiquities.—A tribe of the Belgæ from Gaul had before the time of Cæsar's invasion taken possession of a large portion of Southern Britain, including Kent. The remarkable cromlech, Kit's Coity House, near Aylesford, belongs to this early period, as do numerous earthworks, encampments, stone circles, and excavations on the coast which are now generally regarded as ancient chalk pits. The spot of Cæsar's landing was probably either some part of the coast between Walmer and Thanet—the neighborhood of Deal finding most supporters—or the *Portus Lemanis* in Romney Marsh, which is identical with the town of Lymne. In his first invasion he did not penetrate farther than Kent, and the absence of lapidary inscriptions is regarded as evidence that its conquest was easily effected. The principal Roman road was the Watling Street, between *Dubris* (Dover) and London, which had much the same course as the present highway. This road was joined at *Durovernum* (Canterbury) by two others, one from the *Portus Lemanis* (Lymne) and the other from *Regulbium* (Reculver). The traces of the road from the *Portus Lemanis* are still well marked throughout its whole extent, but agricultural operations have almost wholly obliterated the traces of that from *Regulbium*. Of two other Roman stations, *Durolevum* and *Vagniacæ*, the site cannot be absolutely determined, but most probably the former was near Faversham, and for the latter, which was somewhere between Rochester and London, most opinions favor Springhead, near Gravesend. There are still important remains of Roman fortresses at Dover, Richborough, Reculver, and Lymne; many traces of Roman villas have also been discovered; and portions of Roman structures have frequently been utilized in the construction of churches and other buildings. A great variety of Roman relics have been discovered in nearly every part of the county. The most remarkable are profuse traces of extensive potteries of purple or black ware at Upchurch on the south bank of the Medway, leaden coffins elaborately ornamented, and glass and bronze vessels in various Roman cemeteries. The earliest Teutonic settlement, under Hengest and Horsa, took place in Kent; and, on the arrival of Augustine in 597, Canterbury became the Christian metropolis of the island. Separate kings appear to have occasionally ruled in East and West Kent; and a bishopric was established at Rochester, in West Kent, as well as at Canterbury. Of this period of Kentish history the principal antiquarian remains are the cemeteries; from those at Sarre and Osengal in Thanet, and at Bifrons, Barham, Bishopsbourne, Gilton, and Sittingbourne, a large number of relics of various kinds have been obtained. Some old customs belonging to this period, including that of gavelkind in cases of intestacy, are still extant. Kent in 823 was united by Egbert to the kingdom of the West Saxons. In the 9th, 10th, and 11th centuries it suffered greatly from the ravages of the Danes. After the Conquest the earldom of Kent, which had been held by Godwine and afterwards by Harold, was bestowed by William on his brother Odo, bishop of Bayeux. Among other events of historic importance the following may be mentioned:—the capture of Rochester by William Rufus in 1088, an incident connected with the rebellion of Odo, which was subdued in the same year; the murder of Thomas à Becket at Canterbury in 1170; the submission of King John to the pope's legate at Dover in 1215; the capture of Rochester Castle by King John in the same year, and of the same castle by the dauphin of France in 1216, the greater part of Kent formally submitting to him with the exception of Dover Castle; Wat Tyler's insurrection in 1381 and that of Jack Cade in 1450; the encampment of Cornish insurgents at Blackheath in 1497, where they were surprised by Henry VII.; the insurrection of Sir Thomas Wyatt, which was commenced at Maidstone in 1554; the suppression of the Kentish insurrection by Fairfax at Maidstone, June 1, 1648; and the burning of certain ships at Chatham by the Dutch fleet under De Ruyter in 1667 after the fort of Sheerness had been levelled by his guns.

As was to be expected from its connection with the early history of England, and from its beauty and fertility, Kent possessed a larger than average number of monastic foundations. The earliest were the priory of Christ's Church and the abbey of St. Peter and St. Paul, now called St. Augustine's, both at Canterbury, founded by Augustine and the monks who accompanied him to England. In the time of Henry VIII. the other principal religious houses were a priory at Rochester founded in 1089, a priory founded at Folkestone in 1100 on the site of a nunnery originally founded in 630, a nunnery of St. Sepulchre at Canterbury, founded about 1100, a nunnery at Minster in Sheppey built in 1130 on the site of a nunnery which was founded in 675, but destroyed by the Danes, St. Martin's Priory at Dover established in 1140 in place of one founded in 696 but afterwards dissolved, an abbey at Faversham founded in 1147, and nunneries at Lillechurch in Higham founded before 1151, at Davington founded in 1153, and at Malling founded in the time of William Rufus; the Black Canons possessed a priory at Leeds founded in 1119, an abbey at Westwood in the parish of Erith founded in 1178, a priory at Combwell in Goudherst founded in the reign of Henry II., a priory at Tunbridge founded in the same century, a priory at Bilsington founded in 1253, St. Gregory's Priory at Canterbury, changed in the time of Henry I. from one of secular priests, originally founded in 1084; the White Canons had St. Radegund's Abbey near Dover, founded in 1193, and an abbey at West Langdon, founded in 1192; houses belonging to the Carmelites existed at Aylesford and Newenden, both founded in 1240, and at Sandwich founded in 1272; one belonging to the Dominicans was founded at Canterbury in 1221, the Franciscans having one at the same city founded in 1225, and the Eremite Friars also one at the same city founded in the time of Edward I. or Edward II.; an abbey of Cistercian monks was founded at Boxley in 1146, a preceptory of Knights Templars at Swingfield near Dover some time before 1190, a priory of Trinitarian Friars at Mottenden in the parish of Headcorn in 1224, a nunnery of the order of St. Augustine at Dartford about 1355, a cell of Cluniac monks at Monks Horton in the time of Henry II., and a preceptory belonging to the Knights of St. John of Jerusalem at West Peckham in the time of Henry IV. Of the monastic buildings the principal remains are those of the Benedictine monastery of St. Augustine at Canterbury, the priory of Christ's Church, Canterbury, adjoining the cathedral, the Dominican convent, Canterbury, St. Radegund's Abbey near Dover, St. Martin's Priory, Dover, Horton Priory, Malling Abbey, Aylesford Friary, and the abbeys of Minster in Sheppey and Minster in Thanet. In addition to the cathedrals of Rochester and Canterbury, the churches of special interest are those of Darenth, partly Old English; Lyminge, of very great antiquity; Barfreston, a small but unique specimen of enriched Late Norman work; Patricksbourne, a very beautiful example of Norman; St. Margarets-at-Cliffe, with many portions of very rich Norman, the west doorway being one of the finest examples of Norman work in England; New Romney, with the finest Norman tower in Kent; Folkestone, Early English, with some portions almost Norman; St. Martin's Church, Canterbury; Brabourne, with some singular Norman work, and possessing several brasses; St. Clement's, Sandwich, partly Early English, with enriched Norman tower; Minster in Sheppey, Norman and Early English, with brass of date about 1330; Minster in Thanet, Norman tower and nave, with Early English chancel; Lydd, partly Early English and possessing several brasses; Cobham, Early English, with the finest collection of brasses in England; Hythe, with plain exterior, but possessing a chancel whose interior is one of the finest specimens of Early English work extant; Stone, Early English to Decorated, and in style resembling Lincoln cathedral; Chartham, a fine specimen of the Decorated, and possessing several brasses, one of the date 1306; Ashford, Decorated and Perpendicular, with brass of 1375, and one of the finest towers in Kent.

The principal secular buildings of interest, in addition to the Roman ruins already referred to, are the Norman keeps of Malling, Canterbury, Rochester, Dover, Chilham, and Tunbridge; the castles of Sandown, Deal, and Walmer, built by Henry VIII. for defensive purposes; Hever Castle, the seat of the Boleyns, and the scene of the courtship of Anne Boleyn and Henry VIII.; Allington Castle near Maidstone, the birthplace of Sir Thomas Wyatt; the banqueting hall and gateway of the Royal Palace at Eltham; the castellated mansion of Leeds Castle near Maidstone; Penshurst Castle, the seat of the Sidneys; Knole House near Sevenoaks, formerly one of the palaces attached to the archbishopric of Canterbury, and once the seat of the dukes of Dorset, now of Lord Sackville; the Mote, at Ightham; and Cobham Hall.

A full account of the geology of Kent is comprehended in Topley's *Geology of the Weald*, and Whitaker's *Geology of the London*

Basin, forming part of the memoirs of the Geological Survey of the United Kingdom. Among the more ancient books on Kent are Lambard's *Perambulation*, written in 1570, 1st ed. 1576, latest 1826; Kilburne's *Brief Survey*, 1657; and Philipot's *Villare Cantianum*, 1659. The principal histories are those of Harris (1719), Hasted (1778–99), Seymour (1776), Henshall (1798), Ireland (1828–30), Collings (1834), and Dunkin (1856–77). Among the many works treating on Kentish antiquities may be mentioned Somner, *Treatise on the Roman Ports and Forts of Kent*, 1693; Nichols, *Antiquities in Kent*, 1782–83; Parsons, *Monuments of Kent*, 1794; Sandys, *Consuetudines Kanciæ*, 1851; Hussey, *Notes on the Churches of Kent*, 1852; F. H. Appach, *C. J. Cæsar's British Expeditions from Boulogne to the Bay of Apuldore*, 1868; Larking, *Facsimile of Domesday Book relating to Kent*, 1869; Furley, *A History of the Weald of Kent*, 1871–74; Scott-Robertson, *Kentish Archæology*, 1877–81; Glynne, *Notes on Churches of Kent*, 1877. See also Frost, *In Kent with Charles Dickens*, 1880. A very full bibliography of works relating to Kent and its several towns is given in Smith's *Bibliotheca Cantiana*, 1837; see also Anderson's *British Topography*, 1881. The *Archæologia Cantiana*, a periodical publication of the Kent Archæological Society, contains accounts of the latest antiquarian discoveries.

KENT, JAMES (1763–1847), American jurist, was born at Philippi in New York State, July 31, 1763. He graduated at Yale College in 1781, and began to practise law at Poughkeepsie, in 1785 as an attorney, and in 1787 at the bar. In 1790 and 1792 Kent was chosen to represent Dutchess county in the State legislature. In 1793 he removed to New York, where Governor Jay, to whom the young lawyer's Federalist sympathies were a strong recommendation, appointed him a master in chancery for the city. The year 1796 saw Kent again a member of the legislature and professor of law in Columbia College. In 1797 he became recorder of New York, in 1798 judge of the supreme court of the State, in 1804 chief justice, and in 1814 chancellor of New York. In 1822 he became a member of the convention to revise the State constitution. Next year, having attained the age of sixty, Chancellor Kent resigned his office, and was re-elected to his former chair. Out of the lectures he now delivered grew the *Commentaries on American Law* (4 vols., 1826–30), which by their learning, range, and lucidity of style, have won for him a high and permanent place in the estimation of both English and American jurists. Kent rendered most essential service to American jurisprudence while serving as chancellor. Chancery law had been very unpopular during the colonial period, and had received down to his time but little development, and no decisions had been published. His judgments of this class (see Johnson's *Chancery Reports*, 7 vols., 1816–24) cover a wide range of topics, and are so thoroughly considered and developed as unquestionably to form the basis of American equity jurisprudence. Kent was a man of great purity of character, of singular simplicity and guilelessness in his ways, and is altogether a conspicuous and remarkable figure in American annals. He died in New York, December 12, 1847.

To Kent we owe several other works (including a *Commentary on International Law*), of less importance than the *Commentaries*. These have passed through twelve editions, the most recent (1873) being annotated by O. W. Holmes, jun. See Duer's *Discourse on the Life, Character, and Public Services of James Kent*, 1848; and *The National Portrait Gallery of Distinguished Americans*, vol. ii., 1852.

KENT, WILLIAM (1685–1748), "painter, architect, and the father of modern gardening," as Horace Walpole in his *Anecdotes of Painting* describes him, was born in Yorkshire in 1685. Apprenticed to a coach-painter, his ambition soon led him to London, where he began life as a portrait and historical painter. He was fortunate enough to fall in with kind patrons, who sent him in 1710 to study in Italy; and at Rome he made other friends, among them Lord Burlington, with whom he returned to England in 1719. Under that nobleman's roof Kent chiefly resided till his death on April 12, 1748,—enjoying through his patron's influence abundant commissions in all departments of his art, as well as various court appointments which brought him an income of £600 a year. Walpole flatly says that Kent was below mediocrity in painting. He had some little taste and skill in architecture, of which Holkham palace is perhaps the most favorable example. The mediocre statue of Shakespeare in Westminster Abbey sufficiently stamps his powers as a sculptor. His merit in landscape gardenin is greater. In Walpole's stilted language, Kent "wa painter enough to taste the charms of landscape, bol and opinionative enough to dare and to dictate, an born with a genius to strike out a great system fron the twilight of imperfect essays." In short he wa the first in English gardening to vindicate the natura against the artificial. Banishing all the clipped monstrosities of the topiary art in yew, box, or holly, releasing the streams from the conventional canal an marble basin, and rejecting the mathematical symmetry of ground plan then in vogue for gardens, Ken endeavored to imitate the variety of nature, with du regard to the principles of light and shade and perspective. Sometimes he carried his imitation too far, a when he planted dead trees in Kensington gardens t give a greater air of truth to the scene, though he himself was one of the first to detect the folly of such a extreme. Kent's plans were designed rather with view to immediate effect over a comparatively smal area than with regard to any broader or subsequen results,—doubtless from landscape gardening bein then but in its infancy.

KENTIGERN, ST. (*c.* 516–603), popularly know as St. Mungo, the apostle of Strathclyde and the restorer of Christianity among the Cumbrians, was according to Jocelyn of Furness, the son of "th daughter of a certain king most pagan in his creed who ruled in the northern parts of Britannia." Hi mother, probably a nun, was, it is said, when with child sentenced to be thrown from one of the precipices of Dunpelder (Traprain Law, formerly Dumpender Law, in Haddington), but miraculously escaping, was exposed in a boat to the mercy of the sea and landed on the sand at Culenross (Culross), where she gave birth to the child. On the spot where the boat reached land there was at one time a small chapel dedicated to St. Kentigern. According to the tradition, St. Servanus (who, however, lived two hundred years after Kentigern) took special care of the mother and child, calling the mother Taneu (Thanew) and the child Kentigern, "head master or lord." Afterwards he also named him, on account of his intelligence and the graces of his character, Munghu (Mungo), "dearest friend." As, however, the favor with which he was regarded by Servanus had awakened the animosity of his fellow pupils, he secretly made his escape, and ultimately found his way to Cathures (Glasgow), near a cemetery which had been long consecrated by St. Ninian. There he dwelt for some time with two brothers named Telleyr and Anguen, when on account of the fame of his manner of life and his miraculous deeds the king and clergy of Cumbria, in order to restore the religion of Christianity to its former influence, called over a bishop from Ireland and caused Kentigern to be consecrated bishop. His cathedral seat he named Glasgu, "the dear family," where he collected a number of friends and disciples who practised continence and lived after the manner of the primitive church. On his life being threatened, he journeyed to Menevia (St. David's) in South Wales, where he founded the monastery of Llanelwy, afterwards St. Asaph's. When Roderick ascended the throne of Cumbria, Kentigern returned, and after establishing his see for some time at Hoddam, Dumfriesshire, he settled finally at Glasgow. He is said to have died on a Sunday, and as his saint's day is the 13th January, he probably died in 603.

The fragment of a life of St. Kentigern, composed at the instance of Herbert, bishop of Glasgow, who died in 1164, and made use of by John of Fordun, is preserved in a manuscript of the British Museum. It was first printed by Cosmo Innes in the *Registrum Episcopatus Glasguensis*. A life written by Jocelyn, a monk of Furness, about 1180, exists in two MSS., one in the British Museum, the other in the public library of the archbishop of Dublin, bound along with a life of St. Servanus in a small quarto volume. An abridgment of the life by Jocelyn was published by Capgrave in *Nova Legenda Angliæ*. The British Museum MS.

was published by Pinkerton in the *Vitæ Antiquæ Sanctorum Scotiæ*. The second MS. has been published along with the anonymous fragment, and with translations of both, accompanied with learned notes by Bishop Forbes of Brechin, in vol. v. of *The Historians of Scotland*, 1874. Principally on the earlier fragment have been founded the legends of St. Kentigern and his friends and disciples in the Aberdeen Breviary, which have been published with translations and notes by Rev. William Stevenson, 1874. See also Skene's *Celtic Scotland*, vol. ii., and Montalembert's *Monks of the West*.

KENTUCKY.

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KENTUCKY, the second State admitted into the Federal Union of the United States of America after the adoption of the Constitution, and the first admitted west of the Alleghany Mountains and formed of territory outside of the original colonies, is bounded on the north by Ohio, Indiana, and Illinois, from which it is separated by the Ohio River; on the east by West Virginia and Virginia, from which it is separated by the Big Sandy River and the Cumberland Mountains; on the south by Tennessee, from which it is divided by an arbitrary line running due east and west, with a break at the Tennessee River; and on the west by Missouri, from which it is separated by the Mississippi River. Its extreme geographical extent is from 36° 30′ to 39° 6′ North Latitude, and from 82° 2′ to 89° 40′ Longitude East from Greenwich. Within these limits its greatest length, from east to west, is 308 miles, and its greatest width, from north to south, is 172 miles. Survey reports of its area are even to the present day conflicting, but the State appears to comprise about 41,000 square miles, of which one per cent. is water.

Topography.— The surface of the State is varied in character. The western and northern parts of it are generally level or rolling, while the eastern and southeastern parts are traversed by the Cumberland Mountains — named after the Duke of Cumberland, of Fontenoy and Culloden — and are particularly rugged. Along the southeastern border of the State runs a nearly straight, uniform ridge, from which branch numerous offshoots at all angles and in all directions. These mountains seldom attain a height of more than 2,500 feet, and their extreme altitude is not more than 3,000 feet, but they are steep and rugged, and the valleys among them are narrow and dark. In many places the scenery is exceedingly romantic and picturesque. Among these mountains are the headwaters of various rivers, mostly flowing north and west, toward the Ohio, but a few of them uniting to form the Cumberland, which flows south and west. West of the mountain region is a great, rolling upland, comprising more than half of the State. It is traversed by numerous rivers, which lie at the bottoms of deep, narrow valleys. The western part is a lower plain, traversed by rivers and dotted with small, isolated hills, called "oak knobs." Beside the Big Sandy, the Ohio and the Mississippi Rivers, which bound it, Kentucky contains the Licking, Kentucky, Greene and other rivers, flowing into the Ohio; the upper and lower parts of the Cumberland River are also within its borders; and it is traversed near its western end by the Tennessee River, which flows across it to reach the Ohio at Paducah. These streams with their tributaries amply water the State. There are no lakes of importance within the State. The Mississippi and Ohio Rivers are of course of great value for purposes of transportation. The Big Sandy is navigable for only a short distance, on account of falls. The Licking, which is 100 miles long, may at certain seasons be navigated for about 70 miles. The Kentucky River is 260 miles long, and may be navigated by steamboats for 60 miles and by smaller craft for 100 miles further. Greene River has a length of 300 miles, and is navigable for two-thirds of that distance, but use of it is hampered by falls fifty miles from its mouth. The Cumberland River has a course of 600 miles, and is navigable for two-thirds of that distance. Small vessels can ascend it, across Kentucky, through Tennessee, and into Kentucky again as far as Burkesville. The Tennessee River is of course navigable all the way across Kentucky, and far into Alabama.

Geology and Mineralogy.— The greater part of Kentucky belongs to the Lower Silurian formation, with two considerable areas of the Carboniferous formation superimposed. These latter now form the great coal fields of the State, and while probably at some remote period joined together they are now a hundred miles apart. The great central uplands are composed of blue Silurian limestone. The strata of the rocks show little dip, but are here and there broken into abrupt terraces, such as those which form the falls of the Ohio River. There the rocks abound in fossils, and in coralline productions. In this limestone formation are also to be found many caves, including the world-famed Mammoth Cave, which is situated near Greene River. At some points the blue limestone is changed for a gray or cliff limestone, which furnishes some of the best building stone in the State. Here and there, along the Ohio River, are to be found formations of black or Devonian shale, often bituminous in character. The "oak knobs" already referred to mark the presence of a sandstone formation. The Carboniferous rocks present two important but distinct coal fields. That in the eastern and mountainous part of the State is a continuation of the coal fields of the Appalachian region, in West Virginia, Pennsylvania, and elsewhere. The other, at the west, is a continuation of the coal fields of Illinois, Indiana, and Ohio. In this latter field is found the well known and valuable Breckenridge coal, so rich in oil. The eastern coal field covers nearly 9,000 square miles, and the western nearly half as great an area. In the western end of the State, between the Tennessee and Mississippi Rivers, are to be found Quarternary formations, of marl, clay, and loam, interspersed with small deposits of lignite and fossils.

The minerals of the State, apart from coal and limestone, already mentioned, are chiefly iron, lead, and salt. There are valuable deposits of iron. Lead is found in many places, but not in sufficient quantities for profitable working. Salt springs and saline rocks abound, and have given to many places the name of "licks" — where wild animals used to congregate to lick the salt mud or rocks. At these "licks" rich deposits of fossil remains have been discovered. It may be added that coal oil has been found, and also gypsum, nitrates, and traces of silver. Apart from coal, iron, and limestone, however, the mineral wealth of the State is unimportant.

Climate.— The climate of Kentucky is temperate and agreeable. The extremes of heat and cold are less marked than in other States in the same part of the continent. The mean monthly temperature ranges from 35° to 78° Fahrenheit, and the mean annual temperature is about 56°. In winter the thermometer seldom falls below 20°, though it has been known to fall to zero, and in summer 100° may be regarded as the maximum. Such extremes are, however, rare. Southwest winds prevail in spring and summer, and the northwest wind brings the greatest cold in winter. In the southern counties the winters are so mild that cattle can be left in the fields the year round. Winter and spring are the rainy seasons, the summer and fall being generally dry. The yearly rainfall is about 46 or 47 inches, two-thirds of it occurring in the half-year from November to April, inclusive.

Flora and Fauna.—Few if any States of the Union have a more fertile soil than that of Kentucky, and consequently few if any have a richer vegetation. The "blue grass region," which covers a considerable part of the State, has a soil which seems inexhaustible in richness. Farms which have been steadily cultivated for more than a century still exhibit the qualities of virgin soil. The pasturage of the uplands and plains and of the river bottoms is bewilderingly rich. Much of the State is still covered with splendid forests of oak, ash, whitewood, hickory, walnut and buckeye, while pine and cypress are to be found in some places. The cultivated vegetable products of the State are varied. Chief among the farm crops are corn, wheat, oats, rye, tobacco, potatoes, and hay. Hemp and flax have been grown with much success. Apple and peach orchards are numerous and highly productive, and nearly all fruits and vegetables of the temperate zone can be successfully raised. Cotton and sweet potatoes have also been cultivated to a considerable extent.

In recent years Kentucky has been much noted for its fine horses, the product of the pastures of the blue grass region. Other domestic animals, such as cattle, sheep and swine, are largely raised. Wild animals are now confined to raccoons, opossums, foxes, and the like, though there are still a few bears and wild cats in the mountain region, and also some deer. In former ages this region was evidently rich in fauna. Deer, elk, and bison were innumerable, and further back there were wild horses, mastodons, megalonyx, and many others which now are known to us only through fossil remains.

Industries.— Kentucky is chiefly an agricultural State, yet its mining and manufacturing industries are not inconsiderable. In 1902 it produced 6,041,950 tons of bituminous coal, and 110,725 tons of pig iron. The chief manufacturing industries are flour mills, distilleries, foundries and machine shops, and factories of cloth, carriages and harness, furniture, agricultural implements, lumber and cement. The increase of manufactures in recent years has been marked, as the following table will show; covering the last three decennial censuses:

	1880.	1890.	1900.
Number of establishments	5,328	7,745	9,560
Capital	$45,813,039	$79,811,980	$104,070,791
Number of employes	37,391	56,558	62,962
Total wages paid	$11,657,844	$ 21,326,831	$ 22,434,185
Cost of materials used	47,461,890	63,677,583	82,830,415
Value of products	75,483,377	126,719,857	154,166,365

There were in the State in 1902 3,143.61 miles of railroads, or 1.55 per cent. of the total mileage of the United States.

Agriculture.—According to the census of 1900, Kentucky ranked fourteenth among the States of the Union in the production of cereals. Statistics were as follows:

Acres of improved land	13,471,968
Acres of all crops	6,582,696
Acres of cereals	5,085,529
Value of all crops	$74,783,365
Value of cereals	$39,692,771
Bushels of cereals	92,422,566

The chief cereal raised was corn, 73,794,220 bushels. Of oats there were 4,009,830 bushels, of rye 155,365 bushels, and of wheat 14,264,500 bushels. Other farm products were: Hay and forage, exclusive of cornstalks, 655,066 tons; grass seed, 270,973 bushels; potatoes, 2,661,774 bushels; sweet potatoes, 925,786 bushels; tomatoes, 545,245 bushels; watermelons, 5,875,140 melons; muskmelons, 2,882,560 melons; cotton, 685,724 pounds; sorghum sirup, 1,277,206 gallons; tobacco, 314,288,050 pounds (Kentucky stood first of all the States in tobacco production); and wool, 2,850,000 pounds. There were in the State 237,612 cherry trees; 8,757,238 apple trees; 2,884,193 peach trees; 322,201 pear trees; 375,716 plum and prune trees; and 1,428,968 grapevines. Of small fruits there were produced 1,068,340 quarts of blackberries, 787,820 quarts of raspberries, and 6,767,800 quarts of strawberries.

Statistics of farm property at the last three decennial censuses are as follows:

	1880.	1890.	1900.
Number of farms	166,453	179,264	234,667
Improved acres	10,731,683	11,818,882	13,741,968
Unimproved acres	19,763,557	9,593,347	8,237,454
Total acres	21,495,240	21,412,229	21,979,422
Value, land and buildings	$299,298,631	$346,339,360	$382,004,890
Value, tools and machines	9,734,634	10,906,506	15,301,860
Value, live stock	49,670,567	70,924,400	73,739,106

The farms were classified as follows in 1900:

Total number of farms	234,667
Held by white farmers	223,429
Held by colored farmers	11,238
Held by owners	137,557
Part owners	14,659
Owners and tenants	3,780
Managers	1,606
Cash tenants	16,776
Share tenants	60,289

Live stock statistics were as follows: Neat cattle, 1,119,739; horses, 497,245; mules, 198,110; sheep, 1,300,832; swine, 2,008,989. The value of the horses was $24,548,542; the average being somewhat higher than in most similar States.

Finance and Commerce.—Being an inland State, Kentucky has no direct export trade, and the direct import trade is small. In 1903 imports at Louisville amounted to $568,586, on which duties of $334,604 were collected. The State stood fourth in the amount of internal revenue collected, the sum being $21,115,626.21. This enormous tax is due chiefly to the great production of whiskey and other distilled spirits, in which Kentucky stands second among the States, with an output of 32,250,507 gallons in 1903.

The eight banks of Louisville in 1903 had total loans and discounts of $15,800,517, and the ninety-three other banks in the State $26,321,512, a total for the State of $42,122,029. The exchanges of the Louisville clearing house in 1903 were $529,260,638.

Educational.— Kentucky has a free public school system, including high schools, and a number of institutions of higher learning. Statistics of public schools in 1901 were as follows:

Children of school age, 5 to 18 years	674,269
Number enrolled	497,859
Average daily attendance	312,354
Length of school year, days	104.5
Number of male teachers	4,711
Number of female teachers	5,802
Total expenses of school system	$2,851,651

Statistics of high schools, normal schools, colleges and professional schools, for 1902, are as follows:

INSTITUTIONS.		TEACHERS.		STUDENTS.	
Class.	Number.	Male.	Female.	Male.	Female.
Public High Schools..	80	127	109	2,252	3,138
Private High Schools.	89	123	198	1,773	1,848
Public Normal Schools	2	6	3	43	111
Private N'rm'l Schools	9	17	8	370	386
Colleges for Men and Coeducational......	11	147	53	2,342	972
Colleges for Women..	10	25	84	....	1,244
Schools of Theology..	2	18	....	294	....
Schools of Law......	2	7	....	77	....
Schools of Medicine ..	7	152	....	1,367	....

There is a State Agricultural and Mechanical College at Lexington, and there is a State Normal and Industrial School for Negroes at Frankfort. There are State institutions for the instruction of the blind at Louisville, for deaf mutes at Danville, and for feeble minded children at Frankfort.

Population.— The population of Kentucky at decennial periods since the organization of the State has been as follows, divided according to color, and with Kentucky's rank in population among the States:

YEAR.	WHITE.	COLORED.	TOTAL.	RANK.
1790	61,133	12,544	73,677	14
1800	179,873	41,082	220,955	9
1810	324,237	82,274	406,511	7
1820	434,644	129,491	564,135	6
1830	517,787	170,130	687,917	6
1840	590,253	189,575	779,828	6
1850	761,413	220,992	982,405	8
1860	919,517	236,167	1,155,684	9
1870	1,098,801	222,210	1,321,011	8
1880	1,377,239	271,451	1,648,690	8
1890	1,590,564	268,071	1,858,635	11
1900	1,862,464	284,706	2,147,174	12

Density of population, to the square mile, was as follows: 1790, 1.8; 1800, 5.5; 1810, 10.2; 1820, 14.1; 1830, 17.2; 1840, 19.5; 1850, 24.6; 1860, 28.9; 1870, 33.0; 1880, 41.2; 1890, 46.5; 1900, 53.7. Population divided between native and foreign-born was as follows at the last three decennial censuses:

	1880.	1890.	1900.
Native..................	1,589,173	1,799,279	2,096,925
Foreign..................	59,517	59,356	50,249

Kentucky belongs, therefore, to the number of States in which the number of foreign-born inhabitants is decreasing, both proportionately and actually.

The population of the State by counties at the last three decennial censuses was as follows:

COUNTIES.	1900	1890	1880
Adair	14,888	13,721	13,078
Allen	14,657	13,692	12,089
Anderson	10,051	10,610	9,361
Ballard	10,761	8,390	14,378
Barren	23,197	21,490	22,321
Bath	14,734	12,813	11,982
Bell	15,701	10,312	6,055
Boone	11,170	12,246	11,996
Bourbon	18,069	16,976	15,956
Boyd	18,834	14,033	12,165
Boyle	13,817	12,948	11,930
Bracken	12,137	12,369	13,509
Breathitt	14,322	8,705	7,742
Breckinridge	20,534	18,976	17,486
Bullitt	9,602	8,291	8,521
Butler	15,896	13,956	12,181
Caldwell	14,510	13,186	11,282
Calloway	17,633	14,675	13,295
Campbell	54,223	44,208	37,440
Carlisle	10,195	7,612	....
Carroll	9,825	9,266	8,953
Carter	20,228	17,204	12,345
Casey	15,144	11,848	10,983
Christian	37,962	34,118	31,682
Clark	16,694	15,434	12,115
Clay	15,364	12,447	10,222
Clinton	7,871	7,047	7,212
Crittenden	15,191	13,119	11,688
Cumberland	8,962	8,452	8,894
Daviess	38,667	33,120	27,730
Edmonson	10,080	8,005	7,222
Elliott	10,387	9,214	6,567
Estill	11,669	10,836	9,860
Fayette	42,071	35,698	29,023
Fleming	17,074	16,078	15,221
Floyd	15,552	11,256	10,176
Franklin	20,852	21,267	18,699
Fulton	11,546	10,005	7,977
Gallatin	5,163	4,611	4,832
Garrard	12,042	11,138	11,704
Grant	13,239	12,671	13,083
Graves	33,204	28,534	24,138
Grayson	19,878	18,688	15,784
Green	12,255	11,463	11,871
Greenup	15,432	11,911	13,371
Hancock	8,914	9,214	8,563
Hardin	22,937	21,304	22,564
Harlan	9,838	6,197	5,278
Harrison	18,570	16,914	16,504
Hart	18,390	16,439	17,133
Henderson	32,907	29,536	24,515
Henry	14,620	14,164	14,492
Hickman	11,745	11,637	10,651
Hopkins	30,995	23,505	19,122
Jackson	10,561	8,261	6,678
Jefferson	232,549	188,598	146,010
Jessamine	11,925	11,248	10,864
Johnson	13,730	11,027	9,155
Kenton	63,591	54,161	43,983
Knott	8,704	5,438	....
Knox	17,372	13,762	10,587
Larue	10,764	9,433	9,793
Laurel	17,592	13,747	9,131
Lawrence	19,612	17,702	13,262
Lee	7,988	6,205	4,254
Leslie	6,753	3,964	3,740
Letcher	9,172	6,920	6,601
Lewis	17,868	14,803	13,154
Lincoln	17,059	15,962	15,080
Livingston	11,354	9,474	9,165
Logan	25,994	23,812	24,358
Lyon	9,319	7,628	6,768
McCracken	28,733	21,051	16,262
McLean	12,448	9,887	9,293
Madison	25,607	24,348	22,052
Magoffin	12,006	9,196	6,944
Marion	16,290	15,648	14,693
Marshall	13,692	11,287	9,647
Martin	5,780	4,209	3,057
Mason	20,446	20,773	20,469
Meade	10,533	9,484	10,323
Menifee	6,818	4,666	3,755
Mercer	14,426	15,034	14,142
Metcalfe	9,988	9,871	9,423
Monroe	13,053	10,989	10,741
Montgomery	12,834	12,367	10,566
Morgan	12,792	11,249	8,455
Muhlenberg	20,741	17,955	15,098
Nelson	16,587	16,417	16,609
Nicholas	11,952	10,764	11,869
Ohio	27,287	22,946	19,669
Oldham	7,078	6,754	7,667
Owen	17,553	17,676	17,401
Owsley	6,874	5,975	4,942
Pendleton	14,947	16,346	16,702
Perry	8,276	6,331	5,607
Pike	22,686	17,378	13,001
Powell	6,443	4,698	3,639
Pulaski	31,293	25,731	21,318
Robertson	4,900	4,684	5,814
Rockcastle	12,416	9,841	9,670
Rowan	8,277	6,129	4,420
Russell	9,695	8,136	7,591
Scott	18,076	16,546	14,965
Shelby	18,340	16,521	16,813

Counties.	1900	1890	1880
Simpson	11,624	10,878	10,641
Spencer	7,406	6,760	7,040
Taylor	11,075	9,353	9.259
Todd.	17,371	16,814	15,994
Trigg	14,073	13,902	14,489
Trimble	7,272	7,140	7,171
Union	21,326	18,229	17,809
Warren	29,970	30,158	27,531
Washington	14,182	13,622	14,419
Wayne.	14,892	12,852	12,512
Webster	20,097	17,196	14.246
Whitley	25,015	17,590	12,000
Wolfe.	8,764	7,180	5,638
Woodford	13,134	12,380	11,800
The State	2.147.174	1,858.635	1,648,690

The chief cities of Kentucky with their population in 1900 are Louisville, 204,731; Covington, 42,938; Newport, 28,301; Lexington, 26,369; Paducah, 19,446; Owensboro, 13,189; Henderson, 10,272; and Frankfort, 9,487.

Government.— The Constitution of Kentucky can be amended by a three-fifths vote of all the members elected to each House of the Legislature and a majority vote of the people. A Constitutional Convention may be called by a majority vote of all the members elected to each House of the Legislature at two consecutive sessions, and by a majority vote of the people, provided the number of the affirmative vote be equal to at least one-fourth of the qualified voters who cast their ballots at the last preceding general election. Thus, it will be seen, it is more difficult to change the Kentucky Constitution than that of most other States. Qualifications for the suffrage are one year's residence in the State, six months' in the county, and sixty days' in the precinct. Election day is always the Tuesday after the first Monday of November, but no city, town or county officer, except members of municipal legislatures, can be elected in the years in which Representatives in Congress are chosen. The State sends eleven Representatives to Congress. The State Legislature consists of thirty-eight Senators, elected for four years, and one hundred Representatives, elected for two years, and it can be in session not more than sixty days, beginning on the Tuesday after the first Monday of January in each even-numbered year. The chief State officers are a Governor, Lieutenant-Governor, Treasurer, Auditor, Register of the Land Office, Commissioner of Agriculture, Labor and Statistics, Secretary of State, Superintendent of Instruction, and Attorney-General. They are all elected together, for a term of four years each, and are ineligible for re-election. There are from five to seven Judges of the Court of Appeals, elected from districts for eight year terms; Circuit Court Judges, elected from districts for terms of six years; and county and police judges. Each county has a county judge, a clerk, sheriff, and other local officers. Each county must have an area of at least 400 square miles, and the county seat must be ten miles from the nearest boundary line. There is a State Militia of about 1,800 men. The State formerly managed its finances particularly well. Before the Civil War it had a large debt, of more than $5,500,000, and the war increased it by $2,200,000, but by careful management the whole was reduced in 1865 to less than it had been in 1860, and in 1880 the whole debt was practically paid off. In 1880, however, State revenues fell below necessary expenses, and a loan of $500,000 was contracted. Further deficits, and heavy defalcations by a State Treasurer, have since increased the debt to several millions. This is the result of unwise fiscal policies, but it has happily not impaired the credit of the State, for it is obvious that by a judicious system of revenue the income of the State could easily be made much larger than its expenses.

History.— The first white man to visit Kentucky was probably the Sieur De la Salle, who in 1669 descended the Ohio River as far as the present site of Louisville. It is not known to what extent, if any, he explored the region. At any rate he made no settlement there. The first English pioneers were Dr. Thomas Walker and Christopher Gist, in 1750. Walker discovered the Cumberland Mountains, Cumberland Gap, and Cumberland River, and gave them their present names. But these men made no permanent settlement. About 1769, when the French and Indian War had cleared the French from the western country, Virginians began to cross the mountains to enter the Ohio Valley, which was claimed as a part of the "Old Dominion." The leaders of these were Daniel Boone, James Knox and James Harrod. A considerable part of the present State of Kentucky was soon purchased from the Cherokee Indians by Richard Henderson, and in 1776 George Rogers Clarke persuaded Virginia to annex and organize Kentucky as a county of that State. After the revolution settlers poured into the region rapidly, but met with much trouble from the Indians, and desperate conflicts occurred, justifying the ancient Indian title of the country, "Kentucky," or "dark and bloody ground." The remoteness of Kentucky from the capital of Virginia, and the necessity of self-reliance for self-defence, soon led the settlers to consider the question of independent Statehood. A movement to that end was begun in 1784, and convention after convention was held, to send delegates to Virginia to seek a peaceful separation. The importance of the free navigation of the Mississippi River to the Kentuckians also greatly inflamed their zeal for Statehood, since Virginia was comparatively lukewarm in her demand for such navigation. At one time the Spanish government entered into intrigues with various Kentuckians, promising them free use of the Mississippi if they would secede from the United States, and the people became divided between two opinions, one being to secede and unite with the Spanish provinces beyond the Mississippi, and the other being to begin a war with Spain and drag the United States into it. Happily wiser counsels prevailed. The region remained loyal and tranquil. The movement for Statehood prospered, and in 1790 Kentucky became a Territory, and on June 1, 1792, was admitted into the Union.

Statehood did not bring entire contentment, however. Indian wars continued, the whiskey tax was a burden which almost drove the State to revolt, and the French Minister Genet found there his best field for his disreputable intrigues. Indeed it was actually proposed in Kentucky to raise an army under the French flag, and to march it down to New Orleans for the conquest of Louisiana. The danger that Kentucky would do some extreme deed for the sake of opening the Mississippi freely to American commerce did not entirely pass away until the Louisiana purchase was effected. Before that, however, there was another crucial time in Kentucky, over the Alien and Sedition Laws of John Adams's administration. In November, 1798, John Breckinridge introduced into the Kentucky Legislature a set of resolutions which have become historic. They were adopted by both Houses of the Legislature, approved by the Governor, and then submitted to the governments of all the other States. In addition to detailed arguments against and denunciation of the Alien and Sedition Laws, these resolutions declared as follows:

> "*Resolved*, That the several States composing the United "States of America, are not united on the principle of unlimited "submission to their general government; but that by compact "under the style and title of a Constitution for the United States "and of amendments thereto, they constituted a general gov"ernment for special purposes, delegated to that government "certain definite powers, reserving each State to itself, the "residuary mass of right to their own self-government; and that "whensoever the general government assumes undelegated "powers, its acts are unauthoritative, void and of no force: "That to this compact each State acceded as a State, and is an "integral party, its co-States forming, as to itself, the other "party: That the government created by this compact was not "made the exclusive or final judge of the extent of the powers "delegated to itself; since that would have made its discretion, "and not the Constitution, the measure of its powers; but that "as in all other cases of compact among parties having no com"mon Judge, each party has an equal right to judge for itself, "as well of infractions as of the mode and measure of redress."

Thus early did Kentucky commit itself to the doctrine of State Rights. That episode soon passed, however, and thereafter the history of the State was more peaceful. In the War of 1812 the State played a noble part, sending more than 7,000 soldiers to the field. Again in the Mexican War Kentuckians were numerous and conspicuous for their martial valor, more than 10,000 of them volunteering for service. In the Civil War Kentucky was a "border State" and was thus the scene of the most violent dissensions. A strong effort was made to maintain neutrality, by refusing to respond to the National call for troops and by ordering both Federal and Confederate troops to withdraw from the soil of Kentucky, where they were regarded as invaders. This attitude could not, however, be maintained. The State was at first overrun by Confederate troops, but by 1862 these were driven out and thereafter the State was chiefly in Federal possession. Several battles were fought in Kentucky, including Mill Spring, Perryville and Richmond, and the State was the scene of numerous raids, by the Confederate Generals Bragg, Morgan and Forrest. In 1862 a convention of delegates from sixty-five counties adopted an ordinance of secession and the State was formally admitted to the Confederacy, but this action was never regarded as regular or authoritative. In 1865 the legitimate civil authority of the State was fully restored, and no "reconstruction" process was necessary.

In national politics Kentucky has usually been Democratic, with the exception of the period from 1830 to 1852, when it was a stronghold of the Whig party, and the year 1896, when owing to Democratic dissensions it cast twelve of its thirteen votes for a Republican President. Its Governors with the dates of their accessions have been as follows:— Isaac Shelby, 1792; James Garrard, 1796; Christopher Greenup, 1804; Charles Scott, 1808; Isaac Shelby, 1812; George Madison, 1816; John Adair, 1820; Joseph Desha, 1824; Thomas Metcalf, 1828; John Breathitt, 1832; James Clark, 1836; Robert Letcher, 1840; William Owsley, 1844; John Crittenden, 1848; John Helm, 1850; Lazarus Powell, 1851; Charles Morehead, 1855; Beriah Magoffin, 1859;

James Robinson, 1862; Thomas E. Bramlette, 1863; John Helm, 1867; John Stephenson, 1867; Preston Leslie, 1871; James McCreary, 1875; Luke Blackburn, 1879; Proctor Knott, 1883; S. B. Buckner, 1887; John Y. Brown, 1891; William Bradley, 1895; William S. Taylor, 1900; William Goebel, 1900; J. C. W. Beckham, 1900.

W. Fletcher Johnson.

June, 1904.

KENYON, Lloyd Kenyon, Lord (1732–1802), an English lawyer and lord chief-justice of England, was descended by his father's side from an old Lancashire family, and his mother was the daughter of a small proprietor in Wales. He was born at Gredington, Flintshire, 5th October, 1732. After studying five years at Ruthin grammar school, he was in his fifteenth year articled to an attorney at Nantwich, Cheshire. In 1750 he was entered a student of Lincoln's Inn, London, and in 1756 was called to the bar. As for several years he was left almost unemployed, he utilized his leisure in taking notes of the cases argued in the court of Queen's Bench, which he afterwards published. Through answering the cases of his friend John Dunning, afterwards Lord Ashburton, he gradually became known to the attorneys, after which his success was so rapid that in 1780 he was made king's counsel, his promotion being assisted to some extent through his friendship with Thurlow. He manifested conspicuous ability in the cross-examination of the witnesses at the trial of Lord George Gordon, but his speech was so deficient in tact that the verdict of acquittal was solely due to the extraordinary and brilliant effort of Erskine, the junior counsel. Through the influence of Lord Thurlow, Kenyon in September, 1780, entered the House of Commons as member for Hindon, and in April, 1782, he was, through the same friendship, appointed attorney-general in Lord Buckingham's administration, an office which he also continued to hold under Pitt. In 1784 he received the mastership of the rolls, and was created a baronet. His position at the bar had been achieved chiefly by hard work, a good knowledge of law, and several lucky friendships. As an advocate he was not only deficient in manner and in ability of statement, but frequently made striking blunders from want of tact. As his rough and irritable temper had also gained him several enemies, his elevation in 1788 to the lord chief-justiceship as successor to Lord Mansfield was by no means popular with the bar. The same year he was raised to the peerage as Baron Kenyon of Gredington. On the bench he not unfrequently displayed a capricious and choleric temper towards both the pleaders and his brother judges. Still he proved himself, not only an able lawyer, but a judge of rare and inflexible impartiality. The decisions of no other judge in the court of Queen's Bench have been more seldom overruled, but, as they were accompanied with only a very imperfect and short statement of his reasons, his judgments are of little value as expositions of the principles of law. He died at Bath, 4th April, 1802. See *Life* by Hon. G. T. Kenyon, 1873.

KEOKUK, chief city of Lee county, Iowa, U. S., occupies a lofty site on the west bank of the Mississippi, 2 miles above the mouth of the Des Moines tributary, and about 200 miles above St. Louis. It is situated in the extreme southeast corner of the State (whence its name "gate city"); its streets are spacious, and its houses handsome, although mostly of brick. Keokuk contains several churches, a medical college (founded in 1849), a good system of public schools, and a public library. Pork-packing, iron-founding, and smaller industries are carried on. The city is at the junction of seven railways, which, with its advantages of water communication, bring it an important trade. A canal, 9 miles in length, round the lower rapids of the Mississippi, which formerly obstructed the navigation, has been constructed by the United States Government at a cost of $8,000,000. Keokuk has been a port of entry since 1854. Population in 1880, 12,117.

KEPLER, John (1571–1630), one of the founders of modern astronomy, was born, December 27, 1571, at Weil, in the duchy of Würtemberg, of which town his grandfather was burgomaster. He was the eldest child of an ill-assorted and ill-starred union. His father, Henry Kepler, was a reckless soldier of fortune: his mother, Catharine Guldenmann, the daughter of a small proprietor of Leonberg, had a violent temper, unmitigated by even the rudiments of culture. Under these circumstances her husband found campaigning in Flanders under Alva a welcome relief from domestic life: and, after having lost his fortune by a forfeited security and tried without success the trade of tavern-keeping in the village of Elmendingen, he finally, in 1589, severed an irksome tie by the desertion of his family. The misfortune and misconduct of his parents were not the only troubles of young Kepler's childhood. He recovered from small-pox in his fourth year with crippled hands and eyesight permanently impaired; and a constitution enfeebled by premature birth had to withstand successive shocks of severe illness. . His schooling began at Leonberg in 1577—the year, as he himself tells us, of a great comet; domestic bankruptcy, however, occasioned his transference to field-work, in which he was exclusively employed for several years. Bodily infirmity, combined with mental aptitude, were eventually considered to indicate a theological vocation; he was accordingly, in 1584, placed at the seminary at Adelberg, and thence removed two years later, to that of Maulbronn. A brilliant examination for the degree of bachelor procured him, in 1588, admittance on the foundation to the university of Tübingen, where he laid up a copious store of classical erudition, and imbibed Copernican principles from the private instructions of his teacher and life-long friend, Michael Maestlin. As yet, however, he had little knowledge of, and less inclination for, astronomy; and it was with extreme reluctance that he turned aside from the more promising career of the ministry to accept, early in 1594, the vacant chair of that science at Gratz placed at the disposal of the Tübingen professors by the Lutheran states of Styria.

The best-recognized function of German astronomers in that day was the construction of prophesying almanacs, greedily bought by a credulous public, and quickly belied by the future they pretended to disclose. Kepler thus found that the first duties required of him were of an astrological nature, and set himself with characteristic alacrity to master the rules of the art as laid down by Ptolemy and Cardan. He, moreover, sought in the events of his own life a verification of the theory of planetary influences; and it is to this practice that we owe the summary record of each year's occurrences which, continued almost to his death, affords for his biography a slight but sure foundation. His thoughts, however, were already working in a higher sphere. He early attained to the settled conviction that for the actual disposition of the solar system some abstract intelligible reason must exist, and this, after much meditation, he believed himself to have found in an imaginary relation between the "five regular solids" and the number and distances of the planets. He notes with exultation July 9, 1595, as the date of the pseudo-discovery, the publication of which in *Prodromus Dissertationum Cosmographicarum seu Mysterium Cosmographicum* (Tübingen, 1596) procured him much fame, and a friendly correspondence with the two most eminent astronomers of the time, Tycho Brahe and Galileo.

Soon after his arrival at Gratz, Kepler contracted an engagement with Barbara von Mühleck, a wealthy Styrian heiress, who, at the age of twenty-three, had already survived one husband and been divorced from another. Before her relatives could be brought to countenance his pretensions, Kepler was obliged to undertake a journey to Würtemberg to obtain documentary evidence of the somewhat obscure nobility of

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his family, and it was thus not until April 27, 1597, that the marriage was celebrated. In the following year the archduke Ferdinand, on assuming the government of his hereditary dominions, issued an edict of banishment against Protestant preachers and professors. Kepler immediately fled to the Hungarian frontier, but, by the favor of the Jesuits, was recalled and reinstated in his post. The gymnasium, however, was deserted; the nobles of Styria began to murmur at subsidizing a teacher without pupils; and he found it prudent to look elsewhere for employment. He first turned to his native country; but his refusal to subscribe unconditionally to the rigid formula of belief adopted by the theologians of Tübingen permanently closed against him the gates of his *alma mater*. His embarrassment was relieved by a letter from Tycho Brahe offering him the position of assistant in his observatory near Prague, which, after a preliminary visit of four months, he accepted. The arrangement was made just in time; for on August 7, 1600, he received definitive notice to leave Gratz, and, having leased his wife's property, departed with his family for Prague, September 30. His relations with Tycho were not of an entirely agreeable character. The Danish astronomer, though benevolent, was haughty and overbearing; Kepler's natural irritability was aggravated by prolonged fever, by pecuniary anxieties, and by domestic mismanagement. Nevertheless, after one violent quarrel, smoothed over by mutual concessions, they maintained an amicable intercourse, unexpectedly terminated by Tycho's death, October 24, 1601.

A brilliant and prosperous career seemed by this event to be thrown open to Kepler. The emperor Rudolph II. immediately appointed him to succeed his patron as imperial mathematician, although at a reduced salary of 500 florins; the invaluable treasure of Tycho's observations was, after some futile opposition on the part of his heirs, placed at his disposal; and the laborious but congenial task was intrusted to him of completing the tables to which the grateful Dane had already affixed the title of *Rudolphine*. The first works executed by him at Prague were, however, a homage to the astrological proclivities of the emperor. In *De fundamentis astrologiæ certioribus* (Prague, 1602) he declared his purpose of preserving and purifying the grain of truth which he believed the science to contain. Indeed, the doctrine of "aspects" and "influences" fitted excellently with his mystical conception of the universe, and enabled him to discharge with a semblance of sincerity the most lucrative part of his professional duties. Although he strictly limited his prophetic pretensions to the estimate of tendencies and probabilities, his forecasts were none the less in demand. Shrewd sense and considerable knowledge of the world came to the aid of stellar lore in the preparation of "prognostics" which, not unfrequently hitting off the event, earned him as much credit with the vulgar as his cosmical speculations with the learned. He drew the horoscopes of the emperor and Wallenstein, as well as of a host of lesser magnates; but, though keenly alive to the unworthy character of such a trade, he made necessity his excuse for a compromise with superstition. "Nature," he wrote, "which has conferred upon every animal the means of subsistence, has given astrology as an adjunct and ally to astronomy." He dedicated to the emperor in 1603 a treatise on the "great conjunction" of that year (*Judicium de trigono igneo*); and he published his observations on a brilliant star which appeared suddenly, September 30, 1604, and remained visible for seventeen months, in *De stella nova in pede Serpentarii* (Prague, 1606). While sharing the opinion of Tycho as to the origin of such bodies by condensation of nebulous matter from the Milky Way, he attached a mystical signification to the coincidence in time and place of the sidereal apparition with a triple conjunction of Mars, Jupiter, and Saturn.

The main task of his life was not meanwhile neglected. This was nothing less than the foundation of a new astronomy, in which physical cause should replace arbitrary hypothesis. A preliminary study of optics led to the publication, in 1604, of his *Astronomiæ pars optica*, containing important discoveries in the theory of vision, and a notable approximation towards the true law of refraction. But it was not until 1609 that, the "great Martian labor" being at length completed, he was able, in his own figurative language, to lead the captive planet to the foot of the imperial throne. From the time of his first introduction to Tycho he had devoted himself to the investigation of the orbit of Mars, which, on account of its relatively large eccentricity, had always been especially recalcitrant to theory, and the results appeared in *Astronomia nova αἰτιολογητὸς, seu Physica cœlestis tradita commentariis de motibus stellæ Martis* (Prague, 1609). In this, the most memorable of Kepler's multifarious writings, two of the cardinal principles of modern astronomy—the laws of elliptical orbits and of equal areas—were established;[1] important truths relating to gravity were enunciated, and the tides ascribed to the influence of lunar attraction; while an attempt to explain the planetary revolutions in the then backward condition of mechanical knowledge produced a theory of vortices closely resembling that afterwards adopted by Descartes. Having been provided, in August, 1610, by Ernest, archbishop of Cologne, with one of the new Galilean instruments, Kepler began, with unspeakable delight, to observe the wonders revealed by it. He had welcomed with a little essay called *Dissertatio cum Nuncio Sidereo* Galileo's first announcement of celestial novelties; he now, in his *Dioptrice* (Augsburg, 1611), expounded the theory of refraction by lenses, and suggested the principle of the "astronomical" or inverting telescope. Indeed the work may be said to have founded the branch of science to which it gave its name.

The year 1611 was marked by Kepler as the most disastrous of his life. The death by small-pox of his favorite child was followed by that of his wife, who, long a prey to melancholy, was at last, July 3, carried off by typhus. In his review of their conjugal life, remorse for frequent outbursts of impatience towards his shiftless though well-meaning helpmate took the place of regret for her loss. Public calamity was added to private bereavement. On the 23d of May, 1611, Matthias, brother of the emperor, assumed the Bohemian crown at Prague, compelling Rudolph to take refuge in the citadel, where he died on the 20th of January following. Kepler's fidelity in remaining with him to the last did not deprive him of the favor of his successor. Payment of arrears, now amounting to upwards of 4000 florins, was not, however, in the desperate condition of the imperial finances, to be hoped for; and he was glad, while retaining his position as court astronomer, to accept (in 1612) the office of mathematician to the states of Upper Austria. His residence at Linz was troubled by the harsh conduct of the pastor Hitzler, in excluding him from the rites of his church on the ground of supposed Calvinistic leanings—a decision confirmed, with the addition of an insulting reprimand, on his appeal to Würtemberg. In 1613 he appeared with the emperor Matthias before the diet of Ratisbon as the advocate of the introduction into Germany of the Gregorian calendar; but the attempt was for the time frustrated by anti-papal prejudice. The attention devoted by him to chronological subjects is evidenced by the publication about this period of several essays in which he sought to prove that the birth of Christ took place five years earlier than the commonly accepted date.

Kepler's second courtship forms the subject of a highly characteristic letter addressed by him to Baron Stralendorf, in which he reviews the qualifications of eleven candidates for his hand, and explains the reasons which decided his choice in favor of a portionless orphan girl named Susanna Reutlinger. The marriage was celebrated at Linz, October 30, 1613, and seems to have proved a happy and suitable one. The abundant vintage of that year drew his attention to the defective methods in use for estimating the cubical contents of vessels, and his essay on the subject (*Nova Stereometria Doliorum*, Linz, 1613) entitles him to rank among those who prepared the discovery of the infinitesimal calculus. His observations on the three comets of 1618 were published in *De Cometis*, contemporaneously with the *Harmonice Mundi* (Augsburg, 1619), of which the first lineaments had been traced twenty years previously at Gratz. This extraordinary production is memorable as having announced the discovery of the "third law"—that of the sesquiplicate ratio between the planetary periods and distances. But the main purport of the treatise was the exposition of an elaborate system of celestial harmonies depending on the various and varying velocities of the several planets, of which the sentient soul animating the sun was the solitary auditor. The work exhibiting this fantastic emulation of extravagance with genius was dedicated to James I. of England, and the compliment was acknowledged with an invitation to that island, conveyed through Sir Henry Wotton. Notwithstanding the distracted state of his own country, however, he refused to abandon it, as he had previously, in 1617, declined the post of successor to Magini in the mathematical chair of Bologna.

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[1] See ASTRONOMY, vol. ii. p. 657.

The insurmountable difficulties presented by the lunar theory forced Kepler, after an enormous amount of fruitless labor, to abandon his design of comprehending the whole scheme of the heavens in one great work to be called *Hipparchus*, and he then threw a portion of his materials into the form of a dialogue intended for the instruction of general readers. *The Epitome Astronomiæ Copernicanæ* (Linz and Frankfort, 1618–21), a lucid and attractive text-book of Copernican science, was remarkable for the prominence given to "physical astronomy," as well as for the extension to the Jovian system of the laws recently discovered to regulate the motions of the planets. The first of a series of ephemerides, calculated on these principles, was published by him at Linz in 1617; and in that for 1620, dedicated to Napier, he for the first time employed logarithms. This important invention was eagerly welcomed by him, and its theory formed the subject of a treatise entitled *Chilias Logarithmorum*, printed in 1624, but circulated in manuscript three years earlier, which largely contributed to bring the new method into general use in Germany.

His studies were, however, interrupted by a painful family trouble. The restless disposition and unbridled tongue of Catherine Kepler, his mother, created for her numerous enemies in the little town of Leonburg; while her unguarded conduct exposed her to a species of calumny at that time but too readily circulated and believed. As early as 1615 suspicions of sorcery began to be spread against her, which she, with more spirit than prudence, met with an action for libel. The suit was, by the connivance of the judicial authorities, purposely protracted, and at length, August 5, 1620, the unhappy woman, then in her seventy-fourth year, was arrested on a formal charge of witchcraft. Kepler immediately hastened to Würtemburg, and devoted a whole year to the zealous advocacy of her cause. It was owing to his indefatigable exertions that, contrary to general expectation, she was acquitted after having suffered thirteen months' imprisonment, and endured with undaunted courage the formidable ordeal of "territion," or examination under the imminent threat of torture. She survived her release only a few months, dying April 13, 1622.

Kepler's whole attention was now devoted to the production of the new tables. "Germany," he wrote, "does not long for peace more anxiously than I do for their publication." Financial difficulties, however, combined with civil and religious convulsions, long delayed the accomplishment of his desires. From June 24 to August 29, 1626, Linz was besieged and its inhabitants reduced to the utmost straits by bands of insurgent peasants. The pursuit of science needed a more tranquil shelter; and accordingly, on the raising of the blockade, Kepler obtained permission to transfer his types to Ulm, where, in September, 1627, the *Rudolphine Tables* were at length given to the world. Although by no means free from errors, their value appears from the fact that they ranked for a century as the best aid to astronomy. Appended were tables of logarithms and of refraction, together with Tycho's catalogue of 777 stars, enlarged by Kepler to 1005.

The work of Kepler's life was now virtually completed, but not so its vicissitudes. His claims upon the insolvent imperial exchequer amounted by this time to 12,000 florins. The emperor Ferdinand II., too happy to transfer the burden, countenanced an arrangement by which Kepler entered the service of the duke of Friedland (Wallenstein), who assumed the full responsibility of the debt. In July, 1628, Kepler accordingly arrived with his family at Sagan in Silesia, where he applied himself to the printing of his ephemerides up to the year 1636, and whence he issued in 1629, a *Notice to the Curious in Things Celestial*, warning astronomers of approaching transits. That of Mercury was actually seen by Gassendi in Paris, November 7, 1631 (being the first passage of a planet across the sun ever observed); that of Venus, predicted for the 6th of December following, was invisible in Western Europe. Wallenstein's promises to Kepler were but imperfectly fulfilled. In lieu of the sums due, he offered him a professorship at Rostock, which Kepler declined, being unwilling to compromise his claim. An expedition to Ratisbon, undertaken for the purpose of representing his case to the Diet, terminated his life. Shaken by the journey, which he had performed entirely on horseback, he was attacked with fever, and died at Ratisbon, November 15 (N. S.), 1630, in the fifty-ninth year of his age. An inventory of his effects found among his papers showed him to have been possessed of no inconsiderable property at the time of his death. It is true that he had often been severely straitened; but there is reason to believe that his complaints on the subject were to some extent exaggerated. By his first wife he had five and by his second seven children, of whom only two, a son and a daughter, reached maturity.

The character of Kepler's genius was one of which it is especially difficult to arrive at a just estimate. His irresistible tendency towards mystical speculation formed a not less fundamental quality of his mind than its strong grasp of positive scientific truth. Without assigning to each element its due value, no sound comprehension of his modes of thought can be attained. His idea of the universe was essentially Pythagorean and Platonic. He started with the conviction that the arrangement of its parts must correspond with certain abstract conceptions of the beautiful and harmonious. His imagination, thus kindled, animated him to those severe labors of which his great discoveries were the fruit. His demonstration that the planes of all the planetary orbits pass through the centre of the sun, coupled with his clear recognition of the sun as the moving power of the system, entitles him to rank as the founder of physical astronomy. But the fantastic relations imagined by him of planetary mevements and distances to musical intervals and geometrical constructions seemed to himself discoveries no less admirable than the achievements which have secured his lasting fame. Outside the boundaries of the solar system, the metaphysical side of his genius, no longer held in check by experience, fully asserted itself. The Keplerian like the Pythagorean cosmos was threefold, consisting of the centre, or sun, the surface being the sphere of the fixed stars, and the intermediate space, filled with ethereal matter. It is a mistake to suppose that he regarded the stars as so many suns. He quotes indeed the opinion of Giordano Bruno to that effect, but with dissent. Among his happy conjectures may be mentioned that of the sun's axial rotation, postulated by him as the physical cause of the revolutions of the planets, and soon after confirmed by the discovery of sun-spots; the suggestion of a periodical variation in the obliquity of the ecliptic; and the explanation as an effect of a solar atmosphere of the radiance observed to surround the totally eclipsed sun.

It is impossible to consider without surprise the colossal amount of work accomplished by Kepler under numerous disadvantages. His health was uncertain, his powers of calculation indifferent, his interruptions numerous, his cares at times overwhelming. But his iron industry counted no obstacles, and secured for him the highest triumph of genius, that of having given to mankind the best that was in him. In private character he was amiable and affectionate; his generosity in recognizing the merits of others secured him against the worst shafts of envy; and a life marked by numerous disquietudes was cheered and ennobled by sentiments of sincere piety.

Kepler's extensive literary remains, purchased by the empress Catherine II. in 1724 from some Frankfort merchants, and long inaccessibly deposited in the observatory of Pulkowa, have at length been completely brought to light, under the able editorship of Dr. Ch. Frisch, in the first complete edition of Kepler's works. This important publication (*Joannis Kepleri opera omnia*, Frankfort, 1858–71, 8 vols. 8vo.) contains, besides the works already enumerated and several minor treatises, a posthumous scientific satire entitled *Joh. Kepleri Somnium* (first printed in 1634), and a vast mass of his correspondence. A careful biography is appended, founded mainly on his private notes and other authentic documents.

The reader may also usefully consult Reuschle, *Kepler und die Astronomie*, Frankfort, 1871; Goebel, *Ueber Kepler's astronomische Anschauungen*, Halle, 1871; Apelt, *Johann Kepler's astronomische Weltansicht*, Leipsic, 1849; Breitschwert, *Johann Kepler's Leben und Wirken*, Stuttgart, 1831; W. Forster, *Johann Kepler und die Harmonie der Sphären*, Berlin, 1862; R. Wolf, *Geschichte der Astronomie*, Munich, 1877. (A. M. C.)

KERAK, a town of Syria, situated about 10 miles east of the southern end of the Dead Sea, on the summit of a rocky hill some 3000 feet above sea-level. It stands upon a platform forming an irregular triangle with sides of 800 to 1000 yards in length, and separated by deep ravines from the higher encircling ranges on all sides except one, where a narrow neck connects it with a neighboring hill. The whole place was formerly surrounded by a wall with five towers, with only two entrances through tunnels in the side of the cliff. The town is an irregular mass of about six hundred flat mud-roofed houses. The Christian quarter contains the Greek church of St. George; and the present mosque still bears marks of its Christian origin. On the northwest is the tower or castle of Bibars (see vol. vii. p. 655), with an inscription bearing his name. The great castle at the southern angle was built as a crusading fortress about 1131. Relics of the Roman occupation of Kerak have been found. The inhabitants are estimated at 8000, of whom about one-fourth are Greek Christians. They are fierce and truculent; and, though they were formerly renowned for hospitality, their rapacious treatment of their European visitors has brought them into very bad repute.

Kerak is the ancient Kir-Hareseth or Kir-Moab (2 Kings iii. 25; Isa. xv. 1, xvi. 7). The name Kerak (Syriac Karkâ, fortress) is as old as 2 Macc. xii. 17. In crusading times Kerak was a highly important point. In 1188 it was captured by Saladin (vol. vii. p. 653), and under his dynasty the town prospered. In the early part of the present century Kerak was governed by a powerful sheikh, paying nominal homage to the Wahhaby kingdom; it is now the residence of a Turkish official and garrison under the wály of Jerusalem, but the authority of the government is weak. A considerable trade is carried on by merchants from Hebron.

See Burckhardt's *Syria*, 1822, p. 377 *sq.*; Tristram's *Land of Moab*, 1873; Bädeker-Socin's *Handbook*; Le Quien, *Or. Chr.*, iii. 730.

KERBELA, or Meshhed-Hosein, a town of Asiatic Turkey, in the vilayet of Baghdad, is situated in a fertile and well-cultivated district about 60 miles south-southwest of Baghdad, and about 20 miles west of the Euphrates, from which a very ancient canal extends to it. It is surrounded by a dilapidated brick wall 24 feet high, and contains a fine market-place, with one broad street leading to the governor's residence. The other streets are narrow and dirty. Of the five mosques in the town the largest is the mosque of Hosein with a large gilded dome and minarets; it contains the tomb of Hosein, son of the caliph 'Aly (see Arabia, vol. ii. p. 206), whose sanctity makes Kerbela in the eyes of Shiites less sacred only than Mecca. Some 200,000 pilgrims from all parts of Islam journey annually to Kerbela, many of them carrying the bones of their relatives to be buried in its sacred soil. The moullahs, who fix the burial fees, derive an enormous revenue from the faithful. At one time Kerbela was an inviolable sanctuary for criminals, but it has ceased to be so since 1843, when the inhabitants revolted against the Turks, and were reduced with great slaughter. The enormous influx of pilgrims naturally creates brisk trade in Kerbela and the towns on the route thither,—a fact which makes the Turkish Government anxious not to divert the stream elsewhere, as some years ago was partially done by sanitary and other regulations. The population, necessarily fluctuating, was estimated in 1878 at 60,000; Mr. Clements Markham, writing in 1874, put it at 20,000.

KERGUELEN'S LAND, Kerguelen Island, or Desolation Island, an island in the Southern Ocean, to the southeast of the Cape of Good Hope and southwest of Australia, and nearly half-way between them. To the south is Heard Island, and west-northwest the Crozets and the Marion Group. Kerguelen lies between 48° 39′ and 49° 44′ S. lat., and 68° 42′ and 70° 35′ E. long. Its extreme length is about 85 miles, and its extreme breadth 79, but the area is only about 2050 square miles. The island is throughout mountainous, presenting from the sea in some directions the appearance of a series of jagged peaks. The various ridges and mountain masses are separated by steep-sided valleys, which run down to the sea, forming deep fjords, so that no part of the interior is more than 12 miles from the sea. The chief mountain peaks are Mount Ross (6120 feet), Mount Richards (4000), Mount Crozier (3258), Mount Wyville Thomson (3160), Mount Hooker (2600), Mount Moseley (2400). The coast-line is extremely irregular, many of the fjords being bounded by long, steep rocky promontories. These, at least on the north, east, and south, form a series of well-sheltered harbors; as the prevailing winds are westerly, the safest anchoring ground is on the northeast. Christmas Harbor on the north and Royal Sound on the south are noble harbors, the latter with a labyrinth of islets interspersed over upwards of 20 miles of landlocked waters. The scenery is generally magnificent, and often singularly picturesque. A district of considerable extent in the centre of the islands is occupied by snowfields, whence glaciers descend east and west to the sea. The whole island, exclusive of the snowfields, abounds in fresh-water lakes and pools in the hills and lower ground. Hidden deep mudholes are frequent.

Kerguelen's Land is of undoubted volcanic origin, the prevailing rock being basalt, sometimes intersected by trap, and indeed an active volcano and hot springs are said to exist on the southwest of the island. Judging from the abundant fossil remains of trees, the island must at one time have been thickly clothed with woods and other vegetation, of which it has no doubt been denuded by volcanic action and submergence, and possibly by change of climate. It presents evidences of having at one time been subjected to powerful glaciation, and to subsequent immersion and immense denudation. The soundings made by the "Challenger" and "Gazelle," and the affinities which in certain respects exist between the islands, seem to point to the existence at one time of an extensive land in this quarter, of which Kerguelen, Prince Edwards Islands, the Crozets, St. Paul, and Amsterdam are the remains. The Kerguelen plateau rises in many parts to within 1500 fathoms of the surface of the sea. Beds of coal and of red earth are found at some places. The summits of the flat-topped hills about Betsy Cove, in the southeast of the island, are formed of caps of basalt. Sir J. D. Hooker points out that the vegetation of Kerguelen's Land must be of great antiquity, and may have originally reached it from the American continent; it has no affinities with Africa. The present climate is not favorable to permanent vegetation: the island lies within the belt of rain of all seasons of the year, and is reached by no drying winds; its temperature is kept down by the surrounding vast expanse of sea; and it lies within the line of the cold Antarctic drift. The temperature is, however, very equable. During the transit expedition, the lowest winter temperature was seldom less than 32°, while the summer temperature occasionally approached 70°. Tempests and squalls are frequent, and the weather is rarely calm. On the lower slopes of the mountains a rank vegetation exists, which, from the conditions just mentioned, is constantly saturated with moisture. A rank grass, *Festuca Cookii*, grows thickly in places up to 300 feet, with *Azorella*, *Cotula plumosa*, etc. Sir J. D. Hooker enumerates twenty-one species of flowering plants, and seven of ferns, lycopods, and *Characeæ;* at least seventy-four species of mosses, twenty-five of *Hepaticæ*, and sixty-one of lichens are known, and there are probably many more. Several of the marine and many species of fresh-water algæ are peculiar to the island. The characteristic feature of the vegetation, however, is the Kerguelen cabbage (*Pringlea antiscorbutica*), a perennial cruciferous plant, in appearance somewhat like the garden cabbage. This cabbage and *Azorella* are found growing at a height of 1000 feet, while on the higher rocks a very handsome conspicuous lichen (*Neuropogon Taylori*), of a mingled bright sulphur-yellow and black color, is found abundantly. Fur seals are still found in Kerguelen, though their numbers have been greatly reduced by reckless slaughter. One of the most characteristic animals of the island is the sea elephant (*Macrorhinus leoninus*), which is found in considerable abundance even far up the streams that flow into the fjords. The sea-leopard (*Ogmorrhinus leptonyx*) is pretty abundant on the coasts. All parts of the coast and even the lower slopes are covered with penguins of various species, mainly the Johnny penguin (*Pygoscelis tæniata*), rock-hopper (*Eudyptes saltator*), and king penguin (*Aptenodytes longirostris*). A teal (*Querquedula Eatoni*) peculiar to Kerguelen and the Crozets is also found in considerable numbers, and crowds of petrels, especially the giant petrel (*Ossifraga gigantea*), *Halobæna cærulea*, and *Prion desolatus* frequent the island, as also skuas, gulls, sheathbills (*Chionus minor*), albatross, terns (*Sterna virgata ?*), cormorants (*Phalacrocorax verrucosus*), and Cape pigeons. The island shelters a considerable variety of insects, many of them with remarkable peculiarities of structure, and with a predominance of forms incapable of flying. The island is frequented by sealers and whalers, but has no permanent inhabitants. Kerguelen's Land was discovered by the French navigator Kerguelen Tremarec (born 1745, died 1797), on February 13, 1772, and partly surveyed by him in the following year. It was subsequently visited by Captain Cook, and also by Sir James C. Ross in 1840 in the "Erebus" and "Terror." It has occasionally formed a refuge for shipwrecked sailors. The "Challenger" spent some time at the island, and its staff visited and surveyed various parts of it in January, 1874. Later in the same year it was occupied for several months (October, 1874, to February, 1875) by the expeditions sent from England, Germany, and the United States to observe the transit of Venus. Still the interior is all but unexplored, and we have only vague notions of a considerable part of the coast. The Admiralty chart is based chiefly on mining surveys and information obtained from whalers.

Literature.—Narratives of the voyages of Kerguelen, Cook, and Sir James Ross; *Narrative of the Wreck of the "Favorite" on the Island of Desolation*, edited by W. B. Clarke, M.D.; Hooker's *Flora Antarctica; Phil. Trans.*, vol. 168, containing account of the collections made in Kerguelen by the English transit of Venus expedition in 1874-75; articles by Sir Wyville Thomson in *Good Words*, November and December, 1874; H. N. Moseley's *Notes by a Naturalist in the "Challenger;"* Lord George Campbell's *Log Letters from the "Challenger;"* W. J. J. Spry's *Cruise of the "Challenger;"* Rev. S. J. Perry's *Notes of a Voyage to Kerguelen.*

KERKÚK, or Kerkook, a town of Asiatic Turkey, in the vilayet of Baghdad, is situated on the right bank of the Khaṣa Tshai, about 140 miles north of the city of Baghdad. A suburb, Maḥalle, on the left bank of the stream, which is spanned by a bridge, contains the residence of the pasha. The citadel stands east of the river upon an artificial mound, 130 feet high, which in Niebuhr's time was still surrounded by an earthen rampart. The citadel hill is the residence of the old Nestorians, now adherents of the Church of Rome. Round the foot of this hill run the dirty, crooked, and narrow streets of the lower town, with their flat-roofed, ugly houses, built partly of wood and partly of stone. The only large building is occupied by the bazaar, with passages one hundred paces long. Owing to its position at the junction of several routes, Kerkúk has a brisk transit trade in hides, Persian silks and cottons, coloring materials, fruit, and timber, on the way from Suleimanieh to the north. The natural warm springs at Kerkúk are used to supply baths. The surrounding country is fertile and well cultivated; the petroleum and naphtha springs near the town are its most valuable commercial resource. Till lately the petroleum was used as fuel by the Turkish steamers on the Tigris; but English coal has now superseded it. The official designation of Kerkúk is Shahr Zul. The inhabitants, from twelve to fifteen thousand in number, are chiefly Mohammedan Kurds; there is a Jewish quarter beneath the citadel. The reputed sarcophagi of Daniel and the Hebrew children are shown in one of the mosques.

Kerkúk is the ancient metropolitan city Karkâ a' Beth Slôk ("fortress of the house of Seleucia").

See G. Hoffmann, *Syr. Akten Pers. Märtyrer*, Leips., 1880.

KERMAN. See Kirmán.

KERMANSHAH. See Kirmánsháhán

KERMES (Arabic, *ḳirmis*), a crimson dye, now superseded by cochineal, obtained from *Coccus ilicis*, L. (*Coccus vermilio*, G. Planchon), an hemipterous insect found in Spain, Italy, the south of France, and other parts of the Mediterranean region, feeding on *Quercus coccifera*, a small shrub from 2 to 5 feet high. The discovery of the animal nature of kermes is due to Eméric, Garidel, and Cestoni. Until the year 1714 it was thought to be a gall or excrescence.

Like other members of the group to which it belongs, the female kermes insect is wingless, and furnished with a beak or sucker attached to its breast, by which it fixes itself immovably on its food plant, and through which it draws its nourishment. The male insect is unknown, two insects mistaken for it being, according to Planchon, parasitic hymenoptera of the chalcidian group, living in the kermes grains. In the month of May, when full grown, the insects are globose, 6 to 7 millim. in diameter, of a reddish-brown color, and covered with an ash-colored powder. They are found attached to the twigs or buds by a circular lower surface 2 millim. in diameter, and surrounded by a narrow zone of white cottony down. At this time there are concealed under a cavity, formed by the approach of the abdominal wall of the insect to the dorsal one, thousands of eggs of a lively red color, and smaller than poppy seed, which are protruded and ranged regularly beneath the insect. At the end of May or the beginning of June the young escape by a small orifice, near the point of attachment of the parent. They are then of a fine red color, elliptic and convex in shape, but rounded at the two extremities, and bear two threads half as long as their body at their posterior extremity. At this period they are extremely active, and swarm with extraordinary rapidity all over the food plant, and in the course of two or three days attach themselves to fissures in the bark or buds, but rarely to the leaves. In warm and dry summers the insects breed again in the months of August and September, according to Eméric, and then they are more frequently found attached to the leaves. Usually, however, they remain immovable and apparently unaltered until the end of the succeeding March, when their bodies become gradually distended and lose all trace of abdominal rings. They then appear full of a reddish juice resembling discolored blood. In this state, or when the eggs are ready to be extruded, the insects are collected. In some cases the insects from which the young are ready to escape are dried in the sun on linen cloths—care being taken to prevent the escape of the young from the cloths until they are dead. The young insects are then sifted from the shells, made into a paste with vinegar, and dried on skins exposed to the sun, and the paste packed in skins is then ready for exportation to the East under the name of "pâte d'écarlate."

In the pharmacopœia of the ancients kermes triturated with vinegar was used as an outward application, especially in wounds of the nerves. From the 9th to the 16th century this insect formed an ingredient in the "confectio alkermes," a well-known medicine, at one time official in the London pharmacopœia as an astringent and corroborant in doses of 20 to 60 grains or more. Syrup of kermes was also prepared. Both these preparations have now fallen into disuse, the latter being replaced by the syrup of cochineal.

To dye spun worsted with kermes, the material is first boiled for half an hour with bran in water, and then for two hours in a fresh bath containing one-fifth of Roman alum and one-fifth of tartar, to which "sour water" is commonly added. It is then taken out and laid in a linen bag for some days in a cool place. In order to obtain a full color, it is then put in a warm bath as at the first boiling, the bath containing as much kermes as is equal to three-fourths or even the whole weight of the worsted used. For cloth one-fourth less of the salt and kermes was required. The color imparted by kermes has much less bloom than the scarlet made with cochineal, hence the former has fallen into disuse.

Mineral kermes is an amorphous tersulphide of antimony, prepared by a variety of processes, and containing a variable proportion of teroxide of antimony and sometimes a little alkaline antimonite. The oldest method consists in boiling the finely powdered sulphide with a solution of an alkaline carbonate and leaving the hot filtered solution to cool, the kermes being deposited on cooling. In another method dilute nitric acid was added to the alkaline solution to precipitate the kermes mineral. Mineral kermes is a brown red powder becoming blackish-gray when washed with boiling water. By fusion and slow cooling it is converted into a clay-like mass devoid of crystalline structure, in which it differs essentially from the pure amorphous sulphide.

See G. Planchon, *Le Kermes du Chêne*, Montpellier, 1864; Watts's *Dictionary of Chemistry*, i. p. 880–83, iii. p. 446; Gmelin, *Handbook of Chemistry*, iv. p. 840–49; Lewis, *Materia Medica*, 1784, pp. 71, 865; *Memorias sobre la grana Kermes de España*, Madrid, 1788; Adams, *Paulus Ægineta*, iii. 180; Beckmann, *History of Inventions*.

KERNER, JUSTINUS ANDREAS (1786–1862), a German poet and medical writer, was born in Ludwigsburg, Würtemberg, on the 18th of September, 1786. He received his early education in the Latin school of Ludwigsburg and in the cloister school of Maulbronn. After the death of his father, who was an upper bailiff and government councillor in Ludwigsburg, Kerner was obliged to accept a position in a cloth manufactory; but in 1804, aided by Pastor Conz, who had some reputation as a poet, he was able to enter the university of Tübingen, where he studied medicine. At Tübingen he made the acquaintance of Uhland, who was about his own age; and the two young men encouraged each other in their first efforts in poetry. Having completed his studies in 1809, Kerner spent some time in travel. In 1815 he received a medical appointment in Gaildorf, and in 1819 was transferred to Weinsberg, where he spent the rest of his life. Weinsberg is a pretty little town in Würtemberg, and was formerly a free imperial city. Here the emperor Conrad III. is said to have besieged the castle of Count Welf; and, according to the well-known legend, the women, having obtained permission to retire with their most valuable possessions, stumbled out, each with her husband on her back. Kerner built a house under the shadow of the castle ("Weibertreue"); and through his exertions measures were taken for the preservation of the ruins and the laying out of the surrounding grounds in public gardens. He also occupied himself with the history of the town, and published a work in two volumes describing *The Storming of Weinsberg in* 1525. He was troubled with an affection of the eyes, and becoming almost blind, he resigned his office and medical practice in 1851. He died on the 21st of February, 1862. Kerner takes rank as one of the best of the Swabian school of poets, who had in some respects a close affinity to the Romantic school, but aimed at greater simplicity and clearness.

He attracted attention by his *Reiseschatten von dem Schattenspieler Lux* (1811), and co-operated with Uhland, Schwab, and other writers in producing the *Poetischer Almanach* (1812) and the *Deutscher Dichterwald* (1813). In 1826 he issued a collection of his poems, to which he added many new lyrics in subsequent editions. He also published two other volumes of poetry, *Der letzte Blütenstrauss* (1852) and *Winterblüten* (1859). His lyrics are remarkable for the intermingling of quaint humor and delicate pathos, while in his ballads, which are written with great spirit and in a thoroughly popular tone, he prefers to represent such scenes of horror and mystery as the romantic school delighted in. He devoted much study to abnormal conditions of the brain, and wrote several popular works on animal magnetism and kindred subjects. Of more importance than these labors were his investigations on the influence of sebacic acid on animal organisms, and his work *Das Wildbad im Königreich Würtemberg*. In his *Bilderbuch aus meiner Knabenzeit* he gave a vivid and interesting description of the circumstances of his youth. See K. Mayer in the *Album Schwäbischer Dichter*, and D. Strauss, *Kleine Schriften*.

KERRY, a maritime county of Ireland, in the province of Munster, between 51° 41′ and 52° 23′ N. lat., and between 9° 7′ and 10° 30′ W. long., bounded on the W. by the Atlantic Ocean, N. by the estuary of the Shannon, which separates it from Clare, E. by Limerick and Cork, and S. E. by Cork. Its greatest length from north to south is 60 miles, and its greatest breadth from east to west 58 miles. The area comprises 1,159,358 acres, or 1811 square miles.

Geology.—Kerry, with its combination of mountain, sea, and plain, possesses some of the finest scenery of the British Islands. The portion of the county south of Dingle Bay consists of mountain masses intersected by valleys formed by narrow bands of carboniferous rocks. These masses are composed chiefly of red and green sandstones, grits, and slates, with beds of conglomerate in which are sometimes found pebbles of bright red jasper. The formation is almost entirely unfossiliferous, but on the Geological Survey maps it is marked as Old Red Sandstone. At one time the mountains were covered by a great forest of fir, birch, and yew, which was nearly all cut down to be made use of in smelting iron, and the constant pasturage of cattle prevents the growth of young trees. In the northeast, towards Killarney, the formation rises abruptly from the Carboniferous Limestone rocks into the rugged range of Macgillicuddy's Reeks, the highest summit of which, Carntual, has a height of 3414 feet. The next highest summit to Carntual is Caper, 3200 feet, and several others are over 2500 feet. Lying between the precipitous sides of the Tomies, the Purple Mountains, and the Reeks is the famous gap of Dunloe. A small portion of country at the southwest of the Dingle promontory is occupied by Upper Silurian strata, which in the middle of the promontory are covered by vast strata of grits, slates, and sandstones known as the Dingle beds, but of unknown age. This formation attains at Brandon Hill a height of 3127 feet. Resting unconformably on these beds are the Old Red Sandstone strata which occupy the remainder of the promontory and also a small tract of country at Kerry Head. The remainder of Kerry is occupied by the Coal-measures, which are separated from the mountain masses of Old Red Sandstone by a narrow and irregular band of Carboniferous Limestone or Carboniferous Slate, which abounds in fossils. The Coal-measures, which rest conformably on the Carboniferous Limestone, form a succession of undulating hills rising sometimes to a height of over 1000 feet. All the three measures of coal are represented, but the seams of coal are very thin, and the workable portions are outside the limits of the county. In the upper part of the Kenmare valley some copper veins occur in the Old Red Sandstone, but they are workable only when they enter the limestone. Silver with zinc and lead with zinc are found in a few places. In the coal formation there are some veins both of iron and lead. The Valentia flags and slates are largely exported to England. Amethysts were at one time obtained near Kerry Head

Coast Line.—The sea-coast, which for the most part is wild and mountainous, is much indented by inlets, the largest of which, Tralee Bay, Dingle Bay, and Kenmare River, lie in synclinal troughs, the anticlinal folds of the rocks forming extensive promontories. Between Kenmare River and Dingle Bay the land is separated by mountain ridges into three valleys. The extremity of the peninsula between Dingle Bay and Tralee Bay is very precipitous, and Mount Brandon, rising abruptly from the ocean, is skirted at its base by a road from which magnificent views are obtained. From near the village of Ballybunion to Kilconey Point near the Shannon there is a remarkable succession of caves, which have evidently been excavated by the sea. The principal islands are the picturesque Skelligs, Valentia Island, and the Blasquet Islands.

Rivers and Lakes.—The principal rivers are the Blackwater, which, rising in the Dunkerran Mountains, forms for a few miles the boundary line between Kerry and Cork, and falls into the Kenmare River; the Ruaughty, which, with a course resembling the arc of a circle, falls into the head of the Kenmare River; the Inny and Ferta, which flow westward, the one into Ballinskellig Bay and the other into Valentia Harbor; the Flesk, which flows northward through the lower lake of Killarney, after which it takes the name of the Laune, and flows northwestward to Dingle Bay; the Cara, which rises in the mountains of Dunkerran, and after forming several lakes falls into Castlemaine Harbor; the Maine, which flows from Castle Island southwestward to the sea at Castlemaine Harbor, receiving in its course the northern Flesk, which rises in the mountains that divide Cork from Kerry; and the Feale, Gale, and Brick, the junction of which forms the Cashin, a short tidal river which flows into the estuary of the Shannon. The lakes of Kerry are not numerous, and none of them are of great size, but those of Killarney form one of the most important features in the striking and picturesque mountain scenery amidst which they are situated. (See KILLARNEY.) The other principal lakes in the county are Lough Currane near Ballinskellig, and Lough Cara near Castlemaine Harbor. Near the summit of Mangerton Mountain an accumulation of water in a deep hollow forms what is known as the Devil's Punchbowl, the surplus water, after making a succession of cataracts, flowing into Lough Kittane at the foot of the mountain. There are chalybeate mineral springs near Killarney, near Valentia Island, and near the mouth of the Inny; sulphurous chalybeate springs near Dingle, Castlemaine, and Tralee; and a saline spring at Magherybeg in Corkaguiney, which bursts out of clear white sand a little below high-water mark.

Climate and Agriculture.—Owing to the vicinity of the sea and the height of the mountains, the climate is very moist and unsuitable for the growth of cereals, but it is so mild even in winter that the pasturage on the mountains retains perpetual greenness. Arbutus and other trees indigenous to warm climates grow in the open air, and several flowering plants are found which are unknown in England. In the northern parts of the county the land is generally coarse and poor, except in the valleys, where a rich soil has been formed by rocky deposits. In the Old Red Sandstone valleys there are many very fertile regions, and several extensive districts now covered by bog admit of easy reclamation so as to form very fruitful soil, but other tracts of boggy land scarcely promise a profitable return for labor expended on their reclamation. The lower slopes of the mountains afford a very rich pasturage for cattle even in winter, while large flocks of sheep and goats graze on the upper ridges.

According to the classified summary of owners for 1876 there were no fewer than twenty-eight proprietors who possessed upwards of 10,000 acres, and ten possessed upwards of 20,000 acres, viz., Francis C. Bland, 25,576; Sir Edward Denny, Baronet, 21,479; Robert Drummond, 29,780; Edward Bouchier Hartopp, 24,222; Henry A. Herbert, 47,238; earl of Kenmare, 91,080; marquis of Lansdowne, 94,983; earl of Listowel, 25,964; Richard Mahoney, 26,173; Lord Ventry, 93,629. Altogether the number of owners was 1116, possessing 1,153,373 acres, at an annual valuation of £283,198. Of the owners 637, or 57 per cent., possessed less than one acre, the total possessed by these owners being only 172 acres. The average annual valuation was 4s. 10d. per acre.

The following table shows the number of the various classes of holdings in 1850 and 1880:—

	1 Acre.	Between 1 and 5 Acres.	Between 5 and 15 Acres.	Between 15 and 30 Acres.	30 Acres and upwards.	Total.
1850	623	1,024	3,071	4,391	9,508	18,617
1880	1,078	1,267	2,689	3,655	10,058	18,747

In some of the larger farms the best modern systems of agriculture are practised, but especially on the small farms the primitive form of lazy-bed culture is that almost wholly in use, with alternate crops of oats and potatoes. The total area under crops in 1881 was 165,568 acres, 14.2 per cent. of the acreage of the county. In 1880 there were 586,600 acres (50.6 per cent.) under grass, 18,348 were woods, 105,884 bogs, 248,808 mountain, and 39,392 water, roads, and fences. There has been an increase in the area under crops since 1850 of 16,694 acres, but this is wholly due to an increase of 37,906 in the area under meadow and clover, which in 1881 was 90,068, while between 1851 and 1880 the area under grass increased by 133,489, or more than a fourth. The area under cereals in 1881 was 33,169 acres, a decline of 18,849, or more than a third since 1850, wheat declining from 4502 to 1032, and oats from 30,190 to 27,533. Between 1850 and 1880 the diminution has been very slight in the area under green crop, from 43,129 acres to 41,968, that under potatoes increasing from 30,963 to 31,179, but that under turnips declining from 10,434 to 5723. Flax occupied 300 acres in 1850, and only 39 in 1881.

Horses have increased from 13,129 in 1850 to 15,367 in 1881. The number of horses used for agricultural purposes in 1881 was 11,159. Mules between 1850 and 1881 increased from 1871 to 2311, while asses increased from 3417 to 8765. Cattle in 1850 numbered 147,748, and in 1881 had increased to 209,733. Cows numbered 104,971, dairy farming being very largely followed. The Kerry breed of cattle—small, finely-shaped animals, black or red in color, with small upturned horns—are famed for the quality both of their flesh and milk, and are now in considerable demand for the parks surrounding mansion houses. The "dexter," a cross between the Kerry and an unknown breed, is larger but without its fine qualities. Sheep between 1850 and 1871 had risen from 59,931 to 129,618, but in 1881 they had declined to 82,929. Little regard is paid to the breed, but those in most common use have been crossed with a merino breed from Spain. Goats, which share with sheep the sweet pasturage of the higher mountain ridges, have increased between 1850 and 1881 from 17,382 to 23,442. Pigs since 1850 have increased from 36,246 to 45,630. Poultry have more than doubled in numbers, increasing from 183,115 to 485,076.

Feræ Naturæ.—As may be supposed from the wild and mountainous character of a great part of Kerry, foxes are numerous, and otters and badgers are not uncommon. The alpine hare is very abundant. The red deer inhabits the mountains round Killarney. The golden eagle was at one time frequently seen in the higher mountain regions, but is now rarely met with. The sea eagle haunts the lofty marine cliffs, the mountains, and the rocky islets. The osprey is occasionally seen, and also the peregrine falcon. The merlin is common. The common owl is indigenous, the long-eared owl resident, and the short-eared owl a regular winter visitor. Rock pigeons breed on the sea-cliffs, and the turtle dove is an occasional visitant. The common quail is becoming rare. The great gray seal is found in Brandon and Dingle Bays.

Manufactures.—At the beginning of the century there was a considerable linen trade in Kerry, but this is now nearly extinct, the chief manufacture being that of coarse woollens and linens for home use. At Killarney a variety of articles are made from the wood of the arbutus. A considerable trade in agricultural produce is carried on at Tralee, Dingle, and Kenmare, and in slate and stone at Valentia.

Fisheries.—The number of vessels engaged in the deep sea and coast fisheries is about 600, employing about 2500 men and boys. From the passing of the Act 37 and 38 Vict. up to 31st December, 1880, the total amount of money advanced on loan for fishery purposes in Kerry has been £10,872, and up to the same date the repayments have amounted to £6879. The loans during the year 1880 amounted to £2146. The sum advanced for Kerry fisheries is more than one-third of the whole sum advanced for

Ireland. Perhaps on no part of the coast are the fishing localities so numerous, or such fish as herring, pilchards, cod, hake, and ling so abundant. There is, however, a great want of boats, tackle, and nets, although the stations of Dingle and Kenmare are prosperous and well provided. Fine salmon are obtained in the rivers and in some of the larger lakes. The shellfish are large and abundant.

Railways.—A branch of the great southern and western line passes by Killarney to Tralee.

Administration.—The county comprises nine baronies, and contains eighty-five civil parishes and two parts of parishes, and 2682 townlands. There are six poor-law unions wholly within the county, viz., Cahirciveen, Dingle, Kenmare, Killarney, Listowel, and Tralee, and part of one named Glin, the remaining portion being in Limerick. The county includes one parliamentary borough, Tralee, which in 1881 had a population of 9664, the towship of Killarney, and the towns of Dingle and Listowel. There are in the county twenty-four petty sessions districts, and one part of a petty sessions district. Assizes are held at Tralee, and quarter sessions are held in the towns of Dingle, Kenmare, Killarney, Listowel, and Tralee. The county is within the Cork military district, and there is a barrack station at Tralee. The headquarters of the constabulary force is at Tralee, and sub-inspectors are stationed at Cahirciveen, Dingle, Kenmare, Killarney and Listowel. Previous to the Union the county returned eight members to parliament, two for the county, and two for each of the boroughs of Tralee, Dingle, and Ardfret. At the Union the number was reduced to three, two for the county and one for the borough of Tralee.

Population.—At the census of 1659 the population of Kerry was 8390, of whom 7824 were Irish and 566 English. De Burgo estimates it at 56,628 in 1760, and the census of 1821 gives it as 216,185. In 1841 it had increased to 294,095, but in 1851 had diminished to 238,619, in 1861 to 201,800, and in 1871 to 196,586. The increase to 200,448 in 1881, notwithstanding that Kerry has suffered severely from agricultural distress, is sufficiently accounted for by an increase in the number of the smaller class of holdings. The number of males in 1881 was 100,715, and of females 99,733. The annual rate of marriages in 1880 to every 1000 of estimated population was 2.4, of births, 27.5, of deaths 17.5, and of emigration 26.4. The total number who emigrated from 1st May, 1851, to 31st December, 1880, was 121,826. The number of persons not of Irish birth in Kerry at the census of 1841 was 615, and in 1871 it was 1194. The number in 1871 who could speak Irish only was 1209, and the number who could speak Irish and English 69,959. The number of Roman Catholics in 1881 was 193,917, of Protestant Episcopalians 5767, of Presbyterians 224, of Methodists 271, and of all other persuasions 264.

History.—The county is said to have derived its name from Ciar, who, along with his tribe the *Ciarraidhe*, is stated to have inhabited about the beginning of the present era the territory lying between Tralee and the Shannon. That portion lying south of the Maine was at a later period included in the kingdom of Desmond. Kerry suffered frequently from invasions of the Danes in the 9th and 10th centuries, until they were finally overthrown at the battle of Clontarf in 1014. In 1172 Dermot MacCarthy, king of Cork and Desmond, made submission to Henry II. on certain conditions, but was nevertheless gradually compelled to retire within the limits of Kerry, which was made shire ground in 1210. An English adventurer Raymond le Gros received from this MacCarthy a large portion of the county round Lixnaw. Thomas, grandson of Raymond, and king's sheriff in the counties of Cork, Waterford, and Kerry, was in 1295 made lord chief-justice of Ireland. Of his two sons John the eldest was created earl of Kildare, and Maurice in 1329 became earl of Desmond, and with certain exceptions received all the royal liberties which the king had in the county of Kerry. After the attainder of Thomas, earl of Desmond, in 1467, his kinsmen took up arms against the English, until at last the king was glad to guarantee the earl's elder son the full possession of his father's privileges. In consequence, however, of the rebellion of Gerald the sixteenth earl, the estates of the Desmonds, 574,628 acres in extent, were in 1583 forfeited to the crown, and parcelled into manors and seignories of 12,000, 8000, 6000, and 4000 acres, which were divided among English noblemen and gentlemen. The Irish took advantage of the disturbed state of England at the time of the Puritan revolution to attempt the overthrow of the English rule in Kerry, and ultimately obtained possession of Tralee, but in 1652 the rebellion was completely subdued, and a large number of estates were afterwards confiscated.

Antiquities.—There are remains of a round tower at Aghadoe near Killarney, another, a small cell at Lough Currane, and a third, one of the finest and most perfect specimens of the round tower in Ireland, at Rattoo, not far from Ballybunion. On the summit of a hill to the north of Kenmare River is the remarkable stone fortress known as Staigue Fort. There are several stone cells in the principal Skellig island, where at one time there were monastic remains which have now been swept away by the sea. The principal groups of sepulchral stones are those on the summits of the Tomie Mountains, a remarkable stone fort at Cahirciveen, a circle of stones with cromlech in the parish of Tuosist, and others with inscriptions near Dingle. The most notable monastic ruins are those of Innisfallen, founded by St. Finian, a disciple of St. Columba, and the fine remains of Muckross Abbey, founded by the Franciscans; but there are also monastic remains at Ardfert, Castlemaine, Derrynane, Kilcoleman, Lislaghtin, and O'Dorney. Among old ruined churches of interest may be mentioned those of Aghadoe, Kilcrohane, Lough Currane, Derrynane, Kilmakilloge, and Muckross. The cathedral of Ardfert, founded probably in 1253, was partly destroyed during the Cromwellian wars, but was restored in 1831. Some interesting portions of the old building still remain. There are a large number of old feudal castles.

See Smith, *Ancient and Present State of the Counties of Cork, Waterford, and Kerry*, Dublin, 1746–56; Cusack, *History of the Kingdom of Kerry*, 1871.

KERTCH, the ancient Panticapæon, a seaport town of Russia in the government of Taurida, situated at the eastern extremity of the Crimea, on the Cimmerian Bosphorus (Strait of Yenikale or Strait of Kertch). It is 133 miles northeast of Simpheropol and 50 miles from Theodosia, in 45° 21′ N. lat. and 36° 30′ E. long. Like most towns built by ancient Greek colonists, it occupies a beautiful situation clustering round the foot and climbing the sides of the hill (now named after Mithradates) on which stood the ancient acropolis. In 1876 it contained twelve churches (including one Catholic and one Armenian), two synagogues, and a mosque, a local bank, two hospitals (one at Yenikale), three prisons, two gymnasiums, and a "noble maidens' institute." The church of John the Baptist, which, according to an inscription, was founded in 717 A.D., presents a good example of the purely Byzantine style of architecture. The church of Alexander Nevski was formerly the famous Kertch museum of local antiquities, founded in 1825. The more valuable objects were afterwards removed to the hermitage of St. Petersburg, and those which remained were wantonly scattered during the English occupation of the town. The present "museum" is a small collection in a private house. Among the products of local industry are leather, tobacco, cement, beer, aerated waters, lime, candles, and soap. Fish-curing is carried on, and there are steam saw-mills and flour-mills. Previous to the deepening of the Strait of Yenikale so as to admit vessels drawing 17 feet of water (1876), the harbor was visited by a large number of vessels which now pass on to the Azoff ports. The imports comprise coal, wines, olive oil, etc.; and grain, fish, linseed, rapeseed, wool, and hides are exported. The harbor was improved by dredging at the same time as the strait. A promenade extends along the sea-wall, and beyond the town lie public gardens. About six miles to the northeast is the town and old Turkish fortress of Yenikale, which is united with Kertch to form a separate administrative circle or mayoralty, including, according to the surveys of 1843–44, an area of 42,103 acres. In 1876 the population of Kertch, exclusive of the temporary garrison of 13,745, amounted to 21,211.

The Greek colony of Panticapæon was founded about the middle of the 6th century B.C., by the people of Miletus. From about 438 B.C. till the conquest of this region by Mithradates the Great about 100 B.C., the town and territory formed the so-called kingdom of the Bosphorus, ruled over by an independent dynasty. Phanacer, the son of Mithradates, became the founder of a new line under the protection of the Romans, which continued to exist till the middle of the 4th century A.D., and extended their power over the maritime parts of the Tauris. After this time the town—which had already begun to be known as Bosphora or Bospora—passed into the hands of the Eastern empire, of the Khazars, and of various barbarian tribes.

In 1318 the Tartars who had come into possession in the previous century, ceded the town to the Genoese, who soon raised it into new importance as a commercial centre. They usually called the place Cerchio, by a corruption of the Russian name K'rtcheff (whence Kertch), which appears in the 11th century inscription of Tmutorokansk. Under the Turks, whose rule dates from the end of the 15th century, Kertch was a military port; and as such it plays a part in the Russo-Turkish wars. Captured by the Russians under Dolgorakoff in 1771, it was ceded to them along with Yenikale by the peace of Kertchuk-Kainardji, and it became a great centre of Russian naval activity. Its importance was greatly impaired by the rise of Odessa and Taganrog; and in 1820 the fortress was dismantled. Opened to foreign commerce and made a quarantine station, it attained a certain degree of prosperity, but again suffered severely during the Crimean War.

Archæologically Kertch is of particular interest, the kurgans or sepulchral mounds of the town and vicinity having yielded a rich variety of the most beautiful works of art. Since 1825 (the date of Blaramberg's discoveries) a large number of tombs have been opened. In the so-called Zolotai (*i. e.*, Golden) kurgan, or Abtrimoba, was found a great stone vault similar in style to an Egyptian pyramid; and within, among many objects of minor note, were golden dishes adorned with griffins and beautiful arabesques. In the Kul-oba, or Mound of Cinders (opened in 1830–31 by Dubrux), was a similar tomb, in which were found what would appear to be the remains of one of the kings of the Bosphorus, of his queen, his horse, and his groom. The ornaments and furniture were of the most costly kind; the king's bow and buckler were of gold; his very whip intertwined with gold; the queen had golden diadems, necklace, and breast-jewels, and at her feet lay a golden vase. In the Pavlovskoi kurgan (opened in 1858) was the tomb of a Greek lady, containing among other articles of dress and decoration a pair of fine leather boots (a unique discovery) and a beautiful vase on which is painted the return of Persephone from Hades and the setting out of Triptolemus for Attica. In a neighboring tomb was what is believed to be "the oldest Greek mural painting which has come down to us," dating probably from the 4th century B. C. Among the minor objects discovered in the kurgans perhaps the most noteworthy are the fragments of engraved boxwood, the only examples known of the art taught by the Sicyonian painter Pamphilus.

See Seymour's *Russia on the Black Sea and Sea of Azoff*, 1855; Telfer, *The Crimea*, 1876; Bruhn *Tchernomore*, 1852–77, Odessa, 1878; Sosnogoroff, *Putevoditel po Kruimu* ("Guide to the Crimea"), Odessa, 1880; Gilles, *Antiquités du Bosphore Cimmerien*, 1854; Macpherson, *Antiquities of Kertch*, 1857; *Compte rendu de la Commission Imp. Archéologique*, St. Petersburg; L. Stephani, *Die Alterthümer vom Kertsch*, 1880; C. T. Newton, *Essays on Art and Archæology*, 1880.

KÉSMÁRK, or **KÄSMARK**, an ancient town in the cis-Tisian county of Szepes (Zips), Hungary, is situated on the Poprád, 11 miles northwest of Löcse (Leutschau), in 49° 8′ N. lat., 20° 28′ E. long. The trade is chiefly in linen, wine, and cereals. Owing to the vicinity of the Carpathians the rainfall is high, and the climate frequently tempestuous and inclement. At the end of 1880 the population amounted to 4477, chiefly Germans and Slovaks.

Késmárk (Latin *Forum Caseorum*) is probably a Magyarized form of the German *Käsemarkt*. In 1380, during the reign of Louis I., it was raised to the dignity of a royal free town. As the most important of the Saxon settlements in the north of Hungary, Késmárk in 1440 became the seat of the counts of Szepes (Zips). In 1464 King Matthias Corvinus granted the town the so-called *jus gladii*, its civic blazon, and the right of holding weekly markets. In 1530 Késmárk fell into the power of John Zápolya, and later it suffered much at the hands of the Polish leader Hieronymus Lasky, and from Sebastian Tököli. In 1655 the town was re-established by the emperor Ferdinand III. in all its ancient rights; and it remained a royal free town until the recent administrative changes of 1876. An international exhibition of linen goods was held at Késmárk in the summer of 1881.

KESTREL (French *Cresserelle* or *Crécerelle*, Old French *Quercerelle* and *Quercelle*, in Burgundy *Cristel*), the English name[1] for one of the smaller Falcons, originating probably from its peevish and languid cry. This bird, though in the form of its bill and length of its wings one of the true Falcons, and by many ornithologists placed among them under its Linnæan name of *Falco tinnunculus*, is by others referred to a distinct genus *Tinnunculus* as *T. alaudarius*—the last being an epithet wholly inappropriate. We have here a case in which the propriety of the custom which requires the establishment of a genus on structural characters may seem open to question. The differences of structure which separate *Tinnunculus* from *Falco* are of the slightest, and, if insisted upon, in the way some systematists have done, must lead to including in the former birds which obviously differ from Kestrels in all but a few characters arbitrarily chosen; and yet, if structural characters be set aside, the Kestrels form an assemblage readily distinguishable by several peculiarities from all other *Falconidæ*, and an assemblage that the instinct of real ornithologists (though this is treading upon dangerous ground) does not hesitate to separate from the true Falcons of the genus *Falco*, with its subsidiary groups *Æsalon*, *Hypotriorchis* and the rest (see FALCON, vol. ix. p. 3). Scarcely any one outside the walls of an ornithological museum or library would doubt for a moment whether any bird shown to him were a Kestrel or not; and Mr. Gurney believes (*Ibis*, 1881, p. 277) that the aggregation of species placed by Mr. Sharpe (*Cat. Birds Brit. Museum*, i. pp. 423–448) under the generic designation of *Cerchneis* (which should properly be *Tinnunculus*) includes "three natural groups sufficiently distinct to be treated as at least separate subgenera, bearing the name of *Dissodectes*, *Tinnunculus*, and *Erythropus*." Of these we may say that the first and last are not at all Kestrels, but are perhaps rather related to the Hobbies (*Hypotriorchis*).

The ordinary Kestrel of Europe, *Falco tinnunculus* or *Tinnunculus alaudarius*, is by far the commonest bird of prey on the British Islands, and is too common and well-known a bird to need any description. It is almost entirely a summer migrant, coming from the south in early spring and departing in autumn, though examples (which are nearly always found to be birds of the year) occasionally occur in winter, some arriving on the eastern coast in autumn. It is most often observed while practising its habit of hanging in the air for a minute or two in the same spot, by means of short and rapid beats of its wings, as, with head pointing to windward and expanded tail, it is looking out for prey,—which consists chiefly of mice, but it will at times take a small bird, and the remains of frogs, insects, and even earth-worms have been found in its crop. It generally breeds in the deserted nest of a Crow or Pie, but frequently in rocks, ruins, or even in hollow trees—laying four or five eggs, mottled all over with dark brownish-red, sometimes tinged with orange and at all other times with purple. Though it may occasionally snatch up a young Partridge or Pheasant,[2] the Kestrel is quite the most harmless bird-of-prey, if it be not, from its destruction of mice and cockchafers, a most beneficial species. It is a species of very wide range, extending over nearly the whole of Europe from 68° N. lat., and the greater part of Asia—though the form which inhabits Japan and is abundant in Northeastern China has been by some writers deemed distinct and called *T. japonicus*—and it also pervades the greater part of Africa, becoming, however, scarce in southern latitudes, and unknown beyond Fantee on the west and Mombasa on the east coast (*Ibis*, 1881, p. 457). The southern countries of Europe have also another and smaller species of Kestrel, *T. tinnunculoides* (the *T. cenchris* and *T. naumanni* of some writers), which is widely spread in Africa and Asia, though specimens from India and China are distinguished as *T. pekinensis*.

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[1] Other English names are Windhover and Standgale (the last often corrupted into Stonegale and Stannell), from a habit to be presently mentioned.

[2] When what are called "tame" Pheasants are bred, a Kestrel will often contract the bad habit of infesting the coops and carrying off the young birds. This evil may easily be stopped, but it should not lead to the relentless persecution of the species, especially when it is remembered that the Kestrel is in the first place attracted to the spot by the presence of the mice which come to eat the Pheasants' food

Three other species are found in Africa as well—*T. rupicola*, *T. rupicoloides*, and *T. alopex*—the first of which is a common bird in the Cape Colony, while the others occur in the interior. Some of the islands of the Ethiopian region have peculiar species of Kestrel, as the *T. newtoni* of Madagascar, *T. punctatus* of Mauritius, and *T. gracilis* of the Seychelles; while, on the opposite side, the Kestrel of the Cape Verd Islands has been separated as *T. neglectus*.

The next species deserving of notice is that of America, *T. sparverius*, commonly known in Canada and the United States as the "Sparrow-Hawk"—a beautiful little bird, though not more courageous than the rest of its relations. Various attempts have been made to recognize several species, more or less in accordance with locality, but the majority of ornithologists seem unable to accept the distinctions which have been elaborated chiefly by Mr. Sharpe (*ut supra*) and Mr. Ridgway (*North American Birds*, iii. pp. 159–175), the former of whom recognizes six species, while the latter now admits but three, *T. sparverius*, *T. leucophrys*, and *T. sparverioides*, with five geographical races of the first, viz., the typical *T. sparverius* from the continent of North America, except the coast of the Gulf of Mexico; *T. australis*, from the continent of South America, except the North Atlantic and Caribbean coasts; *T. isabellinus*, inhabiting continental America from Florida to Cayenne; *T. dominicensis* from the Lesser Antilles as far northwards as St. Thomas; and lastly *T. cinnamominus* from Chili and Western Brazil. *T. leucophrys* is said to be from Hispaniola and Cuba; and *T. sparverioides* peculiar to Cuba only. This last has been generally allowed to be a good species, though Dr. Gundlach, the best authority on the birds of that island, in his latest work, published in 1876 (*Contribucion á la Ornitologia Cubana*, p. 48) will not allow its validity. More recently it has been found (*Ibis*, 1881, pp. 547–564) that *T. australis* and *T. cinnamominus* cannot be separated, that Mr. Ridgway's *T. leucophrys* should properly be called *T. dominicensis*, and his *T. dominicensis T. antillarum*, while that gentleman has recorded the supposed occurrence of *T. sparverioides* in Florida.[1] Of other Kestrels it remains to say that *T. moluccensis* is widely spread throughout the islands of the Malay archipelago, while *T. cenchroides* seems to inhabit the whole of Australia, and has occurred in Tasmania (*Proc. Roy. Soc. Tasmania*, 1875, pp. 7, 8). No Kestrel is found in New Zealand, but an approach to the form is made by the very peculiar *Hieracidea* (or *Harpe*) *novæ-zelandiæ* (of which a second race or species has been described, *H. brunnea* or *H. ferox*) the "Sparrow-Hawk," "Quail-Hawk," and "Bush-Hawk" of the colonists—a bird of much higher courage than any Kestrel, and perhaps exhibiting the more generalized and ancestral type from which both Kestrels and Falcons may have descended. (A. N.)

KESWICK, a market-town of Cumberland, is situated on the left bank of the Greta, close to Derwentwater or Keswick Lake, about 30 miles south of Carlisle, and 300 miles from London by rail. It is one of the centres for visitors to the Cumberland lakes, and is the point whence the ascent of Skiddaw is usually begun. In the parish church of Crosthwaite, three-quarters of a mile off, there is a monument to the poet Southey, whose residence for many years, Greta Hall, stands at the end of the main street, close by the river. Keswick was formerly noted for its manufacture of lead-pencils; and the plumbago (locally wad) used to be supplied by the mines in Borrowdale. Lead is still found in the neighboring hills. Char, caught in the neighboring lakes, are potted at Keswick in large quantities during the season, and sent to all parts of England. The population in 1881 was 3220.

KESZTHELY, a market-town in the trans-Danubian county of Zala, Hungary, is picturesquely situated near the western extremity of Lake Balaton, about 97 miles south of Pozsony (Pressburg), 46° 47′ N. lat., 17° 15′ E. long. Keszthely is chiefly noted for its well-organized agricultural institute, founded by Count George Festetics, and known as the "Georgicon." At the source of the Héviz brook there is a warm sulphur spring. The trade is principally in grain, fruit, and wine. The population at the end of 1880 was 5341, mostly Magyars by nationality, and Roman Catholics by creed.

KETCHUP, a sauce or relish prepared principally from the juice of mushrooms and of many other species of edible fungi, salted for preservation and variously spiced. The term ketchup, written also catsup and katchup, is said to be of Japanese origin. The following may be taken as a typical example of the ingredients and method of preparing ordinary ketchup. Freshly gathered mushrooms are placed in a wooden vessel and sprinkled with salt. They are left for two or three days, during which time they are repeatedly stirred and turned over. The juice is then squeezed out, and to every gallon of the juice there is added of crushed cloves and mustard seed half an ounce each, and of black pepper, ginger, and allspice each an ounce. The mixture is boiled gently, decanted, and left to macerate for about two weeks, after which it is strained off and bottled. Should it show any tendency to putrefaction, it is again boiled with the addition of salt and spices. It is of the utmost consequence to avoid copper, lead, and pewter vessels or implements in the preparation of ketchup; as far as possible glazed earthenware vessels alone should be used. The juices of various fruits, such as cucumbers, tomatoes, and especially green walnuts, are used as a basis of ketchup, and shell-fish ketchup, from oysters, mussels, and cockles, is also made; but in general the term is restricted to sauces having the juice of edible fungi as their basis.

KETI, a town and port in Kurrachee district, Sind, India, situated on the Hajámro branch of the Indus, in 24° 8′ 30″ N. lat., 67° 28′ 30″ E. long. Population (1872), 3199. The town is a large seat of river trade, and ranks next to Kurrachee among the ports of Sind. The sea-going exports comprise grain, pulses, oilseeds, wool, cotton, drugs, dyes, saltpetre, and firewood. The imports include cocoanuts, cotton piece goods, metals, sugar, spices, coir, and shells.

KETTERING, a market-town of Northamptonshire, is built on a slope near the Ise, a tributary of the Nen, 14 miles northeast of Northampton, and 75 miles northwest of London. The principal buildings are the church of SS. Peter and Paul, a good specimen of the Perpendicular style, with a tower and spire; the church of St. Andrew, built in 1870, in the Decorated style; the town-hall and corn-exchange; the temperance hall; and the union workhouse. The water works were erected in 1872 at a cost of £12,000. The chief manufactures of Kettering are boots, shoes, brushes, stays, clothing, and agricultural implements. There are iron-works in the immediate neighborhood. The privilege of market was granted in 1227 by a charter of Henry III. The population in 1881 was 11,093.

KEUNJHAR, or KEUNJUR, a petty state in Orissa, India, lying between 21° 1′ and 22° 9′ 30″ N. lat., and 85° 14′ and 86° 24′ 35″ E. long., with an area of 3096 square miles, and a population in 1872 of 181,871. The state originally formed part of Morbhanj; but about two hundred years ago the tribes of this part, finding it a great hardship to travel through the perilous forests of Morbhanj to obtain justice from their prince, separated themselves, and set up the brother of the Morbhanj rájá as their independent ruler. The last prince rendered good service during the Kol rebellion in 1857, and was rewarded with the title maháráján. A Government elephant establishment is maintained at Keunjhar.

KEUNTHAL, a petty hill state in the Punjab, India, between 30° 55′ 30″ and 31° 6′ N. lat., and 77° 10′ and 77° 26′ E. long., with an area of 116 square miles, and an estimated population of 50,000. The chief, a Rajput, received the title of rájá in 1857. After the Gurkhá war, a portion of Keunthál, which had been occupied by the Gurkhás, was sold to the maháráјá of Patiála, the remainder being restored to its own chief. In consideration of this, no tribute is paid by the Keunthál rájá. In 1823 the district of Punár was added to the Keunthál state. The rájá exercises rights of lordship over the petty states of Kothi, Theog, Madhan, and Ratesh.

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[1] The absence of any species of Kestrel from Jamaica is a most curious fact, considering the abundance of the former in other parts of the West Indies.

KEW, a village and parish in the county of Surrey, England. The village is pleasantly situated on the south bank of the Thames, 6 miles by road west-southwest of Hyde Park corner. It has communication with London by steamer and by several railway routes. By a stone bridge of seven arches, erected in 1789, it is connected with Brentford on the other side of the river. The village consists chiefly of a row of houses with gardens attached, situated on the north side of a green, to the south of which is the church and churchyard, and at the west the principal entrance to Kew gardens. In the vicinity there are many fine villas. From remains found in the bed of the river near Kew bridge it has been conjectured that the village is an old British settlement. The name first occurs in a document of the reign of Henry VII., where it is spelt Kayhough. The free school, originally endowed by Lady Capel in 1721, received special benefactions from George IV., and the title of "the king's free school."

The estate of Kew House about the end of the 17th century came into the possession of Lord Capel of Tewkesbury, and in 1721 of Samuel Molyneux, secretary to the prince of Wales, afterwards George II. After his death it was leased by Frederick, prince of Wales, son of George II., and it continued to be the residence of members of the royal family until the estate was purchased about 1789 by George III., who devoted his chief leisure to its improvement. The old house was pulled down in 1802. Dutch House, adjoining Kew House, afterwards sold by Robert Dudley, earl of Leicester, to Sir Hugh Portman, a Dutch merchant, was purchased by George III. as a nursery for the royal children. It is a plain brick structure, and is now known as Kew Palace. The Royal Botanic Gardens of Kew originated in the exotic garden formed by Lord Capel and greatly extended by the princess dowager, widow of Frederick, prince of Wales, and by George III., aided by the skill of the Aitons and of Sir Joseph Banks. In 1840 the gardens were adopted as a national establishment and transferred to the department of woods and forests. The gardens proper, which originally contained only about 11 acres, have been increased to 75 acres, and the pleasure grounds or aboretum adjoining extend to 270 acres.

A catalogue of the plants in the exotic garden of Kew was published by Dr. Hill in 1768, 2d ed. 1769; and in 1789 William Aiton published *Hortus Kewensis*, in 3 vols. 8vo. See Oliver's *Guide to the Royal Botanic Gardens and Pleasure Grounds, Kew*, 26th edition, 1881.

KEW-KEANG FOO, a prefecture and prefectural city in the province of Keang-se, China. The city, which is situated on the south bank of the Yang-tsze Keang, 15 miles above the point where the Kan Keang flows into that river from the Po-yang lake, stands in 29° 42′ N. lat. and 116° 8′ E. long. The north face of the city is separated from the river by only the width of a roadway, and two large lakes lie on its west and south fronts. The walls are from five to six miles in circumference, and are more than usually strong and broad. As is generally the case with old cities in China, Kew-Keang has repeatedly changed its name. Under the Tsin dynasty (265–420 A. D.) it was known as Sin-Yang, under the Leang dynasty (502–557) as Keang-Chow, under the Suy dynasty (589–618) as Kew-Keang, under the Sung dynasty (960–1127) as Ting-Keang, and under the Ming dynasty (1368–1644) it assumed the name it at present bears. Kew-Keang has played its part in the history of the empire, and has been repeatedly besieged and sometimes taken. The last time this worst fate overtook it was in February, 1853, when the Tai-ping rebels gained possession of the city. After their manner they looted and utterly destroyed it, leaving only the remains of a single street to represent the once flourishing town. The position of Kew-Keang on the Yang-tsze Keang and its proximity to the channels of internal communication through the Po-yang lake, more especially to those leading to the green-tea-producing districts of the provinces of Keang-se and Gan-hwuy, induced Lord Elgin to choose it as one of the treaty ports to be opened under the terms of his treaty (1861). Unfortunately, however, it stands above instead of below the outlet of the Po-yang lake, and the 15 miles which separate it from that channel form one of the swiftest parts of the lower Yang-tsze Keang. This has proved to be a decided drawback to its success as a commercial port, but nevertheless the customs returns show a steady annual increase in the trade carried on. The immediate effect of opening the town to foreign trade was to raise the population in one year from 10,000 to 40,000, and at the present time the census declares it to be peopled by 48,000 souls. The foreign settlement extends westward from the city, along the bank of the Yang-tsze Keang, and is bounded on its extreme west by the P'un river, which there runs into the Yang-tsze. The bund, which is 500 yards long, was erected by the foreign community at a cost of 1700 taels. The climate is considered to be good, and though hot in the summer months is invariably cold and bracing in the winter. According to the latest customs returns the value of foreign imports into Kew-Keang in 1878 was 2,514,302 taels as against 2,954,286 in 1880; during the same period native imports showed an increase from 649,109 taels to 962,364 taels; and the value of exports declined from 8,924,436 taels to 8,824,966 taels. 1653 piculs of opium were imported in 1878, and 2290 in 1880, and the revenue returns show that while the duties levied in 1872 amounted to 585,883 taels, in 1880 the sum received from the same source was 764,571 taels.

KEY WEST (Spanish, *Cayo Hueso*, Bone Reef), a coral island 7 miles long, from 1 to 2 miles broad, and 11 feet above sea-level, lies 60 miles south of Cape Sable, the most southerly point of the mainland of Florida.[1] It belongs to Monroe county, Florida, and forms one of the Florida Keys. The soil is thin, but supports a tolerably dense tropical vegetation, including various fruits. In the absence of fresh springs, the water supply is derived from rain and distillation. The healthy climate attracts an annually increasing number of invalids from the north. The inhabitants are chiefly of Cuban and Bahaman extraction, and speak a Spanish patois.

Key West, chief city of Monroe county, covers nearly one-half of Key West island. It has broad streets arranged on the rectangular plan; and the houses, almost all wooden, are picturesquely surrounded by tropical shrubs and plants. The chief buildings are the Government naval and judicial edifices, the masonic hall and the opera house. There is also a convent and several churches and schools. The position of Key West in relation to Cuba, the Gulf of Mexico and the coast of the United States gives it commercial advantages that are seconded by the possession of one of the finest harbors in the Union south of the Chesapeake. Key West shows much the largest tonnage in Florida of vessels clearing and entering; and it has frequent and good steam communication with the mainland. Described as being "to Cuba what Gibraltar is to Ceuta, to the Gulf of Mexico what Gibraltar is to the Mediterranean," Key West is one of the chief naval stations of the United States, and is strongly fortified. The principal manufacture is that of cigars, begun in 1867, and steadily prospering. Previous to 1874, when a hurricane destroyed the works, 30,000 bushels of salt were annually produced on the island by solar evaporation. Fishing, sponge-gathering and turtle-catching occupy many of the inhabitants; and a large number of small vessels are employed in "wrecking," *i. e.*, in saving goods and rendering assistance to vessels that have failed to clear the dangerous Florida reef. The population of the city in 1880 was 9890.

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[1] [The island, in lat. 24° 32′, is the most southerly point of U. S. territory.—Am. Ed.]

KHABAROVKA, the chief town of the Maritime Province, in Eastern Siberia, is situated on high crags, on the right bank of the Amoor, amidst wide forests and marshes, at the confluence of the Ussuri. It was but a poor settlement with 700 inhabitants when it took the place of Nikolaievsk as the seat of the military administration of the Maritime Province and of the various establishments connected with the Amoor fleet. Since its foundation in 1857 it has always been the chief centre for the trade in sables purchased yearly from the aborigines to the average amount of 20,000 pieces, and sent to Irkutsk and to Russia.

KHAIRÁBÁD, or Khyrabad, the chief town of Sitápur district, Oudh, India, situated 5 miles south of Sitápur civil station and cantonment, 27° 31′ 30″ N. lat., 80° 47′ 35″ E. long. It is the fifth largest town in Oudh, with a population in 1869 of 15,677, made up of Hindus and Mohammedans in about equal numbers. The town contains forty mosques and thirty Hindu temples, besides a beautiful group of sacred Mohammedan buildings. A large fair is held here in January, lasting ten days, and attended by an average of 60,000 persons. A second fair is held at the *Dasahára* festival, attended by about 15,000 persons. The annual value of *bázár* sales is about £34,000.

KHAIRPUR, or Khyrpoor, a native state in Sind, India, lying between 26° 10′ and 27° 46′ N. lat., and 68° 14′ and 70° 13′ E. long., bounded on the N. by Shikárpur district, S. by Jáisalmír state, E. by Hyderabad district, and W. by the Indus river, with an area of 6109 square miles. Like other parts of Sind, Khairpur consists of a great alluvial plain, very rich and fertile, in the neighborhood of the Indus and the irrigation canals, the remaining area being a continuous series of sand-hill ridges covered with a stunted brushwood, where cultivation is altogether impossible. A small ridge of limestone hills passes through the northern part of the state, being a continuation of a ridge known as the Ghar, running southward from Rohri. The state is watered by five canals drawn off from the Indus, besides the Eastern Nára, a canal which follows an old bed of the Indus. In the desert tracts are pits of *natron*, forming a source of revenue to the chief; as many as a thousand camel-loads are annually exported to Northern and Central India, as well as to the seaboard, each load being taxed at 5s.

A census taken in 1872 returned the population at 130,350, or 21 per square mile. The Moslems chiefly belong to the Rájur tribe. The Hindus are principally Rájputs of the Soda Thákur clan, who inhabit the extreme eastern part of the state. They are a well-built and sturdy race, of nomadic habits, their wealth consisting in herds of camels, oxen, sheep and goats. The principal food grain crops are *joár* (*Holcus sorghum*), *bájrá* (*Holcus spicatus*), wheat, gram, and pulses. Indigo is largely cultivated, and cotton to a less extent. Fruits consist of the mango, mulberry, apple, pomegranate, date, etc. Several varieties of forest trees are grown in the mír's game preserves. The annual value of the export trade is estimated at about £52,000, and the imports at £25,000. Cotton and silk fabrics, silver ware, lacquered wood-work, boots, shoes, horse trappings, swords, matchlocks and pottery are the chief manufactures. A small quantity of salt and saltpetre is also manufactured. The revenue of the state, which is collected in kind, the mír receiving one-third of the produce, is estimated to amount to about £50,000. The climate is agreeable during about four months of the year, and fiercely hot during the remaining eight. The principal diseases are fever, ophthalmia, and cutaneous affections.

The chief or mír of Khairpur belongs to a Baluchí family, known as the Tálpur, which rose on the fall of the Kalhorá dynasty of Sind. About 1813, during the troubles in Cabul incidental to the establishment of the Bárakzái dynasty, the mírs were able to refuse the tribute which up to that date had been somewhat irregularly paid to the rulers of Afghánistán. In 1832 the individuality of the Khairpur state was recognized by the British government in a treaty under which the use of the river Indus and the roads of Sind were secured. When the first Cabul expedition was decided on, the mír of Khairpur, Alí Murád, cordially supported the British policy; and the result was that, after the battles of Miani and Daba had put the whole of Sind at the disposal of the British, Khairpur was the only state allowed to retain its political existence under the protection of the paramount power.

KHÁMGÁON, a town in Akola district, Berar, India, in 20° 42′ 30″ N. lat., 76° 37′ 30″ E. long., with a population in 1867 of 9432. The cotton market—the largest in the province—was established about 1820. A branch line of 8 miles, opened in 1870, connects Khámgáon with the great Indian Peninsula Railway. In fair seasons above 100,000 bullock-loads of cotton are brought into Khámgáon on the weekly market day. To the east of the town is a large inclosed cotton-market. The factories of the Berár Ginning Company and the Mofussil Pressing Company possess steam machinery for full-pressing cotton.

KHÁNDESH, or Candeish, a district of Bombay Presidency, India, lying between 20° 15′ and 22° N. lat., and 73° 37′ and 76° 24′ E. long., bounded on the N. by the Sátpura hills, E. by Berár, S. by the Sátmála or Ajanta hills, S.W. by Násik district and W. by Baroda territory, with an area of 10,162 square miles. The chief town is Dhulia. The principal natural feature is the Tápti river, which enters at the southeast corner of the district, and flows in a northwesterly direction, dividing Khándesh into two unequal parts. Of these the larger lies towards the south, and is drained by the river Girna. Northward beyond the alluvial plain, which contains some of the richest tracts in Khándesh, the land rises towards the Sáptura hills. In the centre and east the country is level, save for some low ranges of barren hills, and has in general an arid, unfertile appearance. Towards the north and west the plain rises into a difficult and rugged country, thickly wooded, and inhabited by wild tribes of Bhíls, who chiefly support themselves on the fruits of the forests and by the profits of wood-cutting. The drainage of the district centres in the Tápti, which receives thirteen principal tributaries in its course through Khándesh. None of the rivers are navigable, and the Tápti flows in too deep a bed to be made use of for irrigation. The district on the whole, however, is fairly well supplied with surface water. Khándesh is not rich in minerals. A large area is under forest; but the jungles have been robbed of most of their valuable timber. Wild beasts are numerous. As late as 1858 tigers abounded; but since then they have been very closely hunted, and driven almost entirely out of the plains into the rough, hilly country.

The census of 1872 returned the population at 1,028,642 (males, 530,610, and females, 498,032),—Hindus, 948,279, Musalmáns, 79,359; Pársís, 61; Christians, 517; Jews, 36; Síkhs, 59; "others," 331. Of the aboriginal tribes the Bhíls are the most important. They number 122,092, and formerly were a wild and lawless robber tribe. Since the introduction of British rule, the efforts made by kindly treatment, and by the offer of suitable employment, to win the Bhíls from their disorderly life have been most successful. Many of them are now employed in police duties and as village watchmen. The total area of government cultivable land is returned at 3,453,549 acres, of which 2,218,355 acres were under cultivation in 1875-76. Food grains take up 52 per cent.; pulses, 5¾ per cent.; fibres, 28 per cent.; oil seeds, 11 per cent.; miscellaneous crops, 3¼ per cent. of the cultivated area. Irrigation is more extensively practised in Khándesh than in the Deccan and the southern Marhattá country. Owing to the liability of the district to river-floods, almost every year is marked by some failure of the crops. The chief exports are food grains, oil seeds, butter, indigo, wax, and honey; and the imports salt, spices, metal, piece goods, cotton yarn and sugar. There are ten steam cotton presses, and one steam spinning and weaving factory. Many Bombay mercantile houses have established agencies in the district; and towards the east, in the rich Tápti valley, Jalgáon and Bhusáwal are rising into important centres of trade. The trunk road from Bombay to Agra and the Great Indian Peninsula Railway intersect the district, and of late years roads have been made all along the chief lines of traffic. The total revenue in 1876-77 amounted to £422,291, of which £303,706 was made up of the land tax. The same year there were 272 schools, with 16,249 pupils. The average annual rainfall for the five years ending 1875-76 was 25 inches. Fevers and cutaneous affections are the prevailing diseases.

KHANDPÁRA, a petty state in Orissa, India, lying between 20° 11′ and 20° 25′ N. lat., and 85° 1′ and 85° 25′ E. long., with an area of 244 square miles, and a population in 1872 of 60,877, mostly Hindus. Khandpára originally formed a part of the neighboring state of Nayágarh, and was separated from it about two hundred years ago by a brother of the Nayágarh rájá, who established his independence. The present chief, a Rájput by caste, is the eighth in descent from the founder. The country forms a very valuable territory, and is one of the best cultivated of the Orissa states. Fine *sál* timber abounds in the hilly parts, and magnificent banian and mango trees stud the plain. It is intersected by the Kuariá and Dauka rivers, small tributaries of the Mahánadi. The estimated annual revenue of the chief is £2258; tribute to the British government, £421.

KHANDWA, or Cundwah, the chief town and headquarters station of Nimár district, Central Provinces, India, 21° 50′ N. lat., 76° 23′ E. long. Population (1877), 14,119. Khandwa is perhaps the most rising town in the Central Provinces. It is the station on the Great Indian Peninsula Railway where the whole traffic of Central India towards Bombay meets the line. It has entirely superseded Burhanpur, the ancient centre of trade between Málwá, the Nerbudda valley, and the Deccan. Extensive barracks have been built for the relays of troops which pass through in the cold season, and there is also a good travellers' bungalow with a spacious *sarái* or native rest-house.

The Arabian geographer, Al Birúní (*circa* 1000 A.D.), mentions Khandwa; and a century later it was a great seat of Jain worship. The mound on which the town stands has supplied many finely carved pillars, cornices, and other remains of the old Jain buildings, which have been built into Bráhmanical temples, the walls of the Marhattá fort, and other structures. It also formed a quarry for the Sivaite temples surrounding the four *kunds* or water reservoirs, one of which is on each side of the town, that on the west side bearing the date 1132 A.D.

KHARKOFF, a government of European Russia, surrounded by those of Kursk, Poltava, Ekaterinoslaff, and Voronezh, and belonging partly to the basin of the Don and partly to that of the Dneiper. The area is estimated at 21,035 square miles. In general terms the government may be described as a table-land with an elevation of from 300 to 460 feet traversed by deep-cut river valleys. The soil is for the most part of high fertility, about 47 per cent. of the surface being arable land and 30 per cent. natural pasture; and though the winter is rather severe, the summer heat is sufficient for the ripening of grapes and melons in the open air. The bulk of the population is engaged in agricultural pursuits, and the breeding of sheep, cattle, and horses, though various manufacturing industries have also received a rapid development, more especially since the middle of the present century. The ordinary cereals, maize, buckwheat, millet, hemp, flax, tobacco, poppies, and beetroot are all grown, and bee-keeping and silkworm rearing are of considerable importance. In 1879 the horses numbered 258,711, the cattle 475,217, the sheep 1,059,596, of which 376,777 were of fine-fleeced varieties. Beetroot sugar factories, cotton mills, woollen factories, iron-works, and tanneries are the leading industrial establishments; their whole production in 1879 was estimated at 23,939,147 roubles (about £3,790,000). The mass of the people are Little Russians, but there are also Great Russians, Calmucks, Germans, Jews, and Gypsies. In 1867 the total population was ,681,486, and in 1879, 2,036,939—4119 of these being Raskolniks (dissidents), 1960 Roman Catholics, 2732 Protestants, and 3079 Jews. The government is divided into eleven districts—Kharkoff, Akhtuirka, Bogodukhoff, Izyum, Kupyansk, Lebedyin, Zmieff, Starobyelsk, Sumui, Valki, and Voltchansk. In 1879 there were eight towns with populations above 5000—Kharkoff, Izyum (15,741), Starobyelsk (12,581), Voltchansk (11,107), Slavansk (10,558), Tchugueff (9418), Valki (7001), Zolotcheff (5038). Ecclesiastically the government is a separate eparchy or diocese of the Greek Church. The Roman Catholics are subject to the bishop of Tiraspol in Kherson.

Kharkoff, the chief town of the above government, is situated in 56° 37′ N. lat. and 25° 5′ E. long., in the valley of the Donets, 462 miles from Moscow and 137 miles from Kursk. It has railway communication northward by Kursk and southward to Mariupol on the Sea of Azoff and to Odessa by Poltava and Balta. The four annual fairs are among the busiest in Russia, more especially the Krestchenskaya or Epiphany fair, which is opened on the 6th (18th) January. The turn-over is estimated at from £3,000,000 to £4,000,000. Thousands of horses are bought and sold. At the Trinity (Troitsa) fair in June an extensive business (£800,000) is done in wool. A great variety of manufactured goods are produced in the town—linen, felt, sugar (especially from beetroot), tobacco, brandy, soap, candles, cast iron. Besides a flourishing university, instituted in 1805, and attended in 1879 by 720 male and 163 female students, Kharkoff possesses an observatory, a large veterinary college, a botanical garden, a theological seminary, and several important institutions of beneficence. The university building was formerly a royal palace. The library contained in 1878 98,000 volumes; and the zoological collections are especially rich in the birds and fishes of Southern Russia. Extensive barracks are maintained in the town. Public gardens occupy the site of the ancient military works; and the Government has a model farm in the neighborhood. Of the Orthodox churches one has the rank of cathedral. The population of Kharkoff was 59,968 in 1867, and 101,175, in 1879.

The foundation of Kharkoff is assigned to the year 1650, and the name is at least popularly connected with that of Khariton, the Cossack originator of the settlement; but there is archæological evidence of a much earlier occupation of the district, if not of the site. The Cossacks of Kharkoff remained faithful to the czar during the rebellions of the latter part of the 17th century; in return they received a variety of privileges, and continued to be a strong advance guard of the Russian power, till the final subjugation of all the southern region. Along with other military settlements Kharkoff was placed on a new footing in 1765; and at the same time it became the administrative centre of the Ukraine. It has been the government town from the establishment of the government in 1780. For plan see Reclus, *Géographie Universelle*, vol. v. p. 807.

KHARPUT (officially Ma'murat-el-'Azíz), a town of Armenia, the seat of a mutaṣarrif, is situated about 60 miles north of Diarbekir on the highway to Siwas, and occupies a peculiarly picturesque position on a rocky eminence rising above the great plain through which the waters of the Eastern Euphrates describe a devious passage. Besides the imposing ruins of the castle on the height, it possesses an ancient Jacobite church and convent, and is the seat of an important American missionary college and schools. The population may be estimated at 25,000 or rather more, as there are 5000 households in the town (70 Jacobite, 500 Armenian, and the rest Turkish).

There is epigraphic evidence for the existence of a town on this site in the time of Nero (see Mordtmann in *Hermes*, 1880), and by some it is identified with Carcathiocerta, the capital of the province of Sophene. Kharput (Armenian, *Kharpert*, *i. e.*, Castle Rock; Χάρποτε of Cedrenus; Arabic, *Khartabirt*) appears in the older Arabic literature as Ḥiṣn Ziyád. It is the Quart Piert or Quart Pierre of William of Tyre, the scene of the tragical story of the imprisonment of Baldwin II. by the emír Balak. See Tozer, *Turkish Armenia*, etc., London, 1881.

KHARTÚM or **Khartoum** (erroneously Kartum), the chief town of the Egyptian Súdán, situated in 15° 37′ N. lat., and 22° 54′ E. long., on the peninsula formed by the junction of the White and the Blue Nile. The level of the stream just below the town is 1240 feet. The principal landing-place and the dockyards are on the Blue River. The surrounding country is flat and open, the forest described by the first European visitors having disappeared for a considerable distance up the river, but there are many gardens within and around the town planted with date-palms, fig and orange trees, etc. The town, though consisting chiefly of mean mud-built huts, has a considerable number of substantial modern buildings, the most imposing of which is the stone-faced palace of the governor. As the centre of the great caravan routes from the interior of Africa, Khartúm carries on a good legitimate trade, but the inhabitants have always shown a preference for slave traffic when the governor has proved indulgent or inefficient. Khartúm is the seat of a Roman Catholic mission founded by Pope Gregory XVI. in 1846, and long conducted by Dr. Ignaz Knoblecher, of Protestant missions, and of several European consulates. The British consulate, established in 1849, and latterly held by Petherick, was abolished in 1864 under circumstances which gave rise to much comment. The population amounts to 50,000, including in addition to the natives the usual medley elements of an Egyptian town.

Khartúm was founded by Mohammed Aly in 1823. In 1859 the population was estimated at 40,000. In 1869–70 the disturbed state of the country had brought the number down to 15,000, but since then the recovery has been rapid.

See Lord Prudhoe in *Journ. R. Geog. Soc.*, 1832; G. Melly, *Khartoum*, etc., 1851; Heuglin, *Reise n. Abessinien*, 1868; Schweinfurth, *Heart of Africa*, 1873; Hansal, *Briefe aus Chartum*, 1856 and 1880. Details regarding the Roman Catholic mission will be found in the last work: in *Jahresberichte* of the Marienverein; and in *Zeitschr. f. allg. Erdk.*, 1858 and 1861.

KHÁSI AND JÁINTIA HILLS, a district in Assam, India, lying between 25° 1′ and 26° 14′ N. lat., and 90° 47′ and 92° 52′ E. long., and bounded on the N. by Kámrúp and Nowgong districts, E. by Cachar and the Nágá Hills, S. by Sylhet, and W. by the Gáro Hills. Its approximate area is 6157 square miles.

The district consists of a succession of steep ridges running east and west, with elevated table-lands between. On the southern side, towards Sylhet, the mountains rise precipitously from the valley of the Bárák. The first plateau is about 4000 feet above sea-level. Farther north is another plateau, on which is situated the station of Shillong, 4900 feet above the sea; behind lies the Shillong range, of which the highest peak rises to 6449 feet. On the north side, towards Kámrúp, are two similar plateaus of lower elevation. The general appearance of all these table-lands is that of undulating downs, covered with grass, but destitute of large timber. At 3000 feet elevation the indigenous pine predominates over all other vegetation, and forms almost pure pine forests. The highest ridges are clothed with magnificent clumps of timber trees, which superstition has preserved from the axe of the woodcutter. The characteristic trees in these sacred groves chiefly consist of oaks, chestnuts, magnolias, etc. Beneath the shade grow rare orchids, rhododendrons, and wild cinnamon. The streams are merely mountain torrents. As they approach the plains, they form rapids and cascades, and many of them pass through narrow gorges of wild beauty. From time immemorial, Lower Bengal has drawn its supply of lime from the Khási Hills, and the quarries along their southern slope are literally inexhaustible. Coal of excellent quality crops out at several places, but has not yet been remuneratively worked. Ironstone exists in abundance, and in former days the Khásias were renowned as smelters of iron. Among other natural products may be mentioned beeswax, lac, and caoutchouc. Wild animals abound, including the elephant, rhinoceros, tiger, buffalo, *mithun* or wild cow, and many varieties of deer.

Both as regards history and administration the Khási (Khasiá or Cossya) and Jáintia or Jayntiyá Hills constitute two separate tracts. The Khási Hills are occupied by a collection of petty states, each governed by an elective ruler. The chiefs have not been brought completely under British administration, and still retain marks of semi-independence. The headquarters of the British political agent for the Khási Hills is at Chára Púnjí (Cherra Poonjee). The Jáintia Hills, on the other hand, are purely British territory. The inhabitants call themselves Syntengs, and first became British subjects in 1835 (see JÁINTIA HILLS, vol. xiii. p. 554).

An enumeration in 1872 disclosed a total population in the Khási and Jáintia Hills of 141,838—aboriginal tribes, 141,283; Hindus, 365; Mohammedans, 62; Christians, 128. The two races of Khásias and Syntengs have succeeded in preserving to the present day their primitive isolation, free from the interference of Hinduism. They have only given way somewhat to Hindu prejudices as regards purity of food. The Khásias have no written character or literature, nor even any traditions of their own. The most curious of their social customs is the importance attached to female descent and female authority. The husband marries into the wife's family, the wife or her mother is regarded as the head of the household, and all property descends in the female line—a survival of the polyandric institutions still kept up in full force by the Nairs, and other non-Aryan tribes of India. The ashes of the dead are buried under cromlechs consisting of four upright slabs of stone, covered over by a fifth slab. The only places in the Khási and Jáintia Hills above the rank of hamlets are Shillong, the headquarters station, Jowái, and Chára Púnjí.

The principal cereal crop is rice, but even of this they do not grow sufficient for their own consumption. Sugar-cane, cotton, and potatoes are also grown; and fruits such as oranges, limes, and pine-apples are raised in large quantities for export to Calcutta. The land is the absolute property of the cultivators, who pay no rent or revenue either to the British Government or to their own chiefs. Blights, floods, and droughts are almost unknown. Of a total area of 6157 square miles, only 286 are estimated as under cultivation, but other 3898 are returned as available for tillage. The trade of the hills is considerable. The estimated exports in 1876–77 were valued at £160,000, chiefly potatoes, limestone, cotton, stick-lac, bay leaves, oranges, and betel nuts. The imports were valued at £157,000. By far the greater portion of the trade is conducted at a row of markets along the southern foot of the hills, of which Chhatak in Sylhet district is the most important.

The Khási and Jáintia Hills constitute a political agency, independent of the ordinary jurisdiction. The Khási petty states, twenty-five in number, are presided over by elective chiefs, having jurisdiction over their own subjects in all cases except homicide. The British Government undertakes the management of the natural products of the country, such as lime, coal, timber, and elephants, and pays over to the chief a half share of the profits. Their other sources of revenue are market dues, court fines, and various cesses. Their aggregate income is approximately estimated at £5000, of which £2300 is derived from lime quarries. The total revenue of the district to the British Government in 1875 was £13,383, of which the larger portion came from royalties on lime quarries and the house tax; the expenditure was £9692. Education is conducted through the agency of the Welsh Calvinistic mission, and in 1874–75 there were seventy-three schools open, attended by 1666 pupils. Female education is making progress among the Khásias. The climate of the district is mild and equable, though in some parts excessively humid. At Shillong the thermometer rarely exceeds 80° Fahr., and falls as low as 38°. Shallow water occasionally freezes, but snow never falls. The rainfall at Chára Púnjí is the heaviest recorded in the world. The average during the three years ending 1876 is returned at 368.41 inches; and 805 inches are said to have fallen in 1861, including 366 inches in the single month of July. At Shillong the annual rainfall declines to about 85 inches; and at Jowái, which occupies an intermediate position, the average is 150 inches. The district is liable to shocks of earthquake. Generally speaking, the climate is healthy, both for natives and Europeans. Cholera never prevails, unless directly imported from the plains.

KHATMÁNDU, the capital of the kingdom of Nepál, India, situated on the bank of the Vishnumati river at its junction with the Bághmati, 27° 36′ N. lat., 85° 24′ E. long. The town, which is said to have been founded by Rájá Gunakámadeva about 723, now contains a population estimated at about 50,000, occupying 5000 houses made of brick, and usually from two to four stories high. Many of the houses have large projecting wooden windows or balconies richly carved. The mahárájá's palace, a huge, rambling, ungainly building, stands in the centre of the city, which also contains numerous handsome temples. The streets are extremely narrow, and the whole town very dirty. A British resident, with a small staff and escort, is stationed about a mile to the north of the city.

KHAZARS. This vanished people, who appear also as Chozars, as 'Ακάτζιροι or Χάζαροι in Byzantine writers, as Khazirs in Armenian and Khwalisses in Russian chronicles, Ugri Bielii in Nestor, and Kosa (?) in Chinese, occupied a prominent place amongst the secondary powers of the Byzantine state-system. In the epic of Firdousi "Khazar" is the representative name for all the northern foes of Persia, and legendary invasions long before the Christian era are vaguely attributed to them. But the Khazars are an historic figure upon the borderland of Europe and Asia for at least nine hundred years (190–1100 A.D.). The three hundred and fifty years 600–950 A.D. mark the epoch of their greatness, but their rise can be traced for four centuries before and their decline for one hundred and fifty years to follow. Their home was in the spurs of the Caucasus and along the shores of the Caspian—the "sea of the Khazars;" and their cities, all of them populous and civilized commercial centres, were *Itil*, the capital, upon the delta of the Volga, the "river of the Khazars," *Semender* (Tarkhu), the older capital, *Khamlidje* or *Khalendsch*, *Belendscher*, the outpost towards Armenia, and *Sarkel* on the Don. They were the Venetians of the Caspian and the Euxine, the organizers of the transit between the two basins, the universal carriers between East and West; and Itil was the meeting-place of the commerce of Persia, of Byzantium, of Armenia, of Russia, and of the Bulgarians of the Middle Volga. The tide of their dominion ebbed and flowed repeatedly during their history, but the normal Khazaria may be taken as the territory included between the Caucasus, the Volga, and the Don, with the outlying province of the Crimea or "Little Khazaria." The southern boundary never greatly altered; it did at times reach the Cyrus and the Araxes, but on that side the Khazars were confronted by the great power of Byzantium and Persia, and were for the most part restrained within the passes of the Caucasus by the fortifications of Dariel. Amongst the nomadic Ugrians and agricultural Slavs of the north their frontier fluctuated widely, and in its zenith Khazaria extended from the Dnieper to Bolgari upon the Middle Volga, and along the eastern shore of the Caspian to Asterabad.

Ethnology.—Few points have been more disputed than the origin of this interesting people; and there is still no consent amongst authorities upon the subject. They are assigned to the Turkish stock by Latham and Howorth, to the Ugrian by Klaproth and Vivien St. Martin, and have even been claimed as Jews on account of their use of the Hebrew character and the profession of the Hebrew faith amongst them. But their geographical position, their history, and the contemporary witness we have as to their physical character, their language, and their own national tradition, may be accepted as conclusive proof that the Khazars were an indigenous people of the Caucasus, and near akin to the Armenians and the Georgians.

Their king Joseph, in answer to the inquiry of the Rabbi Chasḍai Ibn-Shafrût of Cordova (*circ.* 958) stated that his people sprang from Thogarmah, grandson of Japhet, and the supposed ancestor of the other peoples of the Caucasus. The Arab geographers who knew the Khazars best connect them either with the Georgians (Ibn el Athîr) or with the Armenians (Dimishqy, ed. Mehren, p. 263); whilst Ahmed ibn Faḍlân, who passed through Khazaria on a mission from the caliph Moḳtadir (921 A. D.), positively asserts that the Khazar tongue differed not only from the Turkish, but from that of the bordering nations, which were Ugrian.

Nevertheless there are many points connected with the Khazars which indicate a close connection with Ugrian or Turkish peoples. The official titles recorded by Ibn Faḍlân are those in use amongst the Tartar nations of that age, whether Huns, Bulgarians, Turks, or Mongols. The names of their cities can be explained only by reference to Turkish or Ugrian dialects (Klaproth, *Mém. sur les Khazars*; Howorth, *Khazars*). Some too amongst the mediæval authorities (Ibn Ḥauḳal and Iṣṭakhry) note a resemblance between the speech in use amongst the Khazars and the Bulgarians; and the modern Magyar—a Ugrian dialect—can be traced back to a tribe which in the 9th century formed part of the Khazar kingdom. These characteristics, however, are accounted for by the fact that the Khazars were at one time subject to the Huns (448 A.D. *et seq.*), at another to the Turks (*circ.* 580), which would sufficiently explain the signs of Tartar influence in their polity, and also by the testimony of all observers, Greeks, Arabs, and Russians, that there was a double strain within the Khazar nation. There were *Khazars* and *Kara* (black) *Khazars*. The "Khazars" were fair-skinned, black-haired, and of a remarkable beauty and stature; their women indeed were sought as wives equally at Byzantium and Baghdad; while the "Kara Khazars" were ugly, short, and were reported by the Arabs almost as dark as Indians. The latter were indubitably the Ugrian nomads of the steppe, akin to the Tartar invaders of Europe, Huns, Bulgarians, and Hungarians, who filled the armies and convoyed the caravans of the ruling caste. But the Khazars proper were a civic commercial people, the founders of cities, remarkable for somewhat elaborate political institutions, for persistence, and for good faith—all qualities foreign to the Hunnic character.

They are identified with good reason (by Zeuss, V. St. Martin, Howorth, Latham) with the 'Ακάτζιροι (perhaps Ak-Khazari, "White Khazars") who appear upon the Lower Volga in the Byzantine annals, and thence they have been deduced, though with less convincing proof, either from the 'Αγάθυρσοι or the Καríαροι of Herodotus, iv. 104 (Latham, V. St. Martin). There was throughout historic times a close connection which eventually amounted to political identity between the Khazars and the Barsileens (the Passils of Moses of Chorene) who occupied the delta of the Volga; and the Barsileens can be traced through the pages of Ptolemy (*Geog.*, v. 9), of Pliny (iv. 26), of Strabo (vii. p. 306), and of Pomponius Mela (ii. c. 1, p. 119) to the so-called Royal Scyths, Σκύθαι βασιλῆες, who were known to the Greek colonies upon the Euxine, and whose political superiority and commercial enterprise led to this rendering of their name. Such points, however, need not here be further pursued than to establish the presence of this white race ("La Race Blonde" of Klaproth) around the Caspian and the Euxine throughout historic times. They appear in European history as White Huns (Ephthalites), White Ugrians (Sarogours), White Bulgarians. They were the carriers between Europe and the farthest East. Owing to climatic causes (see ASIA) the tract they occupied was slowly drying up. They were the outposts of civilization towards the encroaching desert, and the Tartar nomadism that advanced with it. They held in precarious subjection the hordes whom the conditions of the climate and the soil made it impossible to supplant. They bore the brunt of each of the great waves of Tartar conquests, and were eventually overwhelmed.

History.—From out of the mass of this white race of the steppe the Khazars can be first historically distinguished at the end of the 2d century of our era. They burst into Armenia with the Barsileens, 198 A.D. They were repulsed and attacked in turn, but thenceforth Khazar wars occupy a prominent place in the Armenian annals for eight hundred years. The pressure of the nomads of the steppe, the quest of plunder or revenge, these seem the only motives of these early expeditions; but in the long struggle between the Roman and Persian empires, of which Armenia was not seldom the battlefield, and eventually the prize, the attitude of this powerful people of the Caucasus assumed political importance. Armenia inclined to the civilization and ere long to the Christianity of Rome, whilst her Arsacid princes maintained an inveterate feud with the Sassanids of Persia. It became therefore the policy of the Persian kings to call in the Khazars to neutralize or to chastise the efforts of the Armenians in every collision with the empire (200–350). During the 4th century, however, the growing power of Persia culminated in the annexation of Eastern Armenia. The Khazars, endangered by so powerful a neighbor, passed from under Persian influence into that remote alliance with Byzantium which thenceforth characterized their policy and they aided Julian in his invasion of Persia (363). Simultaneously with the approach of Persia to the Caucasus the terrible empire of the Huns sprang up among the Ugrians of the northern steppes. The Khazars, straitened on every side, remained passive till the danger culminated in the accession of Attila (434). The emperor Theodosius, with reason terrified for civilization, sent envoys to bribe the Khazars ('Ακάτζιροι) to divert the Huns from the empire by an attack upon their flank. But there was a Hunnic party amongst the Khazar chiefs. The design was betrayed to Attila; and he extinguished the independence of the nation in a moment. Khazaria became the appanage of his eldest son, and the centre of government amongst the eastern subjects of the Hun (448). Even the iron rule of Attila was preferable to the time of anarchy that succeeded it. Upon his death (454) the wild immigration which he had arrested revived. The Khazars and the Sarogours (*i.e.*, White Ogors, possibly the Barsileens of the Volga delta) were swept along in a flood of mixed Tartar peoples which the conquests of the Jouan Jouan (the Avars) had set in motion. The Khazars and their companions broke through the Persian defences of the Caucasus. They appropriated the territory up to the Cyrus and the Araxes, and roamed at large through Iberia, Georgia, and Armenia. The Persian king, deeming the floodgates of the steppes opened, implored the emperor Leo I. to help him defend Asia Minor at the Caucasus (457), but Rome was herself too hard pressed, nor was it for fifty years that the Khazars were driven back, and the pass of Derbend fortified against them (*circ.* 507).

Throughout the 6th century Khazaria was the mere highway for the wild hordes to whom the Huns had opened the passage into Europe, and the Khazars took refuge (like the Venetians from Attila) amongst the seventy mouths of the Volga. The rise of the first Turk empire in Asia (554) precipitated the Avars upon the West. The conquering Turks followed in their footsteps (560–580). They beat down all opposition, wrested even Bosphorus in the Crimea from the empire, and by the annihilation of the Ephthalites completed the ruin of the White Race of the plains from the Oxus to the Don. The empires of Turks and Avars, however, ran swiftly their barbaric course, and the Khazars arose out of the chaos to more than their ancient renown. They issued from the land of Barsilia, and extended their rule over the Bulgarian hordes left masterless by the Turks, compelling the more stubborn to migrate to the Danube (641). The agricultural Slavs of the Dnieper and the Oka were reduced to tribute, and before the end of the 7th century the Khazars had annexed also the Crimea, had won complete command of the Sea of Azoff, and, seizing upon the narrow neck which separates the Volga from the Don, had organized the portage which has continued since an important link in the traffic between Asia and Europe. The alliance with Byzantium was revived. Simultaneously and, we cannot doubt, in concert with the Byzantine campaign against Persia (589), the Khazars had reappeared in Armenia, though it was not till 625 that this people, long known to Persians and Armenians as Khazirs and to the Romans as Akatzirs, take their place as Khazars in the Byzantine annals. They are then described as "Turks from the East," a powerful nation which held the coasts of the Caspian and the Euxine, and took tribute of the Viatitsh, the Severians, and the Polyane. The khakan, enticed by the promise of an imperial princess, furnished Heraclius with 40,000 men for his Persian war, who shared in the victory over Chosroes at Nineveh.

Meanwhile a power had arisen which transformed the whole course of Eastern politics and committed the Khazars to a struggle for life which lasted two hundred years. Mohammed had proclaimed his faith, and the Saracens were advancing to enforce it. The Persian empire was struck down (637), and the Moslems poured into Armenia. The khakan had defied the summons sent him by the invaders, and he now aided the Byzantine patrician in the defence of Armenia. The allies were defeated; and ere long the Moslems undertook the subjugation of Khazaria (651). It was the beginning of eighty years of ceaseless, obstinate, ineffectual warfare. Ten great invasions of Khazaria through the pass of Derbend are recorded, and many a retributive raid upon the Moslems; but in the end their fanaticism and enormous superiority of numbers prevailed. The khakan and his chieftains were captured and compelled to embrace Islam (737), and till the decay of the Mohammedan empire Khazaria with all the other countries of the Caucasus paid an annual tribute of children and of corn (737–861). Nevertheless, though overpowered in the end, the Khazars had protected the plains of Europe from the Mohammedans, and made the Caucasus the limit of their conquests.

In the interval between the decline of the Mohammedan empire and the rise of Russia the Khazars reached the zenith of their power. The merchants of Byzantium, Armenia, and Baghdad met in the markets of Itil (whither since the raids of the Mohammedans the capital had been transferred from Semender), and traded for the wax, furs, leather, and honey that came down the Volga. So important was this traffic held at Constantinople that, when the portage to the Don was endangered by the irruption of a fresh horde of Turks (the Petchenegs), the emperor Theophilus himself dispatched the materials and the workmen to build for the Khazars a fortress impregnable to their forays (834). Famous as the one stone structure is in that stoneless region, the post became known far and wide amongst the hordes of the steppe as Sar-kel or the White Abode. Merchants from every nation found protection, justice, and perfect good faith in the Khazar cities. The Jews, expelled from Constantinople, sought a home amongst them, developed the Khazar trade, and contended with Mohammedans and Christians for the theological allegiance of the pagan people. The dynasty accepted Judaism (*circ.* 740), but there was equal tolerance for all, and each man was held amenable to the authorized code and to the official judges of the faith which he professed. At the Byzantine court the khakan was held in high honor. The emperor Justinian Rhinotmetus took refuge with him during his exile and married his daughter, 702. Justinian's rival Bardanes in turn sought an asylum in Khazaria, and in Leo IV. (775) the grandson of a Khazar sovereign ascended the Byzantine throne. Khazar troops were amongst the bodyguard of the imperial court; they fought for Leo VI. against Simon of Bulgaria (888); and the khakan was honored in diplomatic intercourse with the seal of three solidi, which marked him as a potentate of the first rank, above even the pope and the Carlovingian monarchs. Indeed his dominion became an object of uneasiness to the jealous statecraft of Byzantium, and Constantine Porphyrogenitus, writing for his son's instruction in the government, carefully enumerates the Alans, the Petchenegs, the Uzes, and the Bulgarians as the forces he must rely on to restrain it.

It was, however, from a power that Constantine did not consider that the overthrow of the Khazars came. Long before, when a band of Slav prisoners was brought into the Khazar camp, a sage had prophesied—"These men's swords have two edges; ours have but one. We conquer now; but some day they will conquer us." The arrival of the Varangians amidst the scattered Slavs (862) had now united them into a nation and launched them upon that career of conquest which within a hundred years carried the Russian arms to the Balkans and the Caucasus. The advance of the Petchenegs from the East gave the Russians their opportunity. Before the onset of those fierce invaders the precarious suzerainty of the khakan broke up. By calling in the Uzes, the Khazars did indeed dislodge the Petchenegs from the position they had siezed in the heart of the kingdom between the Volga and the Don, but only to drive them inwards to the Dnieper. The Hungarians severed from their kindred and their rulers, migrated to the Carpathians, whilst Oleg, the Russ prince of Kieff, passed through the Slav tribes of the Dnieper basin with the cry "Pay nothing to the Khazars" (884). The kingdom dwindled rapidly to its ancient limits between the Caucasus, the Volga, and the Don, whilst the Russian traders of Novgorod and Kieff supplanted the Khazars as the carriers between Constantinople and the north. When Ibn Fadlân visited Khazaria forty years later, Itil was even yet a great city, with baths and market-places and thirty mosques. But there was no domestic product nor manufacture; the kingdom depended solely upon the now precarious transit dues; and the king or great khakan was a *roi fainéant* hidden from the sight of men, the actual administration being in the hands of a major domus also called khakan. At the assault of Swiatoslav of Kieff the rotten fabric crumbled into dust. His troops were equally at home on land and water. Sarkel, Itil, and Semender surrendered to him (965–969). He pushed his conquests to the Caucasus and established Russian colonies upon the Sea of Azoff. The principality of Tmoutorakan, founded by his grandson Mstislav (988), replaced the kingdom of Khazaria, the last trace of which was extinguished by a joint expedition of Russians and Byzantines (1016). The last of the khakans, George Tzula, was taken prisoner. A remnant of the nation took refuge in an island of the Caspian (Siahcouyé); others retired to the Caucasus; part emigrated to the district of Kasakhi in Georgia, and appear for the last time joining with Georgia in her successful effort to throw off the yoke of the Seljuk Turks (1089). But the name is thought to survive in "Kadzaria," the Georgian title for Mingrelia, and in "Kadzaro," the Turkish word for the Lazes. Till the 13th century the Crimea was known to European travellers as "Gazaria" the "ramparts of the Khazars" are still distinguished in the Ukraine; and the record of their dominion survives in the names of Kazarek, Kazaritshi, Kazarinovod, Kozar-owka, Kozari, and Kazan (Schafarik, ii. 65).

Authorities.—Khazar: The letter of King Joseph to R. Chasdai Ibn Shafrût, first published by J. Akrish, *Kol Mebasser*, Constantinople, 1577, and often reprinted in editions of Jehuda hal-Levy's

Kusari. German translations by Zedner (Berlin, 1840) and Cassel, *Magyar. Allerth.*, Berlin, 1848; French by Carmoly, *Rev. Or.* (1841). Comp. Harkavy, *Russische Revue*, iv. 69; Graetz, *Geschichte*, v. 364; and Carmoly, *Itinéraires de la Terre Sainte*, Brussels, 1847. *Armenian:* Moses of Chorene; comp. Saint-Martin, *Mémoires Historiques et Géographiques sur l'Armenie*, Paris, 1818. *Arabic:* The account of Ibn Faḍlân (921) is preserved by Yâķût, ii. 436 *sq.* See also Iṣṭakhry (ed. de Goeje, p. 220 *sq.*), *Mas'ûdy*, chap. xvii. 406 *sq.* of Sprenger's translation; *Ibn Ḥauķal* (ed. de Goeje, p. 279 *sq.*), and the histories of Ibn el Athîr and Ṭabary. Much of the Arabic material has been collected and translated by Fraehn, "Veteres Memoriæ Chasarorum," in *Mém. de St. Pet.*, 1822; Dorn (from the Persian Ṭabary) *Mém. de St. Pet.*, 1844; Dufrémery, *Journ. As.*, 1849. See also D'Ohsson's imaginary *Voyage d'Abul Cassim*, based on these sources. *Byzantine Historians:* The relative passages are collected in Stritter's *Memoriæ Populorum*, St. Petersburg, 1778. *Russian:* The *Chronicle* ascribed to Nestor

Modern.—Klaproth, "Mém. sur les Khazars," in *Journ. As.*, ser. 1, vol. iii.; Id., *Tableaux Hist. de l'Asie*, Paris, 1823; Id., *Tabl. Hist. de Caucases*, 1827; Memoirs on the Khazars by Harkavy and by Howorth (*Congrès intern. des Orientalistes*, ii.); Latham, *Russian and Turk*, pp. 209-17; Vivien St. Martin, *Études de Géog. Ancienne*, Paris, 1850; Id., *Recherches sur les populations du Caucase*, 1847; Id., "Sur les Khazars," in *Nouvelles Ann. des Voyages*, 1851; D'Ohsson, *Peuples du Caucase*, Paris, 1828. (P. L. G.)

KHELAT, the capital of Baluchistan, and the residence of the reigning khan, is situated, at an elevation of 6800 feet above the sea, in 29° N. lat., and 66° 40′ E. long., in a narrow valley, which is bounded to the east by the mountain ranges extending to the province of Cutch Gundava; to the west is the Sha Mirdan, on the northern slope of which hill the town is built; to the south the valley is closed by low hills, while to the north it is of sufficient breadth to allow space for two or three small villages. Through the centre of this valley runs a mountain torrent, which is generally dry, but after heavy rain pours down a considerable body of water. The town is surrounded by a mud wall about 30 feet in height, which is pierced by three gateways. The houses are built of mud, and number from three to four hundred; the streets are narrow and tortuous; it possesses a tolerably well supplied bazaar. A miri or citadel, having an imposing appearance, dominates the town, and contains within its walls the palace of the khan. It was in an upper room of this residence that Merab Khan, then ruler of Baluchistan, was killed during the storming of the town and citadel by the British troops at the close of the first Afghan war in 1839. The suburbs of Khelat are comparatively extensive, and contain from 10,000 to 12,000 inhabitants, which number, however, fluctuates according to the season, as well as with the political events passing in the country. There are to be found both in the town and suburbs residents representing many of the countries of Asia, viz., Hindus, Brahoes, Dehwars, Babé, Afghans, Persians, and Baluchis. The Hindu community forms the principal trading class, a fair proportion of which, however, includes the Babé tribe, while agriculture is almost entirely in the hands of the Dehwar tribe. The town is well supplied with excellent water, principally from a spring situated in the eastern side of the valley; this water is also used for irrigating the numerous inclosed gardens studded about, in which are grown most of the fruit trees to be found in European climates, including the vine, apricot, apple, and mulberry; vegetables of all descriptions thrive to perfection. The climate of Khelat is peculiarly dry and pure, nor is there heat during the summer months that can be called oppressive. The citadel, although offering an imposing appearance, has in reality no military value, and could offer no resistance to the artillery in use at the present day. It is quite impossible to give an idea of the period of the building of Khelat, though there can be no doubt that it is of very ancient origin, long prior to the Mohammedan era; but, as political events have now brought England into close friendly relations with the Baluch state, we may look forward to the unravelling of many traditions which now surround and obscure the history of Baluchistan and its capital.

KHERI, a district of Oudh, India, lying between 27° 41′ and 28° 42′ N. lat., and 80° 4′ 30″ and 81° 23′ E. long., bounded on the N. by the river Mohan, separating it from Nepál, E. by the Kauriála river, separating it from Bharáich district, S. by Sítápur district, and W. by Sháhjahánpur district in the Northwestern Provinces, with an area of 2963 square miles.

Kheri district consists of a series of fairly elevated plateaus, separated by rivers flowing from the northwest, each of which is bordered by a belt of alluvial land. The rivers are, commencing from the east, the Kauriála, Suheli, Daháwar, Chauka, Ul, Jámwári, Kathna, Gumti, and Sukheta. North of the Ul, the country is considered very unhealthy. This tract probably formed in ancient times the bed of a lake, through which flows two rivers, the Kauriála and Chauka, changing their courses constantly, so that the whole surface is seamed with deserted river-beds much below the level of the surrounding country. The vegetation is very dense, and the stagnant waters are the cause of endemic fevers. The people reside in the neighborhood of the low ground, as the soil is more fertile and less expensive to cultivate than the forest-covered uplands. South of the Ul, the scene changes. Between every two rivers or tributaries stretches a plain, considerably less elevated than the tract to the north. There is very little slope in any of these plains for many miles, and marshes are formed, from which emerge the head-waters of many secondary streams, which in the rains become dangerous torrents, and frequently cause devastating floods. The general drainage of the country is from northwest to southeast. Several large lakes exist, some formed by the ancient channels of the northern rivers being fine sheets of water; from 10 to 20 feet deep and from 3 to 4 miles long; in places they are fringed with magnificent groves. In the south there are some other large natural lakes. The whole north of the district is covered with vast forests—occupying an area of 650 square miles, of which 423 square miles are now Government reserves. *Sál* occupies about two-thirds of the whole forest area. *Kankar* (nodular limestone) of good quality is met with, and saltpetre is manufactured in large quantities. The wild animals include tigers, leopards, black buck, spotted deer, hogdeer, and *nílgái*.

At the census of 1869 the population was returned at 746,350 (males 403,837, females 342,513)—Hindus, 671,686; Mohammedans, 74,307; Christians, 96; "others," 261. Allowing for recent transfers, the latest return (based on the above census) gives the population at 739,283. All the towns now existing are of recent foundation, none dating earlier than the 16th century. Of their origin, one common tale is told. The Musalmán or Rájput founder came through the woods and marshes, and seized upon the slight hills or hummocks upon which some Pási or Ahír patriarch ruled over a few mud huts. The rightful owner fled deeper into the forest, and the intruder built a block house or a brick fort to guard against his return. Only three towns in 1869 contained upwards of 5000 inhabitants, namely, Kheri, Muhamdi, and Oel, with an aggregate population of 19,087. Lakhimpur, the civil station, is the only municipality in the district. The area under the chief agricultural products is returned as follows:—rice, 166,811 acres; wheat, 135,081; other food grains, 851,133; oil-seeds, 29,380; sugar-cane, 41,065; cotton, 6739; tobacco, 8265; vegetables, 6644; fibres, 419 acres. Poppy and indigo are also cultivated. District manufactures are confined to weaving and cotton printing for local requirements. Grain of all kinds is exported, as also are turmeric, tobacco, timber, sugar, syrup, hides, bullocks, and *ghí*. Catechu is made in large quantities throughout the north of the district, from the *khair* tree (*Acacia catechu*), the heart-wood of which is chopped out and boiled down by a caste called Khairís. *Khaskhas* (*Andropogon muricatum*), the roots of which are used for matting *tatti* screens, is exported in large quantities to Benares and Patna. Two great annual religious trading fairs are held at Gola Gokarannáth—one in January attended by about 50,000 people, and the other in February, lasting about fifteen days, at which 150,000 persons are said to assemble. This great fair is increasing rapidly in importance, goods to the value of about £15,000 being sold annually by traders from all parts of India. The imports, which consist mainly of cotton, salt, country cloth, and English piece goods, considerably exceed the exports in value. The district revenue in 1870 amounted to £74,132, of which £62,471 was derived from the land-tax. In respect of education, Kheri is the most backward district in Oudh. The mean annual temperature is about 79° Fahr.; the mean rainfall during the eleven years ending 1874 was 47.3 inches.

The present district only dates its history as an administrative unit from 1858. At the time of the mutiny of 1857 it was divided between the districts of Muhamdi and Mallápur, and was not constituted a separate district till the reorganization of the province on the pacification of the country.

KHERSON, a government of European Russia, on the borders of the Black Sea, and conterminous with Bessarabia, Podolia, Kieff, Ekaterinoslaff, and Taurida. The area is estimated at 27,455 square miles. Especially in the south the general aspect of the country is that of an open steppe, and almost the whole government is destitute of forest. The Dniester marks the western and the Dnieper the eastern boundary, and the Bug, the Ingul, and several minor streams traverse the intermediate territory. Along the shore lie a number of extensive lagoons. Chalk, saltpetre, salt, sandstone, and a limestone conglomerate largely used for building are the principal minerals. Besides the ordinary cereals, maize, hemp, flax, tobacco, and mustard are pretty commonly grown; the fruit trees of general cultivation include the cherry, the plum, the peach, and the mulberry; and gardening receives a large amount of attention. The agricultural condition of the government has been greatly improved by the presence of numerous German colonies. Cattle-breeding, horse-breeding, and sheep farming are pursued on a large scale. Some of the sheep farmers have as many as 30,000 or 40,000 merinos, and only a very small proportion of the 2,500,000 sheep in the government are of unimproved varieties. The value of the total industrial production has been estimated at upwards of £2,500,000,—the more important departments being the manufacture of wool, hemp, leather, and flour. The ports of Kherson, Otchakoff, Nikolaieff, and more especially Odessa are among the great outlets of Russian commerce; and Berislaff, Alexandriya, Elizabethgrad, Voznesensk, Olviopol, and Tiraspol play an important part in the inland traffic. In 1871 the total population of the government was 1,661,892; and besides Great and Little Russians it comprised Roumanians, Servians, Poles, Greeks, Germans, Gypsies, while no fewer than 44,107 were returned as Roman Catholics, 48,902 as Protestants, 3183 as Armenians, and 128,312 as Jews. There are six administrative districts—Alexandriya, Ananieff, Elizabethgrad, Kherson, Odessa, and Tiraspol. The towns with more than 5000 inhabitants are Odessa (184,820 in 1873), Nikolaieff (82,800), Elizabethgrad (35,200), Tiraspol (16,700), Ananieff (16,000), Alexandriya (10,520), Novo-Georgievsk or Kruiloff (10,225), Voznesensk (9450), Berislaff (8080), Bobrinetz (7150), Gregoriopol, Dubosarui, Novo-Mirgorod, Olviopol, and Otchakoff.

Kherson, the chief town of the above government, is situated on the right bank of the Dnieper, about 19 miles from its mouth. Founded by Prince Potemkin in 1778 as a naval station and seaport, it had become by 1786 a place of 10,000 inhabitants, and, although its progress was checked by the rise of Odessa and the removal (in 1794) of the naval establishments to Nicolaieff, it has still a population of more than 46,000. The Dnieper at this point breaks up into several arms, forming islands overgrown with reeds and bushes; it is difficult to maintain a deep navigable channel, and vessels of burden must anchor at Stanislavskoe Selo, a good way down the stream. Of the traffic on the river the largest share is due to the timber trade, and wool-dressing is the only extensive local industry. Kherson is a substantial and regular town. The cathedral is interesting as the burial-place of Potemkin, and near the church of the Assumption lie the remains of John Howard,[1] the English philanthropist. The fortifications have fallen into decay. The name Kherson was given to the town from the supposition that the site had formerly been that of Chersonesus Heracleotica, the famous Greek city founded by the Dorians of Heraclea.

KHIVA, an independent Uzbeg khanate of Turkestan, which occupies the fertile oasis stretching in a band of varying width along the left bank of the lower Oxus between Pitniak and the Sea of Aral. The inhabited district, which lies between 41° and 43° N. lat., and 59° and 61° 30′ E. long., and practically forms the limits of the khanate, is about 200 miles in length and has an average breadth of 25 to 30 miles—an area therefore of some 5000 to 6000 square miles.

This tract of territory is but a meagre relic of the great kingdom which under the name of Chorasmia, Kharezm (Khwárizm), or Urgentch held the keys of the mightiest river in Central Asia, and formed in consequence a precious jewel for rivalry among Eastern potentates from an early period of the world's history. Great alterations, geographically and politically, have taken place since those times. The Oxus has changed its outlet, and no longer forms a water-way to the Caspian and thence to Europe. A great European power has arisen which has made gradual but important encroachments in Asia, and between this power on the north and the independent Turcoman tribes on the south the authority of the khan of Khiva has been dwarfed and circumscribed within the narrow limits above indicated.

From the establishment of the Russians on the Lower Jaxartes in 1847 dates the decline in power of the khan of Khiva. Prior to that year the khan claimed sovereignty from the Caspian on the west to the confines of Khokand and Bokhara on the east, and from the northern margin of Ust Urt and the Jaxartes on the north to the mountain range forming the Persian frontier on the south, including Merv. Within these limits his authority was recognized, although towards the extremities this was merely nominal. Since that year the Russians have annexed the country between the Lower Jaxartes and Oxus, established the large trans-Caspian military district on the east shore of the Caspian, and conquered the Akhal Tekke country, thereby hemming in the Khivans on all sides. The Russians have, moreover, by imposing a large indemnity (two millions of roubles) for the campaign of 1873, so crippled the finances of the state that the khan, though nominally independent, is in reality a vassal and in a state of complete subjection to his more powerful neighbors. A Russian military force now watches the khanate from Forts Petro-Alexandrovsk and Nukus on the right bank of the Oxus, the former fort being within 35 miles of the capital.

History.—It would be impossible to trace here, even in the briefest manner, the changes through which Kharezm has passed, under the successive waves of migration and conquest which have swept across the country in ancient and historic times. The present insignificance and the eventual disappearance of the khanate from the map of Turkestan in the near future being intimately connected with the extension eastward of Russia, it will be more profitable to trace its history after its first connection with that power.

Russia commenced her relations with Khiva in the 17th century. The warlike Cossacks of the Yaik during their raids across the Caspian learnt of the existence of the rich territory of Khiva, and made an expedition to the chief town, Urgentch, at a time when the khan and his troops were absent. They carried off a large number of women and a rich booty, but were overtaken on their road home by the Khivans and killed to a man. Two subsequent expeditions under Atamans Nechai and Shemai proved equally disastrous to the Cossacks. These three expeditions were simply the raids of freebooters. In 1717, however, Peter the Great, having heard of the presence of auriferous sand in the bed of the Oxus, and desiring also to "open mercantile relations with India through Turan," and to release from slavery some Russian subjects, sent a properly equipped military force to Khiva. The command of the expedition, which consisted of 3300 men and six guns, with three months' provisions, was intrusted to Prince Bekovitch Tcherkassky. After establishing a fortified base of operations on the east shore of the Caspian, Bekovitch collected his forces at the mouth of the Ural and thence marched across the Ust Urt into Khivan territory. When within 100 miles of the capital he was encountered by the forces of the khan. The battle lasted three days, and ended in victory for the Russian arms. The Khivans, however, induced the victors to break up their forces into small detachments in order to facilitate supply, and then treacherously annihilated them in detail. This disaster did not prevent the Russians from sending embassies from time to time to the khan, but the representations of the envoys did not induce him to desist from enslaving Russian subjects or even to free those already in bondage. The Persian campaign which subsequently followed, the designs in other parts of Central Asia, and the constant embroilment of Russia in European wars caused Khivan affairs to recede temporarily to the background, and it was not until the third decade of the 19th century that the attention of the Muscovite Government was again directed to the khanate. In 1839 a force under General Perovsky, consisting of three and a half battalions, three Cossack regiments, and twenty-two guns, in all 4500 men, with a large train of camels, moved from Orenburg across the Ust Urt to the Khivan frontiers, in order to occupy the khanate, liberate the captives, and open the way for trade. This expedition likewise terminated in disaster. The inaccessibility of Khiva was once more her safeguard. Before the force reached half-way towards its destination it was forced to return, in consequence of the severity of the weather and the loss of life among the men and animals. These expeditions had convinced the Russians that for the effective control of the relations of Khiva a nearer position must be sought. In 1847 they founded the Raim fort at the mouth of the Jaxartes. As this advance deprived the Khivans not only of territory, but of a large number of tax-paying Kirghiz, while the establishment of a fort gave the Russians a base for further operations, a collision became sooner or later inevitable. For the next few years, however, the attention of the Russians was taken up with Khokand, their operations on that side culminating in the capture of Tashkend in 1865. Free in this quarter, they directed their thoughts once more to Khiva. In 1869 Krasnovodsk on the east shore of the Caspian was founded, and in 1871–72 the country leading to Khiva from different parts of Russian Turkestan was thoroughly explored and surveyed. In 1873 an expedition to Khiva was carefully organized on a large scale. The forces placed at the disposal of General v. Kaufmann started from three different bases of operation—Krasnovodsk, Orenburg, and Tashkend. The whole force consisted of more than 10,000 men. Khiva was occupied by the Russians almost without opposition. All the territory (35,700 square miles, and 110,000 souls) on the right bank of the Oxus was annexed to Russia and formed into the Amu Daria sub-district, while a heavy war indemnity was imposed upon the khanate. The difficult position financially in which the khan is thereby placed has more than once impelled him to beg the Russians to take the country under their administration. Russia, however, prefers the present arrangement of maintaining Khiva semi-independent instead of in complete subjection, for, not only does the collection of the indemnity fall upon the Khivan authorities, but the country shields the Russian possessions on the Oxus from the attacks of the Turcomans, which if made must first come in contact with the intervening territory of Khiva.

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[1] [His grave is at Dauphiny (see Vol. XII. p. 335), now Stephanovka, 6 versts N. of Kherson, and has a monument over it.—Am. Ed.]

Topography.—The Khivan oasis is indebted for its fertility to the waters of the Oxus, which by means of irrigating canals and ditches penetrate into what was at one time barren steppe. Where this water reaches the land teems with life; where it ends all is death and a waste. The area of sandy desert reclaimed by the Oxus is estimated by the late Major Wood, Madras Engineers, at 1½ millions of acres. The soil of the khanate is a tenacious clay of a red and gray color, more or less impregnated with sand,—the detritus brought down by the river. Black earth is seldom seen; but earth strongly impregnated with salt is frequently found. The oasis is generally level, except some unimportant heights and sand-hills.

That part of the Oxus which waters the khanate has at Pitniak a northwest direction, and flows within a single bed. Below Kipchak it bends sharply to the west, and after describing part of a semicircle to Hodjeili and giving off the Laudan, which with the Usboi forms the ancient course of the Oxus, resumes its northwest course to Kungrad. There it takes a north direction, dividing into two branches, the Taldyk and Ulkun, the latter the principal arm, and ultimately disembogues by many channels into the Sea of Aral. The banks of the river are generally low, and in midsummer do not stand more than 6 to 20 feet above the level of the water. The river is in flood three or four times a year, the chief periods being in April and May, when it overflows its banks and does much damage to the canal dams. The average velocity is about 3 miles an hour, but at times of inundation the current becomes much more rapid. The breadth of the river at ordinary times varies from ¼ to ¾ mile, but increases to 3 or more miles at inundations. There are no obstacles to navigation in the shape of rapids, but the shifting of the sand-banks acts as an impediment. The water of the Oxus is wholesome, although of a yellowish-brown color, which is due to particles in suspension. These particles are gritty, and unlike the mud of the Nile do not fertilize the ground. The deposit from the water when dried is used by the Khivans to form their dams. In consequence of the large body of matter brought down, the irrigating canals require constant clearing. These canals vary from 20 to 150 feet in breadth, and from 10 to 20 feet in depth, and are sometimes as much as 80 miles long. They have a current of about 2 miles an hour, and are mostly navigable by boats. The direction of the canals is west and northwest, from which it may be concluded that the left bank of the river has a natural slope towards the Caspian. By actual measurement it has been found that the fall of the ancient bed is 400 feet from the point near Kipchak where it had its origin to Balkhan Bay in the Caspian —a distance of 500 miles.

From the statement of Abulghazi Khan and other proofs there can be little doubt that two hundred and fifty years ago the Oxus flowed into the Caspian through the Usboi, which was connected with the present channel by at any rate three arms—Daudan, Daryalik, and Lauzan or Laudan. The alteration in the course of the river was probably due to the gradual elevation of the land where the old bed passed, from which naturally resulted a diminution in the velocity of the stream, and at the same time a silting of the channel. From this cause the waters of the Oxus found for themselves another outlet. Whether the Russians will be able to carry out their scheme of forcing the Oxus to resume its old course to the Caspian it would be premature to offer an opinion, but the surveys at present are not favorable. The advantages to Russia would be great, as she would have a continuous waterway from the Volga to Afghanistan.

The khanate has numerous lakes, especially towards the Aral, connected together by affluents and canals. They are usually covered with reeds. Lake Aibugir, once a large inlet of the Aral, is now dry.

The means of communication in the khanate is by road and by water. The roads are usually narrow, but some are as much as 70 feet wide. In spring and autumn, at the time of inundations, they are in bad order. Internal trade is carried on by camels and by carts.

Government.—The government is an absolute despotism, and, subject to a certain moral control exercised by the proximity of the Russians, is entirely in the hands of the khan. The chief secular officials are (1) the *kush-begi* or vizier, prime minister; (2) *mehter*, chancellor of the exchequer; (3) *inakh*, four in number, local governors; (4) *metch-mehrem* and *batchman*, controller and collector of customs respectively; (5) *biy*, the khan's supporter in battle; (6) *minbashi*, *yuzbashi*, and *onbashi*, belonging to the military class, and now fast disappearing. The *ulema* or priests, of whom the nakib is the chief, are subdivided as follows:—(1) *kazi kelan* and *kazi*, judicial functionaries; (2) *alem*, chief of the five muftis; (3) *reis*, *mufti*, and *akhond*. The acknowledged religion is the Suni form of Mohammedanism. Justice is administered in the mosques and in the private dwellings of the cadis and muftis, but every Khivan subject has the right to prefer his complaint before the governor or even before the khan.

Revenue.—The khan's revenue is derived from (1) the land-tax, paid in coin by all sedentary Khivan subjects, and in cattle (2½ per cent.) by nomads; (2) a customs due on all incoming and outgoing caravans, and on the sale of cattle—2½ per cent. *ad valorem;* (3) the rent of crown lands. The revenue of certain districts is set aside for the support of the relatives of the reigning khan, and of the rest the greater part is exhausted in paying the large indemnity imposed by the Russians after the campaign of 1873.

Population.—The inhabitants are partly sedentary and partly nomad. They include Uzbegs, Karakalpaks, Turcomans, Sarts, Kizilbashes, and Arabs—the first three of Mongol origin, the rest of Aryan descent. The Uzbegs come from a Turk stock, and constitute the dominant class. Some few live in towns, but the bulk reside on their farms, where they occupy themselves in agriculture, gardening, silk cultivation and fishing. Very few engage in trade. They are divided into tribes. The Karakalpaks, or "black-hats," are supposed to be a clan of Uzbegs. They inhabit the lower part of the Oxus, and are mostly stock-breeders; they are divided into tribes, and are nearly all nomadic. The Turcomans are of similar origin to the Uzbegs, and are divided into tribes, of which the chief are the Yomud, Karadashli, Goklen, Ersari, Chaudor, and Imrali. They are all engaged in breeding horses and stock and in agriculture. Some are sedentary, while others migrate to the steppe in summer. The Sarts or Tajiks, who were probably the original inhabitants of the country, live chiefly in the large towns and are engaged in trade or in handicrafts, some in agriculture and silk cultivation. The Kizilbashes are liberated Persian slaves, and are distributed over the khanate, but more particularly inhabit the Tashauz district. Of the Semitic race we find Arabs in small numbers at Shavat. They form the living monuments of the Arab conquest.

Owing to the absence of any census it is impossible to give more than a very rough estimate of the population of the Khivan oasis. Major Wood, a competent observer, estimated it in 1875 at 300,000 souls, of whom two-thirds are Uzbegs and Tajiks. Liberated Persians and other slaves make up 50,000, while the remainder is composed of sedentary Turcomans, who occupy cultivated lands, or who nomadize about the western borders of the khanate.

There is no marked division of the people into castes or classes. A Khivan may be a merchant, an agriculturist, or craftsman as he pleases; he may possess land or other real property, but for this privilege he must fulfil his obligation to the state, pay taxes, and furnish laborers for digging or repairing canals, upon which the life of the oasis may be said to depend. Only the military class, the priesthood, and the khodjas are exempt from the payment of taxes. The khodjas consider themselves descendants of the prophet; they pay no taxes and render no military service, nor do they furnish canal labor. They are derived from the same stock as the khodjas of Turkestan, and according to tradition came to Khiva six hundred years ago. Agriculture, trade, and handicrafts constitute their chief employment.

Towns.—Khivan towns are nothing more than agglomerations of houses without plan or regularity; the streets are so crooked and narrow that two carts can only pass with difficulty or not at all. The towns are usually surrounded by a defensive wall, in a more or less dilapidated state; sometimes there is also a wet ditch. Outside the walls stretches an extensive suburb. Each town contains usually a bazaar, a caravanserai, and one or more medresses (ecclesiastical colleges) and mosques. The population consists of government officials, shopkeepers, mechanics, and a very few agriculturists. There are no villages as we understand the term,—only farmsteads dotted at intervals along the banks of the canals. The security against Turcoman raids which is given to the townspeople by the wall and ditch is replaced in the case of the farming class by small round guard-houses (karachi-khane) constructed along the same canals where the farmsteads are placed.

The chief towns are Khiva (the present capital and residence of the khan); Khazarasp, spoken of by the Arab geographers as a strong place in the 10th century, a reputation it still maintains; New Urgentch, the chief trading town; Tashauz, another strong place; Gurlen, Hazavat, Ilalli, Kipchak, Khanka, Hodjeili, Kungrad, Pitniak, Kunia Urgentch (once the capital, but destroyed first by Jenghiz Khan, and afterwards by Timur), and Kiat, which up to the 15th century was the capital of Kharezm, but is now a place of little importance.

Climate.—The climate is quite continental, but is healthy, and the people are long-lived. The prevailing ailments are small-pox, inflammation of the eyes, and ague. Cholera is a rare visitant. Winter begins in November and lasts until February. At this season the thermometer sometimes falls to 20° Fahr., and the Oxus freezes to a depth of 6 to 12 inches. At the end of March the vine, pomegranate, and fig commence to bud, and in the first days of April are covered with green. Wheat harvesting commences early in July; about this time apricots and plums ripen. Leaves begin to grow yellow and fall in the first half of November. The west wind is distinguished by its violence, but it only rages in spring. At this season the north wind also blows strongly. When the wind is in these quarters dews are abundant. Severe storms and earthquakes are of rare occurrence; and, generally speaking, there is little rain, snow, or hail.

Products.—The chief agricultural products are wheat, jugara, rice, sesamum, millet, chigin (a variety of millet), barley, mash (a pulse), linseed, cotton, hemp, lucerne, tobacco, poppy, and madder. The gardens furnish the melon, cucumber, pumpkin, capsicum, garlic, onion, beet, radish, carrot, turnip, potato, and cabbage. Of fruits the mulberry, apple, pear, cherry, plum, date, peach, pomegranate, and grape are in abundance. Of trees we find in small quantities the poplar, black poplar, plane, elm, willow, karaman (a sort of elm), and narvan (a species of oak). Saksaul (*Holoxylon ammodendron*) is found in quantities, and furnishes excellent fuel. Shrubs of various kinds are indigenous, and the reed grass, in the absence of meadow-land, affords good fodder for cattle.

Khiva furnishes no metals, but sulphur and salt are present in sufficient quantities to satisfy home demands.

The domestic quadrupeds are camels, horses, asses, horned cattle, sheep, and goats. Of wild animals are found the hog, giraffe, panther, jackal, fox, wolf, and hare. The feathered tribe is represented by the wild goose, swan, crane, pelican, duck, moorhen, bustard, pheasant, quail, snipe, partridge, magpie, crow, sparrow, nightingale (in large numbers), and lark, besides domestic fowls and pigeons. The fish include sturgeon, sterlet, bream, pike, carp, and sandre.

Trade and Industry.—The trade of Khiva, in the Middle Ages very considerable, has in the present day declined to insignificant proportions. At the epoch when Arab trade flourished, and in the time of Jenghiz Khan, Kharezm possessed important trade routes. Along these routes were dug deep stone-lined wells, and they were moreover dotted at intervals with caravanserais; so that, in the words of a historian of the 14th century, the traveller from Khiva to the Crimea need make no provision for his journey, for all that was needful could be procured from caravanserais on the way. In this latter half of the 19th century the trade is unimportant, and even the ruins of the caravanserais and wells are to be detected with difficulty. The merchants of New Urgentch, it is true, take their wares as far as the great Russian fair of Nijni Novgorod on the west, to Bokhara on the east, and to Persia on the south, but the caravans are small and money is scarce. The chief articles of trade are horned cattle, camels, horses, sheep, cereals, khalats, silk and cotton cloth, clothing, gunpowder, arms, agricultural implements, two-wheeled carts, saddlery, harness, boats, wood, potash, salt, etc. These wares are sometimes bartered, sometimes sold for money. Dried fish is also an article of export for the Bokhara market. The cotton is of excellent quality, and the silk of Khazarasp is renowned in Central Asia.

Of manufactures there are none in the true sense of the word. The Khivans weave in their hand-looms cotton and silk cloth sufficient to satisfy their home necessities. In handicraft they are specially clever as armorers, smiths, and founders. The fuel used is saksaul.

Currency.—The money of the country is the gold tilla, the silver tenghe, and the copper pul. The tilla is worth 28 to 35 tenghe, or from sixteen shillings to a pound, according to the exchange; while the tenghe, value about sevenpence, is equivalent to about 35 to 50 puls. Russian, Persian, and Bokharian money are also in circulation.

Khiva, a fortified city, capital of the khanate of the same name, situated between two canals derived from the Oxus, and in the midst of green fields, orchards, and high poplars. It lies in 41° 22′ 30″ N. lat. and 60° 25′ E. long., about 400 miles east of Krasnovodsk on the Caspian, 350 miles north of Meshhed in Persia, and 700 miles north-northwest of Kandahar. The city is girt with two mud walls. The inner wall, which surrounds the main town, is built on a low eminence, and forms a tolerably regular parallelogram with four towers at the angles. This wall is about 24 feet high, and has a perimeter of some 2500 yards. Three gates lead into the inner town. The outer wall, 10 feet high, was built in 1842 to inclose a former suburb, and has an irregular perimeter of 7200 yards. Twelve gates pierce this outer wall. In the main or inner town are two palaces of mean appearance, seventeen mosques, twenty-two educational seminaries, a caravanserai, a covered bazaar of some one hundred and twenty shops, and two hundred and sixty other shops distributed over the place. The principal mosques are those erected in honor of the saints Polvan Ata and Seid Bai. (F. C. H. C.)

KHOI, a town and district in the province of Azerbijan, Persia, towards the extreme northwest frontier, between Lake Urumiyah and the river Aras. The town lies in 38° 37′ N. lat., 45° 15′ E. long., 77 miles northwest of Tabriz, on the great trade route between the Euxine and Persia, and on the Kotura, a tributary of the Aras, crossed here by a seven-arched bridge. The fortifications, which are in a ruinous state, consist of an outer line of bastions, redans, glacis, ditch and covered way, and an inner high wall flanked with towers, the intervening space being occupied with gardens and mud hovels. But the central part forms one of the best laid out towns in Persia, cool streams and lines of willows running along its broad regular streets. Here are a few good buildings, including the governor's palace, several mosques, a large brick bazaar second only to those of Shiraz, and a fine caravanserai. There is a large transit trade, and considerable local traffic across the Turkish border. Ophthalmia is very prevalent, about 10 per cent. of the inhabitants suffering from inflammation of the eyes. The chief manufactures are copper wares and worsted socks. Here the Turks under Selim I. gained a great victory over the Persians in 1514, but with such heavy losses to themselves that the battle was long after known as the "day of doom." In September, 1881, Khoi was visited by a series of violent earthquakes, the seismic waves running northwest and southeast in the direction of the main mountain ranges. The population numbers about 30,000, including many Armenians, who occupy a separate quarter. The district consists of an elevated plateau 60 miles by 10 to 15, highly cultivated by a skilful system of drainage and irrigation, producing a series of fertile oases laid out in meadows, gardens, and tillage, and yielding rich crops of wheat and barley, besides apples, pears, cherries, walnuts, chestnuts, and unrivalled mulberries.

KHOJEND, or **Hodjent**, chief town of the Khojend and Jizak district in the province of Sír Daria, in Russian Turkestan, is situated on the left bank of the Sír Daria or Jaxartes, 96 miles southeast from Tashkend, and on the direct road from Bokhara to Khokand. The Russian quarter lies between the river and the native town. Near the river is the old citadel, built on the top of an artificial square mound, about 100 feet high, which Mr. Schuyler suspected to be a mere hollow wooden framework, only half filled in with earth. The bazaar of Khojend is very large in proportion to the size of the town. There is a wooden bridge over the Jaxartes, whose banks at this point are so high as to make the river useless to the town in the absence of pumping gear; so that when the little stream Khoja Bakargan dries up in summer, there is much suffering from want of water. The great heat intensifies the distress. There is now no very great trade in Khojend. Formerly the entire commerce between the khanates of Bokhara and Khokand passed through it, but since the Russian occupation much of that has been diverted. Silk worms are reared, and silk goods are manufactured in the town. A coarse sort of ware is made in imitation of the Chinese porcelain. Lignite is carried to Tashkend from the neighborhood of Khojend. The surrounding district is tolerably well cultivated; immediately about the town the ground is taken up with cotton plantations and vineyards. The majority of the inhabitants are Tajiks. They are sociable and pleasure-loving, and the whole air of the town is agreeable. The population for 1873 is put down by Mr. Schuyler at 30,000.

Khojend has always been a bone of contention between Khokand and Bokhara; and, although belonging from very ancient times to the former, it has often been seized by the latter. When the ameer of Bokhara assisted Khudayer Khan to regain his throne in 1864, he kept possession of Khojend. In 1866 it was stormed by the Russians; and during the war with Khokand in 1875 it played an important part.

KHOKAND, a city of Turkestan, was, previous to the Russian conquest, the capital of an independent khan, but, owing mainly to the fact that those who reside in it are subject to goitre, it has not been made the administrative centre of the Russian province (Ferghana, *q.v.*). The town is situated on the skirts of the Kashgar Devan ridge, which separates Kashgar from Ferghana, and it is traversed by three mountain gullies which send their scanty waters to the Jaxartes. Dating only from the reign of Saur Khan, about the early part of the 18th century, Khokand has within the 10 miles circuit of its mud walls a greater amount of space to spare than is to be found in any other city of Central Asia; some of the market-places are of great extent, and the bazaar is built on a more handsome scale than that even of Tashkend. The palace erected by the last khan is after the style of the palace at Samarkand, and rivals it in the rich coloring of its enamels and the general effect of its relief. The audience chamber now serves as a Russian church and the women's departments are occupied by the Russian governor of the fortress. The mosques, according to native exaggeration, number 600, and there are fifteen colleges. The gardens, especially those of the palace, are conspicuous for their rich foliage. Silk weaving and papermaking are the chief industries. Coins bearing the inscription "Khokand the Charming," and known as khokands, have a wide currency. Population about 75,000.

See Schuyler's *Turkistan*, 1876; Khoroshkin's narrative translated in *Recueil d'itinéraries et de voyages dans l'Asie Centrale*, Paris, 1878; Ujfalvy, "L'Asie Centrale," in *Tour du Monde*, 1880.

KHONSAR, a town in the province of Irak-Adjemi, Persia, 92 miles northwest of Ispahan on the Hamadan route, in a gorge of the hills, which here approach so close that all the intervening space is occupied by the houses and their garden plots. The town straggles some 6 miles along the gorge, with a mean breadth of scarcely half a mile. There is good water from the hills, and a great profusion of fruits, the apples yielding a kind of cider, which does not keep. The climate is cool in summer but excessively cold in winter. Population 2500 families, or about 12,500 souls.

KHORAMABAD, a town and fortress of Persia, capital of the province of Luristan, in 33° 32′ N. lat., 47° 43′ E. long., 138 miles west-northwest of Ispahan, 117 southeast of Kirmánsháhán. The fort is perched on an isolated steep rock in the middle of a difficult pass, and is 1000 yards in circuit. The modern town lies at the southwest foot of the fort in a narrow valley watered by the broad but shallow and rapid river Kashgan. A rich plain stretching thence southwards yields abundance of supplies. Population about 6000.

KHORÁSÁN, *i.e.*, "land of the sun," a geographical term originally applied to the eastern quarter of the four, named from the cardinal points, into which the ancient monarchy of the Sassanians was divided.[1] After the Arabic conquests the name was retained both as the designation of a definite province and in a looser sense. Under the new Persian empire the expression has gradually become restricted to the northeastern portion of Persia proper, of which it now forms the largest province. The boundaries of this vast region have scarcely anywhere been accurately determined, and have constantly fluctuated, especially towards the north and east. Speaking generally, however, the province is conterminous on the east with Afghanistan and Sistan, north with Astrabad and the recently organized Russian trans-Caspian territory, northeast with the Turkoman country, west with Mazandaran and Irak-Adjemi, south with Farsistan and Kirman. It lies mainly within 33° 30′–38° 30′ N. lat. and 53°–61° E. long., extending 500 miles northwest and southeast and 300 north and south, with total area of about 150,000 square miles, and a population estimated at from 800,000 to over 1,000,000.

The surface in the north, southwest, and partly in the east is distinctly mountainous to a far greater extent than is commonly supposed. The ranges generally run in two or more parallel ridges, inclosing extensive longitudinal valleys, and running in the normal direction from northwest to southeast. The whole of the north is occupied by an extensive highland system forming a continuation of the Hindú Kúsh and Paropamisus, and stretching from the Herat valley between the Iranian plateau and the Turkestan depression northwest to the southeast corner of the Caspian. This system, for which there is no general name, but which is now sometimes spoken of collectively as the Kuren-Dagh or Kopet-Dagh, from its chief sections, forms in the east three ranges, the Hazar-Masjid, Binalud-Kuh, and Jagatai, inclosing the Meshhed-Kuchan valley and the Jagatai plain. The former is watered by the Kashaf-rud, or river of Meshhed, flowing east to the Hari-rud, their junction forming the Tejend, which sweeps round the Daman-i-Koh, or northern skirt of the outer range in the direction of the Caspian or Usboi (old bed of the Oxus), but now losing itself in the desert long before reaching them. The Jagatai plain is watered by the Kal-Mura river, formed by the junction of the Kara-su and several other head streams, and flowing southwest to the Great Salt Desert. In the west the northern highlands also develop three branches, the Kuren-Dagh stretching through the Great and Little Balkans to the Caspian at Krasnovodsk bay, the Ala-Dagh forming a continuation of the Binalud-Kuh and the Astrabad mountains merging southwestward in the Elburz system. The Kuren and Ala Daghs inclose the valley of the Atrek, which flows mainly west to the Caspian at Hasan Kuli bay. The western offshoots of the Ala-Dagh and the Astrabad mountains inclose in the same way the valley of the Gurgan, which also flows westward to the southeast corner of the Caspian. The outer range has probably a mean altitude of 8000 feet, the highest known summits being the Hazar-Masjid (10,500 feet) and the Kara-Dagh (9800); it is crossed by the Maidan-Kuni and Allaho-Akhbar (4200 feet), passes leading from Kuchan north to the Daragez district. The central range seems to be still higher, culminating with the Shah Jahan Kuh (11,000 feet), the Kuh Ala-Dagh (12,300), and Kuh Khorkhud (12,500). The southern ridges, although generally much lower, have the highest point of the whole system in Shah-Kuh (13,000 feet) at the junction of the Astrabad and Elburz ranges.

Another system runs diagonally right across the province from Yezd in the southwest to the Hari-rud valley in the northeast, throwing off the Kuh Shorab, Kuh Shutari (10,000 feet), and Kuh Nastanji (8000 feet) in the Tabbas district. Towards Sistan the country is also very mountainous, with several nearly parallel ridges stretching from near Tún southeast to the Hamun lake or swamp.

Beyond the Atrek and others watering the northern valleys there are scarcely any rivers, and most of these are brackish and intermittent, losing themselves in the Dasht-i-Kavír or Great Salt Desert, which occupies the central and western parts of the province, and which is separated by the diagonal range from the more sandy and drier desert of Lut in the south. The true character of the kavír, which forms the distinctive feature of East Persia, has scarcely yet been determined, some regarding it as the bed of a dried-up sea, others as developed by the saline streams draining to it from the surrounding highlands. Collecting in the central depressions, which have a mean elevation of scarcely more than 500 feet above the Caspian, the water of these streams is supposed to form a saline efflorescence with a thin whitish crust, beneath which the moisture is retained for a considerable time, thus producing those dangerous and slimy quagmires, which in winter are covered with brine, in summer with a thick incrustation of salt. "The waters of all springs and rivers contain salts in minute quantities, but the rivers of Persia are often so salt as to be undrinkable. The salts brought down by the rivers are deposited in the marsh, which thus gets salter year by year. It dries up during the fierce summer heats, to become a marsh again when the winter floods occur. This process is repeated for ages, and in the course of time the whole soil over which the marsh extends becomes incrusted with salt."[2]

The surface of Khorasan thus consists mainly of highlands, saline swampy deserts, and fertile well-watered upland valleys. Of the last, occurring mainly in the north, the chief are the longitudinal valley stretching from near the Herat frontier through Meshhed, Kuchan, and Shirvan to Bunjurd, and the Daragez district, which lies on the northern skirt of the outer range projecting into the Akhal Tekke domain, now Russian territory. These fertile tracts produce rice and other cereals, some cotton, tobacco, saffron, and especially melons and other fruits in great profusion, 45 ℔ of splendid grapes being sold in Daragez for ninepence. Other products are manna, gums, and great quantities of asafœtida, which is not used by the natives but exported to India. The chief manufactures are the famous Khorasan sabres, firearms, stoneware, armor, fine carpets and rugs, velvets, woollens, cottons, and sheepskin pelisses.

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[1] See Nöldeke's translation of Ṭabari, p. 155.

[2] Colonel C. E. Stewart, in *Proc. Roy. Geog. Soc.*, September, 1881. This traveller visited the north frontier of Persia in 1880-81, disguised as an Armenian horse-dealer from Calcutta.

The population is far from homogeneous, consisting of Iranians (Tajiks, Kurds, and Baluchis), Mongols Tartars, and Arabs, as under:

Races.	District.	Population.	Speech.
Tajiks (Persians)	Towns and agricultural districts.	400,000	Persian.
Kurds	N. frontier.	250,000	Persian mostly.
Baluchis	East frontier.	10,000	Baluchi.
Mongols. Taemuri Aimaks,	South and E. frontiers.	250,000	Persian.
Hazarahs.	Herat frontier.	50,000	
Tartars. Turkomans, Afshars, Kajars, etc.[1]	North and W. mainly.	100,000	Turki & Persian.
Arabs	S. & W. mainly.	100,000	Persian.[2]
		1,160,000	

The Persians proper have always represented the settled, industrial, and trading elements, and to them the Kurds (removed to the north by Shah Ismail) and the Arabs have become largely assimilated. Even many of the Tartar nomad tribes, collectively called Iliat,[3] have become *Shahr-nishin*, *i. e.*, "townsfolk," or settled. But all the Baluchis are not only still *Sahra-nishin*, *i. e.*, "country or desert folk," but have lately resumed their old predatory habits, covering incredible distances on their swift camels, and harassing the country as far west as the Yzed district. On the other hand, the raids of the Turkoman marauders have almost entirely ceased since the reduction of the Akhal Tekke Turkomans by the Russians in the spring of 1881. In religion great uniformity prevails, all except the Baluchis and Turkomans having conformed to the national Shiah sect.

The administrative divisions of the province seem to be Daragez, Kuchan, Turshiz, Tabbas, Ghayn, Khaf, Meshhed, Nishapur, Shahrud, and Damgan. The chief towns are Meshhed, Kuchan, Mohammadabad, Shirvan, Bostan, Turshiz, Tún, Tabbas, Khaf, and Ghayn. (A. H. K.)

KHOSRU. See PERSIA.

KHOTAN, a city and district of Eastern Turkestan, lying between the northern slopes of the Kuenlun Mountains and the eastern portion of the Gobi (Takla Makan) desert. The district is well watered by a number of rivers, the most important of which, the Karakash and the Khotan Daria, meet to the north of the city. Both soil and climate are excellent, and the vegetation is characterized at once by variety and luxuriance. Indian corn, barley, jowar, buckwheat, rice, olives, pears, peaches, apricots, mulberries, grapes, currants, melons, the charas plant, the cotton plant, are all produced in abundance. Willows, poplars, and tamarisks are the ordinary trees: in some parts they form extensive forests. Of the mineral wealth of the country, glowing accounts are given,—gold, copper, iron, antimony, salt, sulphur, coal, jade, and a variety of precious stones being the principal items. Upwards of twenty gold mines are known to exist, and those of Sorghak and Kappa are worked by 4000 and 3000 men respectively. Jade is obtained, more especially in the Karakash district. Among the wild animals are goats, wolves, jackals, foxes, and hares; and the Khotanese keep camels, horses, mules, asses, goats, sheep, geese, ducks, and fowls (the goats and the fowls being particularly numerous). The total number of the inhabitants is variously estimated at from 130,000 to 250,000, and the country is capable of maintaining a much denser population. Females preponderate to as much as 25 per cent. There are six districts, each with a town of its name—Khotan or Ilchi (42,000), Karakash (7000), Yurung Kush (7000), Tchira (28,000), Kiria (28,000), and Naya (3500). The city of Khotan (in Chinese Hutan, locally Ilchi) is situated 150 miles southeast of Yarkand and 90 miles due east of Sanju, and is only 6 miles distant from the borders of the desert. It has long been celebrated as a great industrial centre, silks, felts, rich carpets (of either silk or wool), paper, and articles in jade being the chief productions; and its traders maintain an active traffic with Thibet.

As early as the 1st century the town contained (according to Chinese authorities) 3300 families. Cotan, as he calls it, was one of the places visited by Marco Polo. In modern times the first European who reached the city was Mr. Johnson, in 1865. At that time it was governed by a local khan, the Chinese having been expelled by their Mohammedan subjects, in 1863; and since then it has been subjugated by Yakub Khan of Kashgar (who perpetrated a terrible massacre at his capture of the place), and again recovered by the Chinese forces.

See Johnson, *J. R. G. S.*, 1867; Sir D. T. Forsyth, *Mission to Yarkund*, Calcutta, 1875.

KHOTIN, or KHOTEEN (this is the Russian form of the name which appears in a great variety of disguises—partly dialectal—such as Khotchim, Chotchim, Choczim, and Chocim), a fortified town of 21,000 inhabitants, in the government of Bessarabia, Russia, situated in 48° 30′ N. lat., and 26° 30′ E. long., on the right bank of the Dniester, near the Austrian (Galician) frontier, and opposite Podolian Kamenetz. Though it possesses a few manufactures and carries on a considerable trade both legitimate and contraband, Khotin has all through its history been of importance mainly as a military post. In the Middle Ages it was the seat of a Genoese colony; and it has passed through periods of Polish, Turkish, and Austrian possession. The chief facts in its annals as a fortress are the defeat of the Turks in 1621 by Ladislaus IV., in 1673 by John Sobieski, and in 1739 by the Russians under Münnich: the defeat of the Russians by the Turks in 1768; the capture by the Russians in 1769; and the occupation by the Russians in 1806. It finally passed to Russia along with Bessarabia in 1812 by the peace of Bucharest.

KHULNA, or CULNA, a town in Jessor district, Bengal, India, situated at the point where the Bhairab river debouches on the Sundarban delta, in 22° 49′ N. lat., 89° 57′ E. long., may be described as the capital of the Sundarbans, and for the last hundred years at least has been a place of considerable importance. It was the headquarters of the salt department under the East Indian Company. The whole boat traffic from the east and northeast passes here on its way to Calcutta; from Calcutta the principal cargo is Liverpool salt, the trade in which is very considerable. There are numerous sugar refineries.

KHURJA, an important trading town and station on the East Indian Railway in Bulandshahr district, Northwestern Provinces, India, 28° 15′ N. lat., 77° 54′ E. long. The population in 1872 was 26,858—15,543 Hindus and 11,315 Mohammedans. A large business in raw cotton is carried on, of which about 70,000 cwts. are annually exported to Cawnpur, Mírzápur, and Calcutta; eight cotton presses are at work in the town. There is a local trade in cotton safflower, indigo, sugar, molasses, grain, rice, and *ghí*.

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[1] The Kajars are the royal tribe to which the present dynasty belongs; hence the reigning shah's title, Násir ed-dín Shah Kájár. But Nadir Shah, though commonly called a Kajar, was an Afshar.

[2] Some travellers have stated that the Khorasan Arabs still speak Arabic as well as Persian—a mistake due probably to the fluency with which they repeat passages from the Koran. The great bulk of them have long been "Parsivan" or "Persian-speaking."

[3] *Iliat* (plural of Ili) simply means "tribes," and is applied indifferently to all the nomads of Persia whatever their affinities may be.

KHUSHÁB, or KOSHAUB, a town in Sháhpur district, Punjab, India, situated on the river Jhelum, 32° 18′ N. lat., 72° 24′ E. long.; population (1868) 8509. A flourishing trade is carried on with Mooltan, Sakkar, Afghánistán, and the Deráját. The exports consist of grain, cotton, wool, *ghí*, and country cloth; and the imports of English piece goods, metal, dried fruits, sugar, and molasses. It is the chief mart for the trade of the Salt Range. Coarse cloth and cotton scarfs are manufactured; there are six hundred weaving establishments.

KHÚZISTÁN, a province of West Persia, bounded N. and N.E. by Luristan, S.E. by Fars, S. by the Persian Gulf, W. by Turkey, lies mainly within 30°–33° N. lat. and 47°–51° E. long., stretching about 200 miles north and south, with a mean breadth of 80 to 100 miles, and an area of 25,677 square miles. In the south is the rich alluvial lowland tract of Arabistan, "the most extensive and fertile plain in Persia." Elsewhere the surface is very mountainous, being traversed by the lofty Bakhtiari ranges, which form a southeastern continuation of the Pusht-i-Koh highlands, and which preserve a remarkable parallelism throughout their entire length, while increasing in elevation from 8000 to 16,000 feet as they advance inland to the Kuh-Dinár. They are broken by several deep and romantic gorges, through which the Karkhah, Karún, Jarahi, and Tab rivers escape to the Euphrates delta or to the coast, watering several fertile upland valleys on their winding course seawards. The climate on the coast is excessively hot, and in some low-lying swampy districts very unhealthy; in the highlands severe winters and hot summers are followed by genial springs and autumns; the prevailing winds are northwest and southeast, the latter bearing much moisture from the Indian Ocean. The lowlands take the name of Arabistan from the Arabs, who form the bulk of their population. Many of the Ka'b Arabs have been assimilated in speech and religion to the Persians; but most of the great Beni-Lám nation, comprising in Khúzistán and Baghdad 17 branches, 85 septs, and 30,000 families, are still in the nomad state. The highlands are mainly occupied by the Feili, Bakhtiari, Kohgelu, Mamaseni, and other Luri tribes of Kurd stock and speech, also nomads and addicted to brigandage. The staples of food are dates and fish in the south, elsewhere the produce of the herds and flocks. The chief products are rice, tobacco, cotton, indigo, silk, maize, barley; the trade is mainly with Baghdad and Bussorah. The manufactures include coarse woollens, cottons, tents, red cloth. Dyeing is extensively carried on in Dizful, which, besides Shaster and Mohammrah, is the only place worthy the name of town.

Khúzistán is the Biblical ELAM (*q.v.*), the classical Susiana. The name appears in the great inscription of Darius as Uvaja, corresponding to the Uxii of classical writers. The transition to the modern Khúz, Khúzistán, appears in the name Beth Khûzâyē, used by Syriac writers of the Sassanian period.

KHYRPOOR. See KHAIRPUR.

KIACHTA, or KIAKHTA, a mercantile town of Siberia, and one of the chief centres of trade between Russia and China, is situated upon the Kiachta, an affluent of the Selenga, and on an elevated and barren expanse of country surrounded by mountains, in the Russian government of Transbaikal, about 280 miles southwest of the capital Tchita, and close to the Chinese frontier, in 50° 20′ N. lat., 106° 40′ E. long. Besides the lower town or Kiachta proper, the municipal jurisdiction comprises the fortified upper town of Troitskosavsk, about 2 miles to the north, and the settlement of Ust-Kiachta, 10 miles further distant. The upper town, which is substantially built, contains the public offices, barracks, a stone church, and many large warehouses, etc., and is the headquarters of the commandant of the Transbaikal Cossacks. The lower town, lying directly opposite to the Chinese emporium of Maimaichin, consists of several stores and about a hundred houses inhabited mostly by merchants. Prior to 1727 the trade of Kiachta was a government monopoly, but from that year it was open to private merchants, and continued to improve until 1860, when the right of commercial intercourse was extended along the whole Russian Chinese frontier in conformity with the treaty of Pekin. The annual December fairs for which Kiachta was formerly famous, and which were resorted to by merchants from a great distance, and also the regular commercial traffic passing through the town, have considerably fallen off since that date. The Russians exchange here leather, sheep-skins, furs, horns, woollen cloths, coarse linens, and cattle for teas, porcelain, rhubarb, manufactured silks, nankeens, and other Chinese produce. In 1873 the population, including Ust-Kiachta, was 9050.

KIDDERMINSTER, a market-town and municipal and parliamentary borough of Worcestershire, England, is situated in the northwest corner of the county, on the Stour, near its junction with the Severn, on the Staffordshire and Worcestershire canal, and on the West Midland branch of the Great Western Railway, 14 miles north from Worcester, and 18 miles southwest from Birmingham. The streets are rather irregular, and the houses for the most part small and mean in appearance, but of late years great improvements have been made by the paving and widening of the streets, and the construction of shops and houses of a better class. A new system of drainage has also been completed, and the town is now well supplied with water. Besides the churches, the principal buildings of Kidderminster are the corporation buildings, the infirmary, the town hall in the Renaissance style, erected in 1876, the masonic hall and club, and the buildings of the school of art. The parish church of St. Mary, a fine old structure in the Perpendicular style, containing several ancient monuments, was lately extensively repaired. The town is adorned by a statue erected in 1875 to Richard Baxter, who was for some time minister in Kidderminster, and another to Sir Rowland Hill, completed in 1881, and by a beautiful drinking fountain. There is a free grammar school founded in 1637, besides board schools and others connected with some of the churches. A new cemetery for the town was opened in 1878. At an early period Kidderminster had a large manufacture of broad-cloths, but it is now chiefly celebrated for its carpets (see CARPETS, vol. v. p. 114), the manufacture of which was introduced about the year 1735. At first Scotch carpets were the only variety made, but in 1745 the manufacture of Wilton and Brussels carpets was commenced, and since that period the carpets manufactured at Kidderminster, on account of the permanency of their color, due it is supposed to peculiar properties of the water of the Stour, have obtained an exceptional reputation. Worsted spinning and dyeing are also carried on extensively, and there are iron foundries, tinplate works, breweries, malthouses, tanneries, flour-mills, and a paper-mill. The population of the municipal borough in 1871, was 19,473, and that of the parliamentary borough 20,814; in 1881 the corresponding numbers were 24,270 and 25,634.

The ancient name of Kidderminster was Chidderminster, that is, the minster or church on the brow of the hill. From the time of the Conquest until the time of Henry II. it was a royal manor. Among the private owners who subsequently held possession of it was the poet Waller. Kidderminster returned a member to parliament in the reign of Edward I., bnt the privilege was subsequently lost. In the 12th year of Charles I. it received a charter of incorporation, and by the Reform Act of 1832 it again obtained the privilege of returning a member to parliament. It is now governed according to the Municipal Act of 1835.

KIDNAPPING is defined by Blackstone as the forcible abduction or stealing away of a man, woman, or child from their own country and sending them into another. The term is, however, more commonly applied to the offence of taking away children from the possession of their parents. By 24 and 25 Vict. c. 100, "whosoever shall unlawfully, by force or fraud, lead or take away or decoy or entice away or detain any child under the age of fourteen years with intent to deprive any parent, guardian, or other person having the lawful care or charge of such child of the possession of such child, or with intent to steal any article upon or about the person of such child, to whomsoever such article may belong, and whosoever shall with any such intent receive or harbor any such child, etc.," shall be guilty of felony. The abduction or unlawfully taking away an unmarried girl under the age of sixteen years out of the possession and against the will of her father or mother, or any other person having the lawful care or charge of her, is a misdemeanor under the same Act. The term is used in much the same sense in the laws of the United States. Bishop states the more correct acceptation of the word to be false imprisonment aggravated by the intent to carry the person away to another place, but not necessarily to another country.

KIEFF, Kiyeff, or Kiev, a southwestern government of European Russia, conterminous with those of Minsk, Poltava, Tchernigoff, Podolia, Kherson, and Volhynia. The area is estimated at 31,664 square miles. In the north we find a low-lying district characterized by marsh and woodland; in the east a series of hills keeps company with the Dnieper; and in the west are several outliers from the Carpathian system. The central region is a kind of steppe. It is only in a very few places that the altitude exceeds 900 feet. Granite with underlying syenite is the prevailing rock in the west and southwest of the government; in the east there are various Eocene formations. Iron-ore, fire-clay, sandstone, and lignite are among the useful minerals. Towards the southern and central parts the surface is covered by a deep rich "black earth." Nearly the whole of the government belongs to the basin of the Dnieper, that river forming part of its eastern boundary. In the southwest are a few small tributaries of the Bug. Besides the Dnieper the only navigable stream is its confluent the Pripyat, but two or three of the rest are available for rafts. About a fourth of the surface is occupied by woods, very unequally distributed throughout the territory. Rye is the commonest of the cereals; and next follow oats and wheat. In the growing of beetroot the government is the first in Russia, and its factories for the production of beetroot sugar are the largest in the empire. The whole industrial activity of the district has rapidly developed since about the middle of the century; in 1879 there were 602 establishments, with 35,306 workmen, and a production worth £10,000,000. In the 75 sugar factories large numbers of Tartars from Tamboff and Penza find employment; and next in importance are the flour-mills, leather works, and tobacco factories. The population of the government has increased from 2,017,262 in 1862 to 2,266,000 in 1875. Little Russians form 80 per cent. of the aggregate; Jews, 13 per cent.; Poles, 4 per cent.; White Russians, 2½ per cent.; and there are a few thousand Great Russians. There are twelve districts:—Radomuisl, Kieff, Kaneff, Tcherkasui, Tchigirin, Vasilkoff, Berditcheff, Lipovets, Skvira, Tarashtcha, Uman, Zvenigorodka. Besides the government town the following have upwards of 5000 inhabitants:—Berditcheff, 52,560; Vasilkoff, 16,597; Uman, 15,393; Tcherkasui, 13,914; Tarashtcha, 11,420; Zvenigorodka, 11,375; Skvira, 10,061; Tchigirin, 9677; Kaneff, 7418; Lipovets, 6710; Radomuisl, 5905, to which may be added the large Jewish village of Zlatopol, 10,000. The exarchate or diocese of Kieff and Galitsch is the oldest in Russia, and comprises 1421 churches, 12 cathedrals, and 30 monasteries.

In 1708 a Kieff government was founded, which included the whole Eastern Ukraine and an extensive region in Central Russia containing thirty-six towns—Orel, Kursk, etc. The Kieff lieutenantship, founded in 1782, consisted of parts of the present governments of Kieff, Poltava, and Tchernigoff. In 1796 the present government was practically constituted, though several slight changes in regard to the district towns have since taken place.

Kieff, capital of the above province, the "mother city" and Canterbury of Russia, is situated on the right or western bank of the Dnieper, in 50° 26′ N. lat. and 30° 37′ E. long., 800 miles from St. Petersburg, and 566 miles from Moscow on the highway between Moscow and Odessa. By railway it is connected on the one hand with Kursk and on the other hand with Odessa. The site of the greater part of the town consists of a succession of hills or bluffs separated from each other by ravines and hollows, the elevation of the central portions being from 350 to 365 feet above the ordinary level of the Dnieper. On the opposite side of the river the country spreads out low and level like a sea. Having by this time received all its important tributaries, the Dnieper is a large and navigable stream; but as it approaches the town it breaks up into two currents and forms a low grassy island of considerable extent called Tukhanoff. During the spring floods there is a rise of 16 or even 20 feet, and not only the whole island but the country along the left bank and the lower grounds on the right bank are laid under water. The bed of the river is sandy and shifting, and it is only by costly engineering works that the main stream has been kept from returning to the more eastern channel which it formerly occupied. Opposite the southern part of the town, where the currents have again united, the river is crossed by a wrought-iron bar-chain suspension bridge, which at the time of its erection (1851) was the largest enterprise of the kind in Europe. It is about half a mile in length and 52½ feet in breadth, and the four principal spans are each 440 feet. The bridge was designed by Mr. Vignoles, and the whole of the iron (3500 tons) employed in the construction was prepared in England. The cost was about £400,000.[1]

Owing to the natural character of the site, Kieff is broken up into several distinct portions; and from no point is it possible to get a view of the city as a whole. Up to 1837 the town proper consisted of the Old Town, Petchersk, and Podol; but in that year three districts were added, and in 1879 the limits were extended so as to include Kurenevka, Lukyanovka, Shulyavka, and Solomenka, and the whole was divided into eight districts. The administrative area of the town, as thus defined, is about 12,404 acres, or 18 square miles; but these figures give a very exaggerated notion of the place, as there are extensive suburbs and large intervals of unoccupied ground. Wood is still the most usual building material; no less than 64.68 per cent. of the houses existing in 1874 were of wood alone, and 14.75 per cent. of wood and stone. The number of clay huts is no less than 8.57 per cent.

The Old Town or Old Kieff quarter (Starokievskaya Tchast) occupies the highest of the range of hills. It is here that the houses are the most closely built, and that stone structures are most abundant. In some of the principal streets—as Vladimir's, Vasiltchikoff's—buildings of three to five stories, a comparatively rare thing in Russia, have been erected. In the 11th century the area was inclosed by earthen ramparts, with bastions and gateways; but of these the only remnant is the so-called Golden Gate. In the centre of the Old Town stands the cathedral of St. Sophia, the oldest cathedral in the Russian empire. The statement frequently repeated that it was a copy of St. Sophia's in Constantinople has been shown by Zakrevski to be a mistake. The building measures in length only 118 feet, while in breadth it is 173 feet. But if the plan shows no imitation of the great Byzantine church, the decorations of the interior (pictures, mosaics, etc.) indicate direct Byzantine influence. During the occupation of the church by the Uniats in the 17th century these were covered with a coating of whitewash, and a thorough-going restoration was rendered a matter of necessity; but the chapel of the three Pontiffs has been left untouched to show how carefully the old style has been preserved or copied. Among the mosaics is a colossal representation of the Virgin, 15 feet in height, which, like the so-called "indestructible wall" in which it is inlaid, dates from the time of Yaroslaff. It was this prince who founded the church in 1037 in gratitude for his victory over the Petchenegs. His sarcophagus, curiously sculptured with palms, fishes, etc., is still preserved. The church of St. Andrew occupies the spot where, according to Russian tradition, the apostle stood when as yet Kieff was not, and declared that the hill would become the site of a great city. The present building dates only from 1744–1767. The church of the Tithes, restored in 1842, was originally founded in the close of the 10th century by Vladimir in honor of two martyrs whom he had put to death; and the monastery of St. Michael (or of the Golden Heads—so called from the fifteen gilded cupolas of the original church) claims to have been built in 1108 by Svyatopolk II., and restored in 1655 by Bogdan Khmelnitski.

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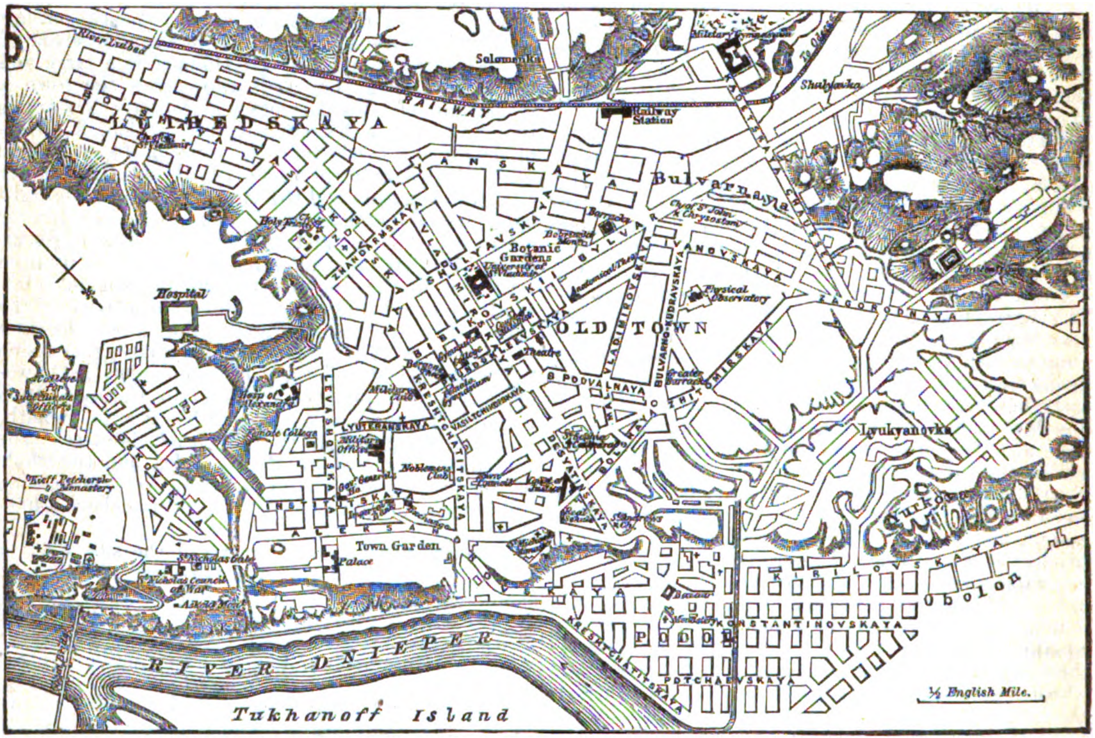
[1] Views of the bridge will be found in *Official Catalogue of the Great Exhibition*, 1851, vol. i. p. 821.

Up to 1820 the southeastern district of Petchersk was the industrial and commercial quarter; but it has been greatly altered in carrying out fortifications commenced in that year by Nicholas I. Most of the houses are small and old-fashioned. The monastery—the Kievo-Petcherskaya—is the chief establishment of its kind in Russia; it is visited every year by about 350,000 pilgrims. From the books of the conventual inns it is shown that shelter is given to 150,000 persons per annum; and the numbers for whom there is no accommodation is often very great,—72,000, for example, were counted lying under the open sky on the night of 15th August, 1872. Of the ten or twelve conventual churches the chief is that of the Assumption. There are four distinct quarters in the monastery, each under a superior, subject to the archimandrite: the Laura proper or New Monastery, that of the Infirmary, and those of the Nearer and the Further Caves. These caves or catacombs are the most striking characteristic of the place; the name Petchersk, indeed, is connected with the Russian *peshtchera*, a cave. The first series of these caves, dedicated to St. Antony, contains about eighty saints' tombs; the second, dedicated to St. Theodosius, about forty-five. The bodies were formerly exposed to view; but the pilgrims who now pass through the gloomy galleries, candle in hand, see nothing but the draperies and the inscriptions. Among the more notable names are those of Nestor the chronicler, and Ilia of Murom, the Old Cossack of the Russian epics. The foundation of the monastery is ascribed to two saints of the 11th century—Antony of Lynbeth, and Hilarion, metropolitan of Kieff. By the middle of the 12th century it had become wealthy and beautiful, but, completely ruined by Batu in 1240, it remained deserted for more than two centuries. Prince Simeon Oblkovitch was the first to start the restoration. A conflagration laid the buildings waste in 1716, and their present aspect is largely due to Peter I. The monastery contains a school of picture-makers of ancient origin, whose productions are widely diffused throughout the empire, and a printing press from which have issued a variety of liturgical and religious works, the oldest known examples bearing the date 1616.



Plan of Kieff.

The Podol quarter, as the name indicates, lies on the low ground at the foot of the bluffs. It is the industrial and trading quarter of the town, and the seat of the great fair of the "Contracts," the transference of which from Dubno in 1797 largely stimulated the commercial prosperity of the city. The present regular arrangement of its streets arose after the great fire of 1811. Lepki district (from the lepki or lime trees, destroyed in 1833) is of recent origin, and is mainly inhabited by the well-to-do classes. It is sometimes called the palace quarter, from the royal palace erected between 1868 and 1870, on the site of the older structure dating from the time of Elizabeth. Gardens and parks abound; the palace garden is exceptionally fine, and in the same neighborhood are the public gardens with the place of amusement known as the Château de Fleurs.

In the New Buildings, or the Luibed quarter, are the university and the botanical gardens. The Ploskaya Tchast (Flat quarter) or Obolon contains the lunatic asylum; the Lukyanovka Tchast, the penitentiary and the camp and barracks; and the Bulvarnaya Tchast, the military gymnasium of St. Vladimir and the railway station.

Kieff is the seat of the governor-general of the three provinces of Kieff, Podolia, and Volhynia, and as such possesses a large number of administrative institutions. In 1862 it was made the headquarters of a great military district including the same provinces. As a centre of intellectual activity it ranks among the principal cities of Russia. The university of St. Vladimir, transferred from Vilna after the Polish insurrection of 1831, possessed 94 professors in 1878, and was attended by 771 students; and the library contained 150,000 volumes. The theological academy and theological seminary are large institutions; and the ordinary educational establishments include three male and four female gymnasiums. A daily paper, founded in 1864, and nine other periodicals are published in the town. Of the learned societies the more important are the medical (1840), the naturalists' (1869), the juridical (1876), the historical of Nestor the chronicler (1872), the horticultural (1875), and the dramatical (1879), the archæological commission (1843), and the society of church archæology. There are three considerable theatres.

In 1862 the population of Kieff was returned as 70,341; of this number 8604 were Roman Catholics, 1411 Jews, and 976 Protestants. In 1874 the total was given as 127,251,—77.43 per cent. being members of the Greek Church, 10.85 per cent. Jews, 8.18 per cent. Catholics, and 2.45 per cent. Protestants. The clergy—regular and secular—amounted to no less than 3505. Russian and its dialects were spoken by four-fifths of the inhabitants. For 1881 the total population is estimated at 165,000.

The history of Kieff cannot be satisfactorily severed from that of Russia. According to Nestor's well-known legend it was founded in 864 by three brothers Ke, Shtchek, and Khoriff. It was in the waters of the Dnieper opposite the town that Vladimir, the first saint of the Russian Church, caused his people to be baptized; and Kieff became the seat of the first Christian church, of the first Christian school, and of the first library in Russia. For three hundred and seventy-six years it was an independent Russian city; for eighty years it was subject to the Tartars; for two hundred and forty-nine years it belonged to the Lithuanian principality; and for ninety-eight years to Poland. It was finally united to the Russian empire in 1667. In 1832 the headquarters of the first army corps, with all the departments of the general staff, were transferred to Kieff from Mogileff. The Magdeburg rights, which the city had previously enjoyed, were abolished in 1835, and the ordinary form of town government introduced; and in 1840 it was made subject to the common civil law of the empire.

A long list of works relating to Kieff will be found in Semenoff, *Slov. Ross. Imp.* Of more recent publication are the following:—Rambaud's *La Russie épique*, Paris, 1876; Avenarius, *Kniga o Kievskikh Bogatuiryakh*, St. Petersburg, 1876, dealing with the early Kieff heroes; Zakrevski, *Opisanie Kieva*, 1868; the materials issued by the temporary commission for the investigation of the ancient records of the city; Taranovskii, *Gorod Kieff*, Kieff, 1881. See also Rambaud in *Rev. de Deux Mondes*, 1874. The standard geological map of the government is Theophilaktoff's (see *Bull. Soc. Imp. de Nat. de Moscow*, 1872).

KIEL, the chief town of the province of Schleswig-Holstein in Prussia, is picturesquely situated at the southern end of the Kieler Föhrde, about 66 miles northeast of Hamburg by rail. It consists of a somewhat cramped old town and a better built and more spacious newer part, increased since 1869 by the inclusion of Brunswick and Düsternbrook. In the old town stands the palace, built in the 13th century, and enlarged by Catherine II. of Russia in the 18th; it contains the university library of 150,000 volumes, and a small collection of casts of antique sculpture and of Thorwaldsen's works. Other interesting buildings are the church of St. Nicholas, dating from 1240, with a lofty tower; the old town-house; the prison and court-house; the observatory; the theatre; the Government naval offices; and the Thaulaw museum, opened in 1877. The university, founded in 1665 by Christian Albert, duke of Schleswig, and named after him Christiana Albertina, had in 1881 a teaching staff of 69, with 380 students. The new university buildings were completed in 1876. A naval academy was opened in 1875. Among the public charities there are three hospitals, a blind asylum, an orphanage, an idiot asylum, and a large institution for poor citizens and their widows. Kiel is the most important naval harbor of Germany, and the station of the German Baltic fleet; the port and its approaches are very strongly fortified. The land defences, not yet completed, are to consist of eleven forts, completely encircling the town. The imperial dockyards on the east side of the haven include two large basins (one 235 yards square, the other 271 yards by 235 yards), connected by a canal 70 yards long, four dry docks (each 100 to 120 yards long by 24 or 25 yards wide), and a wet dock. Near them are the yards of a large shipbuilding company. The excellence and safety of Kiel harbor, whose only drawback is that it is frozen in winter, have made the town one of the principal ports of the Baltic. It carries on a very active trade with the Danish islands as well as with the Continent. The chief imports are grain, coal, timber, and cattle; the chief exports timber, coal, fish, and agricultural produce. Iron-founding and the manufacture of machinery, wooden wares, carpets, tobacco, and oil form the leading industries after the shipping trade. In 1879 there entered at Kiel 3074 ships, representing 279,099 tons; 3021 cleared, representing 275,600 tons. Near the town are large steam corn-mills. Kiel possesses a sea-bathing establishment, and is surrounded by fine scenery. The population in 1875, including the garrison, was 37,246.

The name of Kiel appears as early as the 10th century in the form Kyl. Kiel is mentioned as a city in the next century; in 1242 it received the Lübeck rights; in the 14th century it acquired other privileges, and in 1363 entered the Hanseatic league. It suffered much from neighboring barons; and in the wars in which Schleswig was involved Kiel had its share of siege and capture. In recent times the name of Kiel has been associated with the peace concluded in 1814 between Great Britain and Denmark, and Sweden and Denmark, by which Norway was ceded to Sweden.

KIELCE, the chief town of a government in Russian Poland, is situated about 50 miles northeast of Cracow, in the mountainous district of the Lysa Gora. The copper-mines which were in the 16th century the main support of the place are no longer worked; but it has iron-works and sugar factories of considerable importance. The principal buildings are the cathedral, the bishop's palace, and a nunnery in which is an ancient statue of St. Barbara fashioned out of a single piece of galena. In 1873 the population was 7838. Bishop Gedcow of Cracow is said to have founded Kielce in 1173.

KIERKEGAARD, SÖREN (1813–1855), the greatest philosophical writer that Scandinavia has produced, was born at Copenhagen, May 5, 1813, and was the seventh child of a respectable Jutland hosier. He was a very serious and precocious boy, weak in health, morbid in character. Of his mother, singularly enough, he has said no word in his copious autobiographical remains, although he was in his twenty-second year when she died; she had been his father's servant. Kierkegaard became a student at the university of Copenhagen, and took up theology as a profession, but never became a priest. He lived in great retirement, deeply oppressed with melancholy and physical suffering, and was at first very little known to his contemporaries. In 1838 he published his first volume, *Papers of a Still Living Man*, a very poor attempt to characterize Hans Andersen. Two years later he took his degree, with a treatise *On Irony*, which contains the germs of his later speculations. In 1840 he engaged himself to a young lady, and shortly after broke off the engagement, an extraordinary step for which he has given many extraordinary reasons. It was not until 1842 that he began the composition of his greatest work, *Enten—Eller* ("Either—Or"), on which his reputation mainly rests; this appeared in 1843, and was immediately followed by a rapid succession of philosophical works, which formed at once an epoch in the history of Danish literature. From 1849 to 1854, however, he was silent as an author. In the last-mentioned year he published a polemical tract against Bishop Martensen, and the short remainder of his life was spent in a feverish agitation against the theology and practice of the state church. But his health, which had always been miserable, was growing worse and worse. In October, 1855, he took up his abode in one of the chief hospitals of Copenhagen, where he died, on the 11th of November, at the age of forty-two. His life has been written, with great skill and brilliance, by Dr. Georg Brandes (1877). Kierkegaard published about thirty distinct books during his lifetime, and left at his death about an equal amount of MS.; a competent analysis of these multifarious labors is given in Brandes's admirable biography.

KILDARE, an inland county of Ireland, in the province of Leinster, is situated between 52° 51′ and 53° 26′ N. lat., and between 6° 28′ and 7° 11′ W. long., and is bounded on the W. by Queen's county and King's county, N. by Meath, E. by Dublin and Wicklow, and S. by Carlow. The area is 418,497 acres, or 654 square miles.

Geology.—The greater part of Kildare belongs to the carboniferous plain which occupies the central portion of Ireland. In the east of the county this plain is bounded by elevations belonging to the clay slate formations bordering on the granite mountains of Dublin and Wicklow; in the south it is encroached upon by the granite formations of Carlow; and in the centre it is interrupted by an elevated plateau terminated on the south by the hills of Dunmurry, consisting chiefly of grauwacke and clay slates, and on the north by the Hill of Allen, a conical rock of porphyry and greenstone, which rises abruptly from the Bog of Allen to the height of 300 feet. Marble of very fine quality is obtained in the quarries to the west of the town of Kildare, and copper ore is said to have been found in the hills of Dunmurry.

Rivers.—The principal rivers are the Boyne, which with its tributary the Blackwater rises in the north part of the county, but soon passes into Meath; the Barrow, which forms the boundary of Kildare with Queen's county, and receives the Greese and the Lane shortly after entering Kildare; the Lesser Barrow, which flows southward from the Bog of Allen to near Rathangan; and the Liffey, which enters the county near Ballymore Eustace, and flowing northwest and then northeast, quits it at Leixlip, having received the Morrel between Celbridge and Clane, and the Ryewater at Leixlip. The northern border of the county is traversed by the Royal Canal, which connects Dublin with the Shannon at Cloondara. Further south the Grand Canal, which connects Dublin with the Shannon at Shannon Harbor, occupies the valley of the Liffey until at Sallins it enters the Bog of Allen, passing into King's county near the source of the river Boyne. Several branch canals connected with it afford communication with the southern districts of the county.

Climate and Agriculture.—Owing in a considerable degree to the large extent of bog, the climate of the northern districts is very moist, and fogs are frequent, but the eastern portion is drier, and the climate of the Liffey valley is very mild and salubrious. The soil, whether resting on the limestone or on the clay slate, is principally a rich deep loam inclining occasionally to clay, easily cultivated and very fertile if properly drained, which too often is not the case. About 40,000 acres in the northern part of the county are included in the Bog of Allen, which is, however, intersected in many places by elevated tracts of firm ground. To the south of the town of Kildare is the Curragh, an undulating down of about 8000 acres in extent, and presenting to the eye a beautiful sward of vivid green unbroken by a single tree or shrub. The common is the property of the crown, and is occupied as a sheep walk, while a portion of it forms the principal racecourse of Ireland. It is now also the headquarters of a military division. The most fertile and highly cultivated districts of Kildare are the valleys of the Liffey and a tract in the south watered by the Greese. The demesne lands along the valley of the Liffey are finely wooded. More attention is paid to drainage and the use of manures on the larger farms than is done in many other parts of Ireland, but the small farms are mostly cultivated in the usual slovenly manner. The pastures which are not subjected to the plough are generally very rich and fattening.

The following table gives a classification of holdings according to size in 1850 and 1880, as contained in the agricultural returns:

	1 Acre.	1 and under 5.	5 and under 15.	15 and under 30.	30 and upwards.	Total.
1850	1,295	2,518	2,145	1,589	3,854	11,346
1880	1,414	1,764	1,682	1,166	2,981	8,957

The total area under crop in 1881 was 120,953 acres, or 29 per cent. of the whole acreage of the county. In 1880 239,406 acres, a percentage of 57.2, were under grass, 360 acres lay fallow, 7332 were woods, 37,540 bog and marsh, 983 barren mountain land, and 15,404 water, roads, and fences. The area under crop in 1850 was 147,507 acres, the diminution in 1881 being more than accounted for by a fall of 34,932 in the area under cereals. On the other hand, the area under grass increased between 1850 and 1881 by 47,156 acres. Between 1850 and 1881 the area under wheat, for which the rich deep soil in the valley of the Liffey is well suited, declined from 22,737 to 4120, and that under oats from 45,791 to 23,761, or nearly one-half, while the area under barley was nearly doubled, being 13,883 in 1881. The area under potatoes declined from 12,158 acres in 1850 to 9348 acres in 1881. and, notwithstanding a large increase in pasturage and in the number of cattle, the area under turnips only increased from 9622 to 11,501.

Horses have increased from 13,521 in 1855 to 13,795 in 1881. The number used for agricultural purposes was 8205. Little attention is paid to the breed, and the supply is obtained chiefly outside the limits of the county. Cattle in 1855 numbered 74,480, and in 1881 had increased to 92,252. Milch cows numbered only 12,578, and have diminished since 1855 by 3612. There has been great improvement in the breeds of cattle, crosses with the shorthorned or the Durham being now the most common. Sheep numbered 127,614 in 1855, 133,996 in 1880, and 117,760 in 1881. They are grazed chiefly on the Curragh, and are now principally Leicesters or crosses with that breed. Pigs have diminished since 1855 from 15,993 to 12,936. Goats in 1881 numbered 3835, and poultry 224,310.

According to the corrected summary of the return of owners of land in Ireland, 1878, the county in 1873 was divided among 1768 owners, possessing altogether 412,490 acres, with a ratable valuation of £338,233. Of the owners 848, or 48 per cent., possessed 1 acre and upwards and the average ratable valuation all over was 16s. 4½d. The duke of Leinster owned 67,227 acres; the marquis of Drogheda 16,609; Sir G. G. Aylmer 15,396; John La Touche 11,282; and seven other estates exceeded 5000 acres.

Manufactures.—Though possessing a good supply of water-power, the county is almost wholly destitute of manufactures; but there are a few small cotton, woollen, and paper mills, as well as breweries and distilleries, and several corn mills. Large quantities of turf are exported to Dublin by the canal.

Railways.—The Great Western line crosses the county at its northern boundary near Leixlip, Maynooth, Kilcock, and Enfield, and the Great Southern and Western passes through nearly its whole extent by Naas, Newbridge, Kildare, Monasterevan, and Athy.

Administration.—The county comprises fourteen baronies, and contains 107 civil parishes, five parts of parishes, and 1240 townlands. Judicially it is within the home circuit, and is divided into fourteen petty sessions districts and three parts of petty sessions districts. Assizes are held at Naas, and quarter sessions at Athy, Kildare, Maynooth, and

Naas. The county contains portions of the six poor-law unions of Athy, Baltinglass, Carlow, Celbridge, Edenderry, and Naas. The military stations at Newbridge and the Curragh constitute the Curragh military district, and the barracks at Athy and Naas are included in the Dublin military district. There are three townships—Athy, Naas, and Newbridge. The principal other towns are Maynooth (which is the seat of a Roman Catholic college), Celbridge, Kildare, Monasterevan, Kilcullen, Leixlip, Kilcock, Castledermot, Ballymore Eustace, and Rathangan. Previous to the Union Kildare returned ten members to parliament, of whom eight represented boroughs; but now it sends only two, who sit as members for the county.

Population.—According to the census return of 1659 the population amounted to only 13,825, of whom 796 were English and 13,029 Irish. In 1760 it was estimated at 51,728. According to the parliamentary return of 1821 it was 99,065, and by 1841 it had increased to 115,190, but in 1851 had diminished to 96,495, in 1861 to 90,946, in 1871 to 83,614, and in 1881 to 76,102, of whom 40,859 were males and 35,243 females. In several other counties there is an excess of males over females, but it is much larger in Kildare than in any other, which is the more remarkable that between 1851 and 1880 there has been also an excess of male emigrants, the total number of emigrants being 13,651 males and 11,765 females, or 27.9 per cent. of the population of 1861. The rate of marriages in 1880 to every 1000 of the population was 3.6, of births 22.0, and of deaths 16.9, the rates for Ireland being 3.8, 24.0, and 19.3. The number of natives of England and Wales residing in the county in 1841 was 406, and in 1871 they had increased to 5270; of natives of Scotland there were 151 in 1841 and 574 in 1871. The number of Roman Catholics in 1881 was 66,184; of Protestant Episcopalians, 8616; of Presbyterians, 754; of Methodists, 344. In 1871 there were none who spoke Irish only, but 554 spoke Irish and English. The number who could read and write in 1871 was 43,783; 11,472 could read but could not write, and 28,359 could neither read nor write.

History.—The early inhabitants of the county are perhaps to be identified with Ptolemy's Coriondi. Afterwards it formed part of the district of Caellan or Galen, which also included portions of Wicklow and Carlow, the principal chieftain being a representative of the family of Hy Caellan or M'Kelly, who had their residence at the moat of Ardscull near Naas. According to a tale in the Book of Leinster the original name of Kildare was *Druim Criaidh* (Drumcree), which it retained until the time of St. Brigit, after which it was changed to *Cilldara*, the church of the oak, from a very old oak under whose shadow the saint had constructed her cell. For some centuries it was under the government of the Macmurroughs, kings of Leinster, but along with the remainder of Leinster it was granted by Henry II. to Strongbow. On the division of the palatinate of Leinster among the five granddaughters of Strongbow, Kildare fell to Sibilla, the fourth daughter, who married William de Ferrars, earl of Derby. Through the marriage of the only daughter of William de Ferrars it passed to William de Vescy—who, when challenged to single combat by John Fitz Thomas, baron of Offaly, for accusing him of treason, fled to France. His lands were thereupon in 1297 bestowed on Fitz Thomas, who in 1316 was created earl of Kildare, and in 1317 was appointed sheriff of Kildare, the office remaining in the family until the attainder of Gerald, the ninth earl, in the reign of Henry VIII. Kildare was a liberty of Dublin until 1296, when an Act was passed constituting it a separate county.

Antiquities.—In the county there are several old gigantic pillar stones, the principal being those at Punchestown, Harristown, Jigginstown, and Mullamast. Among the more remarkable earthworks are the raths at Mullamast, Knockcaellagh near Kilcullen, Ardscull near Naas, and elsewhere, and the numerous sepulchral mounds in the Curragh. Of the round towers the finest is that of Kildare, which is 130 feet high; there are remains of others at Taghadoe, Kilcullen, Oughterard, and Castledermot. At one time there was an immense number of religious houses in the county. There are remains of a Franciscan abbey at Castledermot. At Graney there are the ruins of an Augustinian nunnery and also portions of a building said to have belonged to the Knights Templars. The town of Kildare has ruins of no less than four monastic buildings, among others the nunnery founded by St. Brigit. The site of a monastery at Old Kilcullen, said to date from the time of St. Patrick, is marked by two stone crosses, one of which is curiously sculptured. The fine abbey of Monasterevan is now the seat of the marquis of Drogheda. On the Liffey are the remains of the Great Connel Abbey near Celbridge, of St. Wolstan's near Celbridge, and of New Abbey. At Moone, where there was at one time a Franciscan monastery, there are the remains of a very old cross with curious sculpturings. Among the old castles may be mentioned those of Athy and Castledermot, built about the time of the Anglo-Norman invasion; Maynooth Castle, built by the Fitzgeralds; Kilkea, originally built by the seventh earl of Kildare, and restored within the present century; and Timolin, erected in the reign of King John.

KILIA, a seaport town of Roumania, formerly in the province of Moldavia, situated on the northern bank of the northern arm of the Lower Danube, 20 miles from its mouth. The inhabitants, between 6000 and 7000 in number, are mainly engaged in the river trade and fisheries. Kilia was occupied by the Russians in 1790, and bombarded by the English and French in 1854. Old Kilia is on the opposite side of the river. A plan of the present town will be found in the maps published by the European Commission of the Danube.

KILIAN, St., the apostle of Franconia, was, according to Hrabanus Maurus, a native of Ireland, whence along with his companions he went to Eastern Franconia. After having preached the gospel in Würzburg, the whole party were put to death by the orders of an unjust judge of the name of Gozbert. Notker Balbulus (*c.* 912) relates that Kilian's mission emanated from the pope, and that Gozbert was the duke of Franconia, who, after receiving baptism, had been persuaded to put away his wife (Geila) because she was his brother's widow. Geila in revenge caused Kilian and his comrades, Coloman and Totman, to be secretly put to death. Later accounts assign the mission to the time of Conon (686). In the *Martyrologies* Saints Kilian (Kyllena, Chilianus), Coloman, and Totman are commemorated on July 8. Their relics lie in the cathedral (St. Kiliansmünster) at Würzburg.

KILIMANJÂRO, a great snow-topped mountain in Eastern Africa, in 3° 5′ S. lat. and 37° 22′ E. long., has a height of 18,715 feet, and is believed to be the loftiest eminence of the whole continent. It stands completely apart from all the neighboring heights, but is only "one of many summits that crown the eastern edge of the great plateau of equatorial Africa." At a distance of 100 miles to the north, across the wide expanse of the Kaptei and Kikuyu plains, lie the less-known mountains Kenia and Lemeru; and due west, at a distance of about 30 or 40 miles, rises the noble mass of Mount Meru.

As the natives believe that the summit of Kilimanjâro is composed of silver, it is possible that Aristotle's reference to "the so-called Silver Mountain" from which the Nile flows was based on indistinct reports about this mountain; but the real discovery of its existence was made only in 1848 by Mr. Rebman of the Church Missionary Society (*Church Missionary Intelligencer*, 1849). His account, though fully borne out by Dr. Krapf, was at first received with great incredulity by professional geographers. The matter has been finally set at rest by the visit paid to the mountain by Von der Decken (1861 and 1862) and Mr. Charles New (1867), the latter of whom reached the lower edge of the snow. Kilimanjâro has two principal summits. The eastern, Kibo or Bareni, is a magnificent dome with a smooth and regular outline; the other, Kimawenzi, is a dark and rugged peak; and between the two stretches a saddle-like ridge several miles in extent. Trachytes, basalt, and obsidian were obtained by Von der Decken from the upper part of the mountain. Mr. New distinguished six clearly marked zones of vegetation. The first was the region of the banana and maize, the surface, when not under cultivation, being clothed with a close turf exceedingly rich in clover; above this lay a belt of jungle; the jungle was succeeded by a forest of gigantic trees with a dense and varied undergrowth, and an extraordinary profusion of moss both on the ground and on the stems and branches; beyond the trees was a region of hills covered with rich grass and clover; beyond the grass came heath; and this gradually dwindled away into a region of bare wind-swept rocks. Among the fifty species of plants collected on the mountain Dr. Hooker found only a few of those European forms which are known to exist in the Cameroons and the Abyssinian mountains.

From the southern slopes of Kilimanjâro descend a great many streams—the Weri-Wari, the Rau, the Ganu, etc.—which, uniting with the Jipe from Lake Jipe, ultimately form the Rufu or Pangani, an important river reaching the Indian Ocean about 5° 30′ S. lat. The hilly country round the southern skirts is occupied by the Jaggas or Chaggas, who cultivate maize, millet, pulse, and keep cattle. Their chief villages are Kilema and Moche.

See R. Thornton (the geologist of Von der Decken's party) in *Proc. of Roy. Geog. Soc.*, 1861-62; Krapf, *Travels in East Africa*, 1860; New, *Life . . . in East Africa*, 1873; Hooker in *Journal of Linnæan Society*, 1875; and for further literature, Petermann's *Mittheilungen*, 1866, pp. 75-76.

KILKENNY, an inland county of Ireland, in the province of Leinster, is situated between 52° 14′ and 52° 52′ N. lat., and between 6° 56′ and 7° 38′ W. long. It is bounded on the N. by Queen's county, E. by Carlow and Wexford, S. by Waterford, and W. by Waterford and Tipperary. Its greatest length from north to south is about 45 miles, and its greatest breadth from east to west about 25 miles. The area is 507,254 acres, or about 793 square miles.

The greater part of Kilkenny is a continuation forming the southeastern extremity of the Carboniferous Limestone plain of Ireland, but in the southeast this is bounded partly by the Cambro-Silurian rocks which run into the county from Wexford, and partly by a continuation of the granite mountains of Wicklow and Carlow, and it is interrupted in the north by an extensive hilly region forming part of the Castlecomer coal-field, which extends also into Queen's county and Tipperary. The field lies in the form of a broad basin, and rests on flagstone and black shale. The coal is anthracite, and the most productive portions of the bed are in the centre of the basin at Castlecomer. Besides a large number of fossil plants, crustaceans of a rare species and also several peculiar reptilian remains have been found in the measures. The field is believed to contain nearly 80,000,000 tons of workable coal, and at present the annual yield is about 80,000 tons,—the annual yield of Ireland being only about 130,000 tons. On the granite the limestone has the form of a bedded dolomite, and this is also principally the form of the central division to the northwest of Kilkenny. In other places the limestones are bluish or black, the latter being the best quality for burning, and are often associated with shales of a considerable thickness. Cherty beds frequently occur between the limestone and the Coal-measures. Hematitic iron of a rich quality is found in the Cambro-Silurian rocks at several places. Tradition has it that silver shields were made about 850 B. C. at Argetros or Silverwood on the Nore, and at Ballygunnion there were very ancient mines associated with the lead. The shelly black marble obtained near the town of Kilkenny has gained wide fame, and is used for tombstones, chimney-pieces, and picture frames. Manganese is obtained in some of the limestone quarries, and also near the Barrow. Marl is abundant in various districts. Pipeclay and potter's clay are found, and also yellow ochre. Copper occurs near Knocktopher.

Rivers.—The principal rivers, the Suir, the Barrow, and the Nore, have all their origin in the Slieve Bloom mountains, and after a widely divergent course southward discharge their waters into Waterford Harbor. The Suir forms the boundary of the county with Waterford, and is navigable for sloops to Carrick. The Nore, which is navigable to Innistioge, enters the county at its northwestern boundary, and flows by Kilkenny to the Barrow, 9 miles above Ross, having received in its course the King's river at Jerpoint and the Argula near Innistioge. The Barrow, which is navigable beyond the limits of Kilkenny into Kildare, forms the eastern boundary of the county from near New Bridge. There are no lakes of any extent, but turloughs are occasionally formed by the bursting up of underground streams.

Climate and Agriculture.—On account of the slope of the country and the nature of the soil, the surface occupied by bog or wet land is very small, and the air is dry and very salubrious. So temperate is it in winter that the myrtle and arbutus grow in the open air. There is less rain than at Dublin, and vegetation is earlier than in the adjacent counties. Along the banks of the Suir, Nore, and Barrow a very rich soil has been formed by alluvial deposits. Above the Coal-measures in the northern part of the county there is a moorish tract devoted chiefly to pasturage. The soil above the limestone is for the most part a deep and rich loam admirably adapted for the growth of wheat. The heath-covered hills afford honey with a flavor of peculiar excellence.

The following table gives a classification of holdings according to size in 1850 and in 1880, as contained in the agricultural returns:

	1 Acre.	1 and under 5.	5 and under 15.	15 and under 30.	30 and upwards.	Total.
1850	1,982	3,588	4,109	3,802	5,206	18,682
1880	1,784	1,816	2,508	2,662	5,325	14,045

The total area under crops in 1881 was 159,304 acres, a percentage of 31.4 of the whole acreage of the country. In 1880, 293,252 acres, a percentage of 57.8, were under grass, 2196 fallow, 10,799 wood, 10,746 bog, 13,515 mountain, and 21,661 water, roads, and fences. The area under crops in 1850 was 195,923. The area under cereals declined from 112,220 acres in 1850 to 65,232 in 1881, wheat decreasing from 47,343 acres to 11,843, and oats from 52,236 to 35,878, while in other cereals, of which the chief is barley, there has been an increase from 12,641 acres to 17,511. Between 1851 and 1880 the area under grass increased by 40,530 acres. Almost nothing has been done to improve the pasturage of the hilly districts, which are still largely covered with heath. The area under meadow and clover, which includes a large portion of rich soil on the banks of the Nore and Suir, increased from 42,482 acres in 1850 to 62,079 in 1881. Green crops diminished in area from 41,189 acres in 1850 to 31,993 in 1881, potatoes from 26,321 acres to 18,269, and turnips from 11,613 to 9929. Horses since 1850 declined from 17,161 to 16,933. The number in 1881 used for agricultural purposes was 11,606. Mules since 1850 have increased from 687 to 1054, and asses from 3355 to 5345. Cattle in 1850 numbered 72,998, and in 1881 had increased to 120,594. Cows numbered 37,695, or about a third of the total number of cattle, dairy-farming being largely followed, especially in the hilly districts to the south. The most common species of cattle is a cross between the old Irish breed and the longhorn, but Kerry cows are considerably in demand for dairies. For winter-feeding pounded furze tops are frequently used, but in many cases the cattle graze outside in winter. Sheep, the breed of which has been much improved by crossing, increased from 40,450 in 1850 to 85,393 in 1881. Pigs have declined in numbers from 45,763 to 39,777, while goats have increased from 5958 to 6376, and poultry from 197,955 to 410,524.

According to the corrected summary of owners of land, 1878, the land in 1873, exclusive of the county of the city of Kilkenny, was divided among 1150 proprietors, of whom 827 possessed less than 1 acre. The annual ratable valuation is stated in the return of 1876 as £340,696, giving an average value of 13s. 9d. per acre. There were forty-seven owners who possessed upwards of 2000 acres, twelve who possessed upwards of 5000 acres, and six upwards of 10,000 acres, viz., Viscount Clifden, 35,288; Earl of Bessborough, 23,967; Charles Wandesforde, 22,232; Col. W. F. Tighe, 11,970; Marquis of Ormonde, 11,960; and Viscount Mountgarret, 11,919.

Manufactures.—The linen manufacture introduced into the county in the 17th century by the duke of Ormonde to supersede the woollen manufacture gradually became extinct, and the woollen manufacture now carried on is also very small. There are, however, breweries, distilleries, tanneries, and flour-mills, as well as marble polishing works.

Railways.—The county is intersected from north to south by the Maryborough and Waterford line, which is joined near Kilkenny by the Southeastern Railway from Carlow. The Great Southern and Western Railway skirts the southwestern boundary of the county.

Administration.—The county comprises 10 baronies, 124 civil parishes and 15 parts of parishes, and 1601 town-lands. The county of the city contains one parish and four parts of parishes. There are three poor-law unions wholly within the county, viz., Castlecomer, Kilkenny, and Thomastown, and portions of five, viz., Callan, Carrick-on-Suir, New Ross, Urlingford, and Waterford. The county includes the parliamentary borough of Kilkenny, part of that of New Ross, and the township of Callan. There are in the county and city sixteen petty sessions districts. Assizes are held at Kilkenny, and quarter sessions at Kilkenny, Pilltown, Urlingford, Castlecomer, Grace's Old Castle, Callan, and Thomastown. The county is within the Cork military district, and there are barrack stations at Kilkenny and Castlecomer. Previous to the Union Kilkenny returned sixteen members to parliament, two representing the county. Since that period two members have been returned for the county, one for the city of Kilkenny, and one for New Ross, which, however, is situated chiefly in Wexford.

Population.—According to the census of 1659, the total population of the county was 18,427, of whom 1442 were English and 16,985 Irish. In 1760 it was estimated at 62,832. In 1821 it had increased to 158,716, and in 1841 to 202,746, but in 1851 it had diminished to 159,514, in 1871 to 109,379, and in 1881 to 99,064, of whom 48,682 were males and 50,382 females. The total number of emigrants from 1st May, 1851, to 31st December, 1880, was 55,402, or 44.5 per cent. of the population in 1861. The marriage rate in 1880 to every 1000 of the population was 3.2, the birth rate 22.1, and the death rate 20.0. In 1881 the Roman Catholics numbered 93,699; Protestant Episcopalians, 4963; Presbyterians, 197; Methodists, 131; and all other denominations, 74. There were resident in 1871 in the county 805 natives of England and 160 of Scotland. In 1871 the number of persons who spoke Irish only was 316, while 6424 could speak Irish and English. 44,779 could read and write, 15,369 could read but could not write, and 36,521 could neither read nor write.

History.—Kilkenny received its name from St. Cannech or Canice, abbot of Aghaboe in Queen's county, who died in 598, and whose see was removed to Kilkenny in the beginning of the 11th century. In the time of Ptolemy the county was inhabited by the Brigantes and the Cauci. Afterwards it formed part of the kingdom of Uisraigagh, modernized into Ossory, which was tributary sometimes to Leinster and sometimes to Munster. In 1210 Kilkenny was formed into a county by King John. During the Revolution it was held by the Irish, and it also strongly adhered to the cause of James II. against William III.

Antiquities.—Circular groups of stones of very ancient origin are to be seen on the summits of Slieve Grian and the hill of Cloghmanta. There is a remarkable cromlech at Kilmogue and a large number of cromlechs as well as raths in various parts of the county. Besides numerous forts and mounds there are five round towers, one adjoining the cathedral of Kilkenny, and others at Tulloherin, Kilree, Fertagh, and Aghaviller respectively. The monastic remains in the city of Kilkenny are mentioned under the notice of the town. There are interesting remains of a Cistercian monastery at Jerpoint, said to have been founded by Dunnough, king of Ossory, and of another belonging to the same order at Graig, founded by the earl of Pembroke in 1212. The Dominicans had an abbey at Rosbercon founded in 1267, and another at Thomastown, of which there are still some remains. The Carmelites had a monastery at Knocktopher. There was an Augustinian monastery at Innistioge, and priories at Callan and Kells, of all of which there are still some remains. Of the old castles the most remarkable is Graney or Grandison Castle in Iverk, which is supposed to have been founded by the eighth earl of Ormonde in 1521, and of which three towers and the walls still remain. See Robertson, *Antiquities and Scenery of the County of Kilkenny*, 1851.

Kilkenny, the chief town of the above county, a market-town, county of a city, and parliamentary borough, is finely situated on the Nore, and on the Great Southern and Western Railway, 73 miles southwest of Dublin and 32 north of Waterford. It consists of two distinct portions, Englishtown or Kilkenny proper and Irishtown, separated from each other by a small rivulet, but although Irishtown still retains its name it is now included in the corporation of Kilkenny. The city is irregularly built, but possesses several spacious streets with many good houses, while its beautiful environs and several imposing ancient structures give it an unusually interesting and picturesque appearance. The Nore is crossed by two handsome bridges erected towards the close of last century. The old cathedral of St. Canice, from whom the town takes its name, dates from 1052, and with the exception of the cathedral of St. Patrick in Dublin is the largest ecclesiastical building in Ireland, having a length from east to west of 226 feet, and a breadth along the transepts from north to south of 123 feet. It occupies a commanding position on an eminence at the western extremity of Irishtown. It is a cruciform structure in the Early English style, with a low massive tower supported on clustered columns of the black marble peculiar to the district. The building was lately restored at a cost of £15,000. It contains a large number of old sepulchral monuments. On the eastern side of the north transept is the parish church, and a short distance from the south transept are the remains of a round tower, rising to the height of 100 feet. The episcopal palace near the east end of the cathedral was erected in the time of Edward III. and enlarged in 1735. Besides the old cathedral, the principal other churches are the Episcopal church of St. Mary, a plain cruciform structure; that of St. John, containing a portion of the old abbey of St. John; and the Roman Catholic cathedral, erected in 1857 at a cost of £30,000, a cruciform structure in the late First Pointed style, with a massive central tower 186 feet in height. There are important remains of three old monasteries—the preceptory of St. John's, founded in 1211; the Dominican abbey, founded in 1225, and now used as a Roman Catholic church; and the Franciscan abbey on the banks of the Nore, founded about 1230. But, among the ancient buildings, that next in importance and interest to the cathedral is the castle, occupying a commanding position on the summit of a precipice above the river Nore. It was originally built by Strongbow, but rebuilt by William le Mareschal in 1175, and again restored in the present century, and transformed into the princely residence of the marquis of Ormonde. The grammar school or college, which was originally founded by Pierce, earl of Ormonde, and re-endowed in 1684 by the duke of Ormonde, stands on the banks of the river opposite the castle. In it Swift, Farquhar, Congreve, and Bishop Berkeley received part of their education. Adjoining the city is the Roman Catholic college of St. Kyran, a Gothic building completed about 1840 at a cost of £20,000. The other principal public buildings are the new court-house, the tholsel or city court, the city and county prison, the barracks, and the county infirmary. There is still a small manufacture of coarse woollens and linens. In the neighborhood there are large collieries, as well as quarries for marble, the manufactures connected with which are an important industry of the town. It also possesses corn-mills, breweries, and a tannery. The population of the county of the city of Kilkenny in 1851 was 19,973, of the town proper 15,808; in 1871 the numbers were 15,748 and 12,710; and in 1881 they were 14,964 and 12,182.

The town of Kilkenny proper owes its origin to an English settlement which took place in the time of Strongbow, and it received a charter from William le Mareschal, who married Strongbow's daughter. This charter was confirmed by Edward III., and from Edward IV. Irishtown received the privilege of choosing a portrieve independent of Kilkenny. By Elizabeth the boroughs, while retaining their distinct rights, were constituted one corporation, which in 1608 was made a free borough by James I., and in the following year a free city. From James II. the citizens received a new charter, constituting the city and liberties a distinct county, to be styled the county of the city of Kilkenny, the burgesses of Irishtown continuing, however, to elect a portrieve until the passing of the Municipal Reform Act. Frequent parliaments were held at Kilkenny in the 14th century, and so late as the reign of Henry VIII. it was the occasional residence of the lord-lieutenant. In 1642 it was the meeting-place of the assembly of confederate Catholics. In 1648 Cromwell, in the hope, by means of a plot, of obtaining possession of the town, advanced towards it, but before his arrival the plot was discovered. In 1650 it was, however, compelled to surrender after a long and resolute defence. At a very early period Kilkenny and Irishtown returned each two members to parliament, but since the Union one member only has been returned for the city of Kilkenny.

KILLARNEY, a market-town of Ireland, county of Kerry, is situated on a branch line of the Dublin and Cork Railway, 180 miles southwest from Dublin and 47 miles north from Cork. On account of the beautiful scenery in the neighborhood, the town is much frequented by tourists. Within late years it has been greatly improved in appearance, and the streets are now spacious and well-paved, while many good houses and several imposing public buildings have been erected. The principal buildings are the court-house, the Roman Catholic Cathedral and bishop's palace, designed by Pugin, the episcopal church lately rebuilt, the lunatic asylum, erected at a cost of £30,000, and the railway hotel. Adjoining the town is the fine mansion of the earl of Kenmare. The only manufacture of any importance now carried on at Killarney is that of fancy articles from the wood of the arbutus; but it owed its origin to iron-smelting works, for which abundant fuel was obtained from the neighboring forests.

The lakes of Killarney, about a mile and a half distant from the town, are situated in a basin between several lofty mountain groups, some rising abruptly from the water's edge, and all clothed with trees and shrubbery almost to their summits. The lower lake, or Lough Leane, which has an area of 5001 acres, is studded with finely wooded islands, on the largest of which, Ross Island, are the ruins of Ross castle, an old fortress of the O'Donoghues; and on another island, the "sweet Innisfallen" of Moore, are the picturesque ruins of an abbey founded by St. Finian the leper at the close of the 6th century. Between the lower lake and the middle or Torc lake, which is 680 acres in extent, stands Muckross Abbey, built by the Franciscans about 1440. With the upper lake, which is 430 acres in extent, thickly studded with islands, and closely shut in by mountains, the lower and middle lakes are connected by the Long Range, a winding and finely wooded channel, 2½ miles in length, and commanding magnificent views of the mountains. Midway in its course is a famous echo caused by the Eagle's Nest, a lofty pyramidal rock. The population of the urban sanitary district in 1881 was 6546.

KILLDEER, a common and well-known American Plover, so called in imitation of its whistling cry, the *Charadrius vociferus* of Linnæus, and the *Ægialitis vocifera* of modern ornithologists. About the size of a snipe, it is mostly sooty-brown above, but showing a bright buff on the tail coverts, and in flight a white bar on the wings; beneath it is pure white except two pectoral bands of deep black. It is one of the finest as well as the largest of the group commonly known as Ringed Plovers or Ring Doterels,[1] forming the genus *Ægialitis* of Boie. Mostly wintering in the south or only on the sea-shore of the more northern States, in spring it spreads widely over the interior, breeding on the newly-ploughed lands or on open grass fields. The nest is made in a slight hollow of the ground, and is often surrounded with small pebbles and fragments of shells. Here the hen lays her pear-shaped, stone-colored eggs, four in number, and always arranged with their pointed ends touching each other, as is indeed the custom of most Limicoline birds. The parents exhibit the greatest anxiety for their offspring on the approach of an intruder; the hen runs off with drooping wings and plaintive cries, while the cock sweeps around, gesticulating with loud and angry vociferations. It is the best-known bird of its family in the United States, throughout which it is found in all suitable districts, but less abundantly in the northeast than further south or west. In Canada it does not range further to the northward than 56° N. lat., and it is not known to occur in Greenland, or hardly in Labrador, though it is a passenger in Newfoundland every spring and autumn.[2] In winter it finds its way to Bermuda and to some of the Antilles, but it is not recorded from any of the islands to the windward of Porto Rico. However, in the other direction it goes very much further south, travelling down the Isthmus of Panama and the west coast of South America to Peru. The Killdeer has several other congeners in America, among which may be noticed *Æ. semipalmata*, so curiously resembling the ordinary Ringed Plover of the Old World, *Æ. hiaticula*, except that it has its toes connected by a web at the base; and *Æ. nivosa*, a bird inhabiting the western parts of both the American continents, which in the opinion of some authors is only a local form of the widely-spread *Æ. alexandrina* or *cantiana*, best known by its English name of Kentish Plover, from its discovery near Sandwich towards the end of the last century, though it is far more abundant in many other parts of the Old World. The common Ringed Plover, *Æ. hiaticula*, has many of the habits of the Killdeer, but is much less often found away from the sea-shore, though a few colonies may be found in dry warrens in certain parts of England many miles from the coast, and in Lapland at a still greater distance. In such localities it has the curious habit of paving its nest with small stones, (whence it is locally known by the name of "Stone-hatch"), a habit almost unaccountable, unless regarded as an inherited instinct from shingle-haunting ancestors.

About thirty species all apparently referable with propriety to the genus *Ægialitis* have been described, but probably so many do not exist. Some, as the Kentish Plover above named, have a very extended distribution, for that, letting alone its supposed American habitat, certainly occurs in greater or less numbers on the coasts of China, India, and Africa generally. On the other hand there is one, the *Æ. sanctæ-helenæ*, which seems to be restricted to the island whence it takes its scientific name, and where it is called the "Wire-bird" (*Ibis*, 1873, p. 260). Nearly allied to *Ægialitis* are two genera peculiar to the New Zealand subregion—*Thinornis*, which does not call for any particular remark, and the extraordinary *Anarhynchus*, which deserves a few words. Of this there is but one species, *Æ. frontalis*, the Wrybill, so called from its bill being congenitally bent in the middle and diverted to the right side—a formation supposed to give the bird greater facility in seeking its food, chiefly anthropods that lurk under stones, round which it may be seen running from left to right. Mr. Buller (*B. New Zealand*, p. 219) connects with this habit the curious fact that the black pectoral band worn by the bird is "narrower and of a less decided color on the left side of the breast," whence he infers that "the law of natural selection has operated to lessen the coloring on the side of the bird more exposed to hawks and other enemies while the *Anarhynchus* is hunting for its daily food." Be that as it may, it does not detract from the wonderful nature of this asymmetry of the bill, which is comparable indeed with that found in so large a number of cetaceans among mammals, but with nothing known among birds, for in the CROSSBILLS (*q.v.*) the bones of the mandibles are not affected, and in certain owls (*Nyctala*) the distortion of the ear-bones is not externally visible. (A. N.)

KILLIZ, or KILIS, a town of Syria, in the Turkish vilayet of Aleppo, in 37° 2′ N. lat. and 37° 2′ E. long., 60 miles north of the city of Aleppo. It is situated in an extremely fertile plain or plateau, completely surrounded with olive groves, the produce of which is reckoned the finest oil of all Syria; and its position on the regular route from Birejik on the Euphrates to Southern Caramania gives it considerable traffic. The bazaars are unusually fine, and gunmaking is a common craft in the town. The population, variously estimated at 12,000 and 6000, consists largely of Arabs, the town lying just on the northern rim of the Arab territory.

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[1] The word Doterel seems properly applicable to a single species only, the *Charadrius morinellus* of Linnæus, which, from some of its osteological characters, may be fitly regarded as the type of a distinct genus, *Eudromias*. Whether any other species agree with it in the peculiarity alluded to is at present uncertain.

[2] A single example is said to have been shot near Christchurch, in Hampshire, in April, 1857 (*Ibis*, 1862, p. 276)

KILMARNOCK, a market-town, and parliamentary and municipal burgh, in the district of Cunningham, Ayrshire, Scotland, is situated on both sides of the Kilmarnock water, near its junction with the Irvine, 21 miles southwest of Glasgow by rail. The town is long and narrow, but its principal streets are well-built and spacious. Among the chief buildings are the town-house, the court-house, the corn-exchange buildings (including the Albert tower, 110 feet high, and various public offices), the observatory, and the academy, built in 1876 at a cost of £5000 to accommodate six hundred children. Kilmarnock also possesses the endowed Kay schools, an industrial school in the once famous Kilmarnock House, a school of art, an athenæum, a public library, an opera house, and an infirmary. In the Kay park of 40¾ acres, purchased from the duke of Portland for £9000 (with a legacy left by a native of the town in 1866), stands the Burns Monument, inaugurated in August, 1879. Kilmarnock rose into importance in the 17th century by its production of striped woollen "Kilmarnock cowls" and broad blue bonnets. Knitted woollen bonnets are still manufactured to an annual value of about £25,000, but by far the most important textile industry is carpet-weaving. When trade is good, the annual turnout of Brussels and Scotch carpets is valued at about £100,000. There are several spinning mills in connection with the carpet factories. Tweeds, blankets, shawls, and tartans are produced to a limited but rapidly increasing extent; the manufacture of wincey is larger. Calico-printing, once important, has dwindled. The boot and shoe trade is prosperous; and there are very extensive iron and engineering works in the town. Situated in a highly cultivated region, Kilmarnock is famous for its dairy produce; and the largest cheese-show in Scotland is held there annually. The neighborhood abounds in freestone and coal. The burgh is governed by a provost, six bailies, and eighteen councillors. It unites with Dumbarton, Port-Glasgow, Renfrew, and Rutherglen in returning one member to parliament. The population in 1881 was 23,901.

KILSYTH, a burgh of barony in Stirlingshire, Scotland, is situated about 12 miles northeast of Glasgow. It is ill built and dingy. On August 15, 1645, the Covenanters under Baillie were defeated at Kilsyth by Montrose with great slaughter. Kilsyth is further interesting as the centre of remarkable religious revivals in 1742–43 and 1839. The present village dates from the middle of the 17th century. It became a burgh of barony in 1826 by charter from George IV. The inhabitants are chiefly engaged in the neighboring coal and iron works; but weaving and paper-making are also carried on. The population in 1881 was 5402.

KILWINNING, a market-town in Cunningham district, Ayrshire, Scotland, is situated on the right bank of the Garnock, 26 miles southwest of Glasgow by rail. The houses are neat, but somewhat straggling. The chief buildings are the parish church (with a handsome detached Gothic tower erected in 1815 in place of an older one, 103 feet high, which fell in 1814), the Free church, and the board school. The greatest interest of the place centres in its ruined abbey, originally one of the richest in Scotland. Founded about 1140 by Hugh de Morville, lord of Cunningham, it was dedicated to St. Winning, who lived on the spot during the 8th century, and has given his name to the town. This beautiful specimen of Early English was destroyed in 1561; and its lands were granted to the earl of Eglinton and others. Kilwinning is the traditional birthplace of Scottish freemasonry; and Kilwinning lodge, said to have been founded by the foreign architects and masons who came to build the abbey, is still looked up to as the mother-lodge in Scotland. The royal company of archers of Kilwinning—dating, it is said, as far back as 1488—used till recently to meet annually to shoot at the papingo, or popinjay, in the manner described in Scott's *Old Mortality;* and in 1881 an attempt has been made to revive the custom. The former industry in weaving shawls and lighter fabrics has quite died out. The large iron, coal, and fire-clay works in the neighborhood employ most of the working inhabitants. A woollen-mill, with sixty hands, but capable of employing three hundred, was opened in 1881. The population of the parish in 1881 was 7037; of the town, 3469. About a mile from Kilwinning is Eglinton Castle, the principal seat of the earl of Eglinton, where the famous Eglinton tournament was held in 1839.

KIMBERLEY, formerly called New Rush, one of the mining towns of the diamond district of South Africa, situated in Griqualand West, to the east of the Orange river, 520 miles northeast of Cape Town. Though it dates only from 1872, and has much of the temporary character to be expected from the conditions that gave it existence, it bids fair to be a permanent settlement, having a number of buildings of stone and brick, a market-place, banks, churches, etc., and publishing a *Diamond News.* Although in 1874 the population left almost *en masse* for the gold-mines of Leydenberg (in Transvaal), the town was estimated in 1881 to have something like 10,000 inhabitants, besides a floating native population about equal in number. See Holub, *Seven Years in South Africa*, 1881.

ḲIMḤI. ReDaK, *i. e.* Rabbi David Ḳimḥi or Kimchi,[1] was born at Narbonne after 1155, and died probably in the same city about 1235. His father Rabbi Yoseph, or his grandfather Rabbi Isaac (Yiṣḥak) Ibn Ḳimḥi, had immigrated into Provence from Spain, where Arab fanaticism had compelled the Jews to flee from the sword of tyranny. In Provence the family took the Gentile surname of *Petit.*[2] Rabbi David lost his father (who was himself a grammarian, Bible commentator, and poet of no mean order) very early; but his elder and only brother, Rabbi Mosheh (a fair scholar, but famous chiefly through his younger brother), was his principal oral teacher. The valuable literary treasures of his father, however, falling into his hands, Redak grew strong by studying them, and, as we know, eclipsed them completely, although he lacked his father's originality. But, if Rabbi David lacked originality, he had abundance of instinct for finding out the best in the works of his predecessors, and abundance of genius for digesting and assimilating it till it became his own in a peculiar way. Although preceded by Ḥayyúj, Ibn Janáḥ, and others, and succeeded by Abraham de Balmes, Elias Levita, and others, Ḳimḥi has maintained the position of the greatest Jewish grammarian and lexicographer for six hundred and fifty years. And although much inferior as a Biblical scholar and talmudist to Rashi, and as a critic and philosopher to Abraham Ibn Ezra, he has outstripped both in the eyes not only of the Christians, but to some extent even of the Jews, and thus reigned supreme for more than half a millennium, as a commentator on the Bible. The fact is, he united in his own person the childlike simplicity of Rashi and the incisive criticism of Ibn Ezra. Add to this that he was master of the Targums and Aggadoth as few before or after him, that he had Hebrew, Arabic, and Greek philosophy at his fingers' ends, and that he was endowed with a truly poetical soul, and the mystery is explained how the merely reproductive scholar could cause original scholars of the highest eminence, but who were one-sided, to be all but forgotten. Not only have his works, in whatever field they are to be found, been printed and reprinted, but the most important of them are translated into Latin,[1] into Judæo-German,[2] and even into English.[3] The following is a list of Ḳimḥi's works, which, however, lays no claim to perfection:—

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[1] Not Kamchi. Compare קימחית in the Talmud Yerushalmi, *Horayoth*, iii. 2.

[2] From these circumstances Ḳimḥi is known as *Hassephardi* (the Spaniard), as *Ibn* Ḳimḥi, or as *Maistre Petit.* *Petit* is, to a certain extent, an equivalent of Ḳimḥi (from קמח, grain ground small).

Grammar.—מכלול, part i.:—(1) Constantinople, 1532–34, folio; (2) Constantinople, 1532–34, 8vo; (3) with Latin translation by Agathius Guidacerius, Paris, 1540, 8vo; (4) with additamenta by Elias Levita, Venice, 1544, 8vo,[4] and again (5) 1545, folio; (6) with the same additions, Venice, 1545, 8vo; (7) with the same additions and commentary by Mosheh העכים (Hechingen?), Fürth, 1793, 8vo, (8) with additions, see MSS. by Rittenberg, Lyck, 1862, 8vo. In addition to these have appeared *Compendia* from this grammar by Pagninus, Paris, 1549, 4to; and by Baynus, Paris, 1554, 4to.

Lexicon.—מכלול, part ii.:—(1) without place and date, but before 1480, folio; (2) with a Biblical index on the margin, Naples, 1490, folio; (3) with a Biblical index inserted, Naples, 1491, folio; (4) without pagination, Constantinople, 1513, folio; (5) Venice, 1529, folio; (6) with corrections from MSS., Salonika, 1532–33, folio; (7) Venice, 1546, folio; (8) with notes by Elias Levita, Venice, 1546–48, folio; (9) with Latin translation of the roots, Venice, 1546–48, folio; (10) the text revised from three MSS., Berlin, 1847, 4to.

Commentaries.—(1) *On the Greater Part of Genesis*,[5] Pressburg, 1842, 8vo. (2) *On the Prophets and the Psalms*, in the first Rabbinic Bible, Venice, 1517, folio. (3) *On the Prophets and the Chronicles*, in the third and all subsequent Rabbinic Bibles, Venice, 1548, 1568, 1617–19; Basel, 1618–19; Amsterdam, 1724; Warsaw, 1860–68; 1866–76. (4) *On the Former Prophets, Jeremiah and Ezekiel*, in the second Rabbinic Bible, Venice, 1524–25, folio. (5) *On the Former Prophets*, Soncino, 1485; Leiria, 1494; Pesaro, 1511; Salonika, 1535, all in folio. (6) *On the Latter Prophets*, Guadalaxara, 1482; Soncino, 1485–86; Pesaro, 1515, all in folio. (7) *On Isaiah and Jeremiah*, Lisbon, 1492, folio. (8) *On the Minor Prophets*, Paris, 1539–40, 4to. (9) *On Hosea, Joel, Amos, Obadiah, and Jonah*, Paris, 1556, 4to. (10) *On Hosea*, with the Latin translation of Mercier abridged by Coddæus, Leyden, 1621, 4to; with the sacred text, Helmstädt, 1702–3, 4to; by Herman von der Hardt, Göttingen, 1775, 4to. (11) *On Joel and Malachi*, by Münster, Basel, 1570, 12mo. (12) *On Joel and Obadiah*, Utrecht, 1657, 8vo. (13) *On Amos*, with a letter by Elias Levita, Basel, 1531, 8vo. (14) *On Obadiah*, Bremen, 1673, 4to; Jena, 1678, 8vo. (15) *On Jonah*, Utrecht, 1656, 8vo; Leipsic, 1683, 8vo; Utrecht, 1692, 8vo; Frankfort-on-the-Main, 1697, 4to. (16) *On Haggai, Zechariah, and Malachi*, by Thomas Neale, Paris, 1557, 4to. (17) *On Malachi*, Basel, 1530, 8vo; Rostock, 1637, 4to; Leipsic, 1679, 8vo. Besides these editions it ought to be mentioned that the *Haphtaroth*, or "Prophetic Portions," read on sabbaths, festivals, etc., are to be found attached to the Pentateuch, Constance, 1505, folio; Venice, 1516, folio; Constance, 1522, folio; Cremona, 1566, folio; Venice, 1568, folio; Cracow, 1588, folio; Basel, 1618, folio; Berlin, 1705, folio; Wilmersdorf, 1713, folio; Amsterdam, 1726, folio; Frankfort-on-the-Main, 1730, folio; Metz, 1766, 4to. (18) *On the Psalms*, without place (but no doubt Bologna), 1477, folio; in the *Hagiographa*, Naples, 1486–87, folio; in the first Rabbinic Bible, as above; Salonika, 1522, folio; Isny, 1541, folio; Cremona, 1561, 8vo; Venice, 1566, 8vo; Venice, 1596; Amsterdam, 1681, 4to; Zolkiew, 1696, 4to; Frankfort-on-the-Main, 1712, 8vo; Dyhernfurt, 1714, 4to; Amsterdam, 1765, 4to; Berlin, 1767, 4to; Amsterdam, 1777, 16mo; as part of prayer-book, Amsterdam, 1796, 18mo; Amsterdam, 1816, 8vo; a part of a Bible, Fürth, 1842–47, 8vo; Zitomir, 1867, 16mo. In addition to these there ought to be mentioned *The First Ten Psalms*, etc., Constance, 1544, folio, and *An Extract from Kimchi on the Psalms*, etc., Wilmersdorf, 1725, 4to.

Miscellaneous Works.—(1) *Et Sopher on the Massoreth and the Accents*, Lyck, 1864, 8vo. (2) *Antichristiana*:—(*a*) in the *Milchemeth Chobah*, Constantinople, 1710, 8vo; and (*b*) in the *Nitzzachon*, Nuremberg, 1644, 4to; Amsterdam 1709, 16mo; Amsterdam, 1711, 16mo; Amsterdam, 1827, 16mo; Königsberg, 1848–50, 24mo. The "Antichristiana" contained in the *Nitzzachon* are the "Answers to the Christians," from the author's commentary on the *Psalms*, which are omitted in most of the editions. (3) *Religious Philosophy.*—The "explanation of the *Merkabah* (first chapter of Ezekiel) in a mystic way," is, although attached to the author's commentary on Ezekiel, a separate essay. In all the editions it is to be found after that commentary.

KIMPULUNG, a town of Roumania, in that part of the country formerly known as Great Wallachia, is situated at the foot of the Transylvanian Alps on the banks of one of the left-hand tributaries of the Danube, about 80 miles northwest of Bucharest. Its position near the Törzburg pass gives it a considerable share of the trade between Hungary and Roumania. Population about 9000.

KINCARDINE, or The Mearns, a maritime county in the east of Scotland, is situated between 56° 46′ and 57° 9′ N. lat., and between 2° 3′ and 2° 47′ W. long. It is bounded on the E. by the German Ocean, on the N. W. by Aberdeenshire, and on the S. W. by Forfarshire. Its length along the coast from the mouth of the North Esk to that of the Dee is 31 miles, and its breadth east to west from Dunnottar to Mount Battock 22 miles. The total area is 248,284 acres, or about 388 square miles.

Geology.—The Grampian range of mountains intersects the county from east to west, and occupies a breadth of about 8 miles in the western and northwestern districts, terminating in the northeastern corner in the promontory of Girdleness. To the north the county slopes into the picturesque and finely wooded valley of the Dee, and towards the south into the "How (or hollow) of the Mearns," a continuation of the valley of Strathmore, but it rises again into smaller eminences towards the coast. The highest summit of the Grampians in Kincardineshire is Mount Battock, 2465 feet, but a considerable number range from 1500 to a little above 2000 feet. The southern part of the coast from the North Esk is rocky but low, with considerable stretches of sand; from Bervie to Stonehaven it rises into an almost unbroken line of perpendicular cliffs ranging from 100 to 250 feet in height; from Stonehaven to the mouth of the Dee it is still more bold and rocky, but at the same time more frequently interrupted by creeks and bays, which form natural harbors for a number of fishing villages. The greater part of the county belongs to the Upper Silurian strata of the Highlands, consisting chiefly of gneiss, but towards the west there is a large eruption of granite, and the southern half of the county belongs to the upper strata of Old Red Sandstone. Conglomerate occurs on the coast, and porphyry, sandstone, and whinstone in the southern part of the county. Lime is found, but not in amount sufficient to meet agricultural wants, and large quantities are imported.

Rivers and Lakes.—The principal rivers are the Dee, which skirts the northern boundary of the county, and receives the Feugh at Banchory, where are the beautiful falls of Feugh; the North Esk, which, after entering it from Forfarshire, receives the tributary of the Luther, and forms a portion of the southwestern boundary of the shire; the Bervie, which rises in the Grampians, and after flowing southeastward for about 10 miles, falls into the sea at Bervie; and the Carron and Cowie, which flow, the one eastward and the other southeastward to the sea at Stonehaven. The principal lakes are the Loch of Drum, lately reduced from 300 to 100 acres, and Loirston Loch, 27 acres.

Climate, Soil, and Agriculture.—The climate is healthy, but, except on the north side of the Dee, often cold even on the low grounds, owing both to exposure to east winds, especially near the sea-coast, and to the proximity of bleak and chilly uplands. It has, however, been greatly improved by extensive drainage of the marshes. The mean annual temperature is 45° Fahr., that of summer being 58°, and of winter 37°. A great part of the mountainous district is unsuitable for either pasturage or tillage, and is occupied chiefly by deer forests and grouse moors; but the land in the valley of the Dee, in the "How," and along the coast is very productive, and is cultivated according to the most advanced methods. A considerable portion of the "How" is, however, on account of the difficulty of drainage, still occupied by moor and moss. The land in this district is richer and stronger than that in the valley of the Dee, but the most fertile region is that along the sea-coast, the soil consisting more generally of a deep loam resting on clay, although in some places it is poor and thin, or stiff and cold.

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[1] As, *e. g.*, the commentary *On Isaiah*, by Malanimeus, Florence, 1774, 4to; *On Hosea*, by Mercier, Leyden, 1621, 4to; *On Joel*, by Leusden, Utrecht, 1657, 8vo; *On Obadiah*, by Crocius, Bremen, 1673, 4to; *On Obadiah*, by Bedwell, London, 1601, 4to; *On Jonah*, by Leusden, Utrecht, 1656, 8vo; *On Haggai, Zechariah, and Malachi*, by Neale, Paris, 1557, 4to; *On Malachi*, by Bohl, Rostock, 1637, 4to; *On the Psalms*, by Janvier, Paris, 1666, 4to; *On Psalms* i.–x., by Fagius, Constance, 1544, folio, and with Janvier's translation in Reland's *Analecta Rabbinica*, Utrecht, 1723, 8vo; *On Psalm* iv., by Bourdelot, Paris, 1619, 4to; and on *Psalm* xix., by Philipp. d'Aquino, 1629, 8vo.

[2] That, for instance, *On Isaiah*, Cracow, 1586, 4to.

[3] As that *On Zechariah*, by M'Caul, London, 1837, 8vo.

[4] Dr. W. Aldis Wright, Fellow of Trinity College, Cambridge, possesses this edition, printed by Cornelio Adelkind at Bombergi's house, with the remarkable date on the title-page—אתק ומד לגאולתינו (*sic*), *i. e.*, 1544 of our redemption, showing that the editor was a baptized Jew. Of this edition no other copy is known to us.

[5] This was no doubt Ḳimḥi's last production.

According to the agricultural returns for 1881, the total area under crops was 120,631 acres, a percentage of 48.6 that for 1870 being 47.1. The area under corn crops was 44,803; under green crops, 22,476; under rotation grasses, 46,645; under permanent pasture, 6552 acres. The area under woods was 27,880 acres, while 12 acres were under nursery grounds, and 23 under market gardens. About two-thirds of the area under corn crops is occupied by oats, which in 1881 covered 31,430 acres, while 12,120 acres were under barley, and 577 acres, chiefly in the neighborhood of the sea-coast, were under wheat, the area of which has been rapidly declining, 55 under rye, 581 under beans, and 40 under pease. Of green crops about four-fifths of the area is under turnips and swedes, which in 1881 occupied 18,304 acres, 3696 being occupied by potatoes, 450 by vetches and similar crops, 17 by carrots, and 8 by cabbage. Flax occupied 1 acre, and there were 184 acres fallow. Great improvements have lately been effected in regard to farm buildings and drainage.

The total number of horses, many of which are well-bred Clydesdales, in 1881 was 4798. Of these, 3893 are stated to be used solely for agricultural purposes, and 905 to be kept solely for breeding purposes. Cattle in 1881 numbered 25,013, or an average of 21 to every 100 acres under cultivation, the average for Scotland being 23.9. Much attention is paid to the rearing of stock, and cattle feeding is carried on according to the most advanced methods. The most common breed is the shorthorn, which are bought in for feeding from Ireland, but a few Canadian cattle have also lately been bought. The more common home-bred stock is a cross between shorthorned and polled; but there are also many valuable herds of the pure polled breed. Sheep in 1881 numbered 24,966, an average of 20.7 to every 100 acres under cultivation, the average for Scotland being 141.3. Blackfaced sheep are of course those chiefly kept on the hill pastures, but on the lowland farms Cheviots, or a cross with Leicesters, are not uncommon. The number of pigs in 1881 was 1967.

The following table gives a classification of holdings according to size in 1875 and 1880, with the total area under each class of holding:

	50 Acres and under.		From 50 to 100 Acres.		From 100 to 300 Acres.		From 300 to 500 Acres.		From 500 to 1000 Acres.		Above 1000 Acres.		Total.	
	No.	Acres.	No.	Acres.	No.	Acres.	No.	Acres.	No.	Acres.	No.	Acres.	No.	Acres.
1875	1,200	15,604	301	22,583	362	60,730	41	15,254	10	6,281	...	....	1,914	120,452
1880	1,081	14,705	308	23,118	370	63,338	39	14,692	8	4,489	...	....	1,806	120,332

It will thus be seen that about three-fifths of the holdings are under 50 acres in extent, but that their number has within recent years been diminishing. According to the *Owners of Lands and Heritages Return*, 1872-73, the land was divided among 1384 proprietors, possessing 244,585 acres, with a gross annual value of £253,393. Of the owners, 1189 possessed less than 1 acre, and the average value per acre was £1 0s. 6½d. Sir Thomas Gladstone owned 45,062 acres; Earl of Kintore, 17,370; James Young, 16,659; Viscount Arbuthnott, 13,560; Sir J. H. Burnett, 12,025; R. W. Duff, 8722; Mrs. Badenoch Nicolson, 8481; W. N. Forbes, 6528. A comprehensive account of the agriculture of Kincardineshire, by James Macdonald, is contained in the *Transactions of the Highland and Agricultural Society* for 1881.

Manufactures.—Woollen manufactures are carried on at Stonehaven, and flax-spinning and weaving at Bervie, Laurencekirk, and a few other places. There are several breweries, tanneries, and distilleries. Fishing gives employment to a number of persons in the sea-coast villages. The rental of the salmon fishings on the coast is £7000 and of those on the rivers £1250 per annum. There is some shipping at Stonehaven.

Railways.—The Caledonian Railway traverses the county from Marykirk to the mouth of the Dee, and a branch line runs along the sea-coast as far north as Bervie.

Administration.—The county comprises eighteen parishes and three parts of parishes; one royal burgh, Bervie, which received its constitution from David II. in return for the hospitality of the inhabitants when he landed there through stress of weather; and one burgh of barony, Stonehaven, which since 1600 has been the capital of the county, the former capital, Kincardine, in the parish of Fordoun, at which there was at one time a royal castle, having now declined to the position of a mere hamlet. The county is now joined to the sheriffdom of Aberdeen, weekly courts being held at Stonehaven. One member of parliament is returned for the county, and Bervie is united with the Montrose district of burghs, which returns one member.

Population.—The population between 1801 and 1851 increased from 26,349 to 34,598. In 1871 it was 34,466, and in 1881 it was 34,460, of whom 16,972 were males and 17,488 females. The population of Stonehaven in 1871 was 3896, and in 1881 it was 3948. Laurencekirk in 1881 had a population of 1454, Johnshaven 1039, and Bervie 1094.

History and Antiquities.—Anciently Kincardine belonged to the district of Pictavia. Cairns and stone circles are frequent in nearly every part of the shire, and there are numerous traces of Roman camps. According to some the county received the name Mearns from having been granted to Mernia, a Scottish king, brother of the Angus who received the neighboring county of Forfar. The only old building of special interest is Dunnottar Castle near Stonehaven, the old seat of the Keiths, earl marischals of Scotland. The castle stands on a high projecting rock about 150 feet above the sea, by which it is nearly surrounded, and was formerly an extensive fortress of great strength. In the reign of James II. it was used as a prison for nonconformists. Among the eminent persons connected with Kincardine may be mentioned John of Fordoun the historian, George Wishart, Robert Barclay the Quaker, Bishop Burnet, Dr. John Arbuthnott, Dr. James Beattie, Dr. Thomas Reid, and Lord Monboddo.

See the *History and Traditions of the Lands of the Lindsays*, 1853; *History and Antiquities of the Mearns*, 1858; and *Memorials of Angus and the Mearns*, 1861,—all by A. Jervise.

KINDERGARTEN, a German word meaning "garden of children," is a name given by Friedrich Froebel (see FROEBEL) to a kind of "play-school" invented by him for furthering the physical, moral, and intellectual growth of children between the ages of three and seven. Froebel's observation of the development of organisms and his fondness for analogies drawn from trees and plants made him attach especial importance to our earliest years, years in which, as he said, lies the tap-root of much of the thought and feeling of after life. Although the analogies of nature had constantly been referred to before Froebel's days ("First the blade, then the ear, then the full corn in ear"), and Bacon, speaking of education, has said that the gardener bestows the greatest care on the young plants, the Renaissance left the imparting theory of education so firmly fixed on the mind of Europe that for two hundred years the developing theory could hardly get a hearing, and little was done to reduce it to practice before the attempt of Pestalozzi. Pestalozzi and other great thinkers (notably Comenius), who attached much importance to the first years of life, looked to the mother as the sole educator. But in the case of the poor the mother might not have time to attend to her children; so towards the end of the last century Pestalozzi planned and Oberlin formed day asylums for young children, the benefit of which was intended no less for the mother than the child. Schools of this kind took in the Netherlands the name of "play school," and in England, where they have especially thriven, of "infant schools." But Froebel's idea of the "Kindergarten" differed essentially from that of the infant schools. He maintained that there was something to do for young children which even the ideal mother in the ideal family could not do. The child required to be prepared for society by being early associated with its equals; and young children thus brought together might have their employments, especially their chief employment, play, so organized for them as to draw out their capacities of feeling and thinking, and even of inventing and creating.

According to the development theory all education must be based on study of the nature to be developed. Froebel's study of the nature of children showed him that their great characteristic was restlessness. This was, first, restlessness of body, delight in mere motion of the limbs; and, secondly, restlessness of mind, a constant curiosity about whatever came within the range of the senses, and especially a desire to examine with the hand every unknown object within reach. Children's fondness for using their hands was specially noted by Froebel, and he found that they delighted, not merely in examining by touch, but also in altering whatever they could alter, and further that they endeavored to imitate known forms, whether by drawing or by modelling in putty or clay. Besides remarking in them these various activities, he saw that children were sociable and needed the sympathy of companions. There was, too, in them a growing moral nature, passions, affections, and conscience, which needed to be controlled, responded to, cultivated. Both the restraints and the opportunities incident to a well-organized community would be beneficial to their moral nature, and prove a cure for selfishness.

Froebel held that the essence of all education was to be found in rightly directed but spontaneous action. So the children must be employed; and at that age their most natural employment is play, especially, as Wordsworth has pointed out, games in which they imitate and "con the parts" they themselves will have to fill in after years. Froebel agreed with Montaigne that the games of children were "their most serious occupations," and with Locke that "all the plays and diversions of children should be directed towards good and useful habits, or else they will introduce ill ones" (*Thoughts concerning Education*, § 130). So he invented a course of occupations, most of which are social games. Many of the games are connected with the "gifts," as he called the series of simple playthings provided for the children, the first being the ball, "the type of unity." The "gifts" are chiefly not mere playthings but materials which the children work up in their own way, thus gaining scope for their power of doing and inventing and creating. The artistic faculty was much thought of by Froebel, and, as in the education of the ancients, the sense of rhythm in sound and motion was cultivated by music and poetry introduced in the games. Much care was to be given to the training of the senses, especially those of sight, sound, and touch. Intuition or first-hand experience (*Anschauung*) was to be recognized as the true basis of knowledge, and though stories were to be told, and there was to be much intercourse in the way of social chat, instruction of the imparting and "learning-up" kind was to be excluded. Froebel sought to teach the children not what to think but how to think, in this following in the steps of Pestalozzi, who had done for the child what Bacon nearly two hundred years before had done for the philosopher. Where possible, the children were to be much in the open air, and were each to cultivate a little garden.

To judge by all appearances at the present date (1881), the kindergarten will be an important institution in the education of the future. The first kindergarten was opened at Blankenburg, near Rudolstadt, in 1840, but after a needy existence of eight years was closed for want of funds. In 1851 the Prussian Government declared that "schools founded on Froebel's principles or principles like them could not be allowed." But the idea had far too much vitality to be starved or frowned down. Although its progress has not been rapid, it has been constant. As early as 1854 it was introduced into England by the then famous Ronges, and Henry Barnard reported on it that it was "by far the most original, attractive, and philosophical form of infant development the world has yet seen" (*Report to Governor of Connecticut*, 1854). But the attempt failed, and though there are now a Froebel Society, an institution for training young women to conduct kindergartens, and also some good kindergartens, Froebel's idea has hardly yet found a home in Britain. The great propagandist of Froebelism, the Baroness Marenholtz-Bülow, drew the attention of the French to the kindergarten from the year 1855, and Michelet declared that Froebel had "solved the problem of human education." In the department of the Seine the "Salles d'asile" now consist of a class for children from two to four years old, and a "Froebel class" of children from four to six. In Italy the kindergarten has been introduced by Madame Salis-Schwabe, and is used in the education of the poor. In Austria it is recognized and regulated by the government, though the Volks-Kindergärten are not numerous. But by far the greatest developments of the kindergarten system are in the United States and in Belgium. Dr. William T. Harris, assisted by Miss Blow, tried the experiment of making the kindergarten a part of the public education in St. Louis eight years ago, and there are now no less than 8000 children, all over five years of age, in the St. Louis public kindergartens. In Belgium the mistresses of the "Écoles gardiennes" have for some time been instructed in the "idea of the kindergarten" and "Froebel's method," and in 1880 the minister of public instruction, Van Humbeeck, issued a programme for the "Écoles Gardiennes Communales," which is both in fact and in profession a kindergarten manual. This programme attributes the improvement in infant schools to "le souffle puissant de Froebel;" and, after explaining that the method to be adopted is based on the laws which govern the development of the child, the minister continues: "In its great principles as well as in its main applications this method is that created by the genius of Froebel." This estimate of Froebel's principles contrasts strangely with the Prussian minister's thirty years earlier.

Literature.—Henry Barnard's volume, *Froebel's Kindergarten*, Hartford, U. S. A., 1881, contains a large collection of papers on the subject, original and translated; W. T. Harris's *Reports*, give full accounts of the adaptation of the Kindergarten to public education in St. Louis. Kindergartens in Germany are described in Joseph Payne's *Visit to German Schools*, 1876. Practical guides published in England are J. and B. Ronge's, 3d ed., 1855; E. Wiebe's *Paradise of Children*; and Miss Lyschinska's, 1880. Other literature is cited in Steiger's *Cyclopædia of Education*; and in L. Walter's *Die Fröbelliteratur*, 1881. (R. H. Q.)

KINEMATICS. See MECHANICS.

KING, WILLIAM (1650–1729), a political and religious writer, and successively bishop of Derry and archbishop of Dublin, was born at Antrim in 1650. He was educated at Trinity College, Dublin, and after being presented to the parish of St. Werburgh, Dublin, in 1679, was elected dean of St. Patrick's, Dublin, in 1688, bishop of Derry in 1691, and archbishop of Dublin in 1702. He died in 1729. King was the author of *The State of the Protestants in Ireland under King James's Government*, 1691, but is best known by his *De Origine Mali*, 1702 (English translation, 1731), an endeavor to reconcile the presence of evil with the existence and goodness of an Omnipotent Being, which was deemed worthy of a reply by Bayle and Leibnitz. He also published a sermon entitled *Divine Predestination and Foreknowledge consistent with the Freedom of Man's Will*, 1709, and various other small treatises.

KING-BIRD, the *Lanius tyrannus* of Linnæus, and the *Tyrannus carolinensis* or *T. pipiri* of most later writers, a common and characteristic inhabitant of North America, ranging as high as 57° N. lat. or further, and westward to the Rocky Mountains, beyond which it goes to Oregon, Washington Territory, and British Columbia, though apparently not occurring in California. In Canada and the Northern States of the Union it is a summer visitor, wintering in the South, but also reaching Cuba; and, passing through Central America, it has been found in Bolivia and Eastern Peru. Both the scientific and common names of this species are taken from the way in which the cock will at times assume despotic authority over other birds, attacking them furiously as they fly, and forcing them to divert or altogether desist from their course. Yet it is love of his mate or his young that prompts this bellicose behavior, for it is only in the breeding season that he indulges in it; but then almost every large bird that approaches his nest, from an eagle downwards, is assaulted, and those alone that possess greater command of flight can escape from his repeated charges, which are accompanied by loud and shrill cries. On these occasions it may be that the King-bird displays the emblem of his dignity, which is commonly concealed; for, being otherwise rather plainly colored—dark ashy-gray above and white beneath—the erectile feathers of the crown of the head, on being parted, form as it were a deep furrow, and reveal their base, which is of a bright golden-orange in front, deepening into scarlet, and then passing into silvery-white. This species seems to live entirely on insects, which it captures on the wing, and is in bad repute with bee-masters,[1] though, according to Dr. Coues, it "destroys a thousand noxious insects for every bee it eats." It builds, often in an exposed situation, a rather large nest, coarsely constructed outside, but neatly lined with fine roots or grasses, and lays five or six eggs of a pale salmon color, beautifully marked with blotches and spots of purple, brown, and orange, generally disposed in a zone near the larger end.

King-Bird.

Nearly akin to the King-bird is the Petchary or Chicheree, so called from its loud and petulant cry, *T. dominicensis*, or *T. griseus*, one of the most characteristic and conspicuous birds of the West Indies, and the earliest to give notice of the break of day. In habits, except that it eats a good many berries, it is the very counterpart of its congener, and is possibly even more jealous of any intruder. At all events its pugnacity extends to animals from which it could not possibly receive any harm, and is hardly limited to any season of the year.

In several respects both of these birds, with several of their allies, resemble some of the Shrikes; but it must be clearly understood that the likeness is but of analogy, and that there is no near affinity between the two Families *Laniidæ* and *Tyrannidæ*, which belong to wholly distinct sections of the great Passerine Order; and while the former is a comparatively homogeneous group, much diversity of form and habits is found among the latter. Similarly many of the smaller *Tyrannidæ* bear some analogy to certain *Muscicapidæ*, with which they were at one time confounded (see FLYCATCHER, vol. ix. p. 308); but the difference between them is deepseated.[2] Nor is this all, for out of the seventy genera, or thereabouts, into which the *Tyrannidæ* have been divided, comprehending perhaps three hundred and fifty species, all of which are peculiar to the New World, a series of forms can be selected which find a kind of parallel to a series of forms to be found in the other group of *Passeres*; and the genus *Tyrannus*, though that from which the family is named, is by no means a fair representative of it; but it would be hard to say which genus should be so accounted. The birds of the genus *Muscisaxicola* have the habits and almost the appearance of Wheatears; the genus *Alectorurus* calls to mind a Water-Wagtail; *Euscarthmus* may suggest a Titmouse, *Elainea* perhaps a Willow-Wren; but the greatest number of forms have no analogous bird of the Old World with which they can be compared; and, while the combination of delicate beauty and peculiar external form possibly attains its utmost in the long-tailed *Milvulus*, the glory of the family may be said to culminate in the king of King-birds, *Muscivora regia*. (A. N.)

KINGFISHER—*Königsfischer*, Germ.,[3] *Roi-pêheux* (= *pêcheur*), Walloon—the *Alcedo ispida* of ornithologists, one of the most beautiful and well-known of European birds, being found, though nowhere very abundantly, in every country of this quarter of the globe, as well as in North Africa and Southwestern Asia as far as Sind. Its blue-green back and rich chestnut breast render it conspicuous as it frequents the streams and ponds whence it procures its food, by plunging almost perpendicularly into the water, and emerging a moment after with the prey—whether a small fish, a crustacean, or an aquatic insect—it has captured. In hard frosts it resorts to the sea-shore, but a severe winter is sure to occasion a great mortality in the species, for many of its individuals seem unable to reach the tidal waters where only in such a season they could obtain sustenance; and to this cause rather than any other (though, on account of its beauty and the utility of its feathers in making artificial flies, it is shot and netted in great numbers) is perhaps to be ascribed its general scarcity. Very early in the year it prepares its nest, which is at the end of a tunnel bored by itself in a bank, and therein the six or eight white, glossy, translucent eggs are laid, sometimes on the bare soil, but often on the fish-bones which, being indigestible, are thrown up in pellets by the birds; and, in any case, before incubation is completed these *rejectamenta* accumulate so as to form a pretty cup-shaped structure that increases in bulk after the young are hatched, but, mixed with their fluid excretions and with decaying fishes brought for their support, soon becomes a dripping fetid mass.

The Kingfisher is the subject of a variety of legends and superstitions, both classical and mediæval. Of the latter one of the most curious is that having been originally a plain gray bird it acquired its present bright colors by flying towards the sun on its liberation from Noah's ark, when its upper surface assumed the hue of the sky above it and its lower plumage was scorched by the heat of the setting orb to the tint it now bears.[4]

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[1] It is called in some parts the Bee-Martin.

[2] This is not the place to dwell upon the essential nature of the difference; but two easy modes of discriminating them externally may be mentioned. All the *Laniidæ* and *Muscicapidæ* have but *nine* primary guides in their wings, and their tarsi are covered with scales in front only; while in the *Tyrannidæ* there are *ten* primaries, and the tarsal scales extend the whole way round. The more recondite distinction in the structure of the trachea seems to have been first detected by Macgillivray, who wrote the anatomical descriptions published in 1839 by Audubon (*Orn. Biography*, v. pp. 421, 422); but its value was not appreciated till the publication of Johannes Müller's classical treatise on the vocal organs of Passerine Birds (*Abhandl. k. Akad. Wissensch. Berlin*, 1845, pp. 321, 405).

[3] But more commonly called *Eisvogel*, which finds its counterpart in the Anglo-Saxon *Isern* or *Isen*.

[4] Rolland, *Faune populaire de la France*, ii. p. 74.

More than this, the Kingfisher was supposed to possess many virtues. Its dried body would avert thunderbolts, and if kept in a wardrobe would preserve from moths the woollen stuffs therein laid, or hung by a thread to the ceiling of a chamber would point with its bill to the quarter whence the wind blew. All readers of Ovid (*Metam.*, bk. xi.) know how the faithful but unfortunate Ceyx and Alcyone were changed into Kingfishers—birds which bred at the winter solstice, when through the influence of Æolus, the wind-god and father of the fond wife, all gales were hushed and the sea calmed so that their floating nest might ride uninjured over the waves during the seven proverbial "Halcyon Days;" while a variant or further development of the fable assigned to the Halcyon itself the power of quelling storms.[1]

The common Kingfisher of Europe is the representative of a well-marked family of birds, the *Alcedinidæ* or *Halcyonidæ* of ornithologists, which is considered by some authorities[2] to be closely related to the *Bucerotidæ* (see HORNBILL, vol. xii. p. 172); but the affinity can scarcely be said as yet to be proved; and to the present writer there seems to be at least some ground for believing that a nearer alliance is to be found in the *Galbulidæ* (see JACAMAR, vol. xiii. p. 540), *Momotidæ* (MOTMOT, *q. v.*). *Meropidæ*, and perhaps some other families—though all may possibly be discovered to belong to one and the same larger group. Be that as it may, the present family forms the subject of a work by Mr. Sharpe,[3] which, though still incomplete as regards their anatomy,[4] is certainly one of the best of its class, and reflects infinite credit on its then youthful author, whose treatment of his subject was most successful. Herein are described one hundred and twenty-five species, nearly all of them being beautifully figured by Mr. Keulemans, and that number may be taken even now as approximately correct; for, while the validity of a few has been denied by some eminent men, nearly as many have since been made known, and it seems likely that two or three more described by older writers may yet be rediscovered. These one hundred and twenty-five species Mr. Sharpe groups in nineteen genera, and divides into two Subfamilies, *Alcedininæ* and *Daceloninæ*,[5] the one containing five and the other fourteen genera. With existing materials perhaps no better arrangement could have been made, but in the absence of anatomical knowledge it is certainly not to be deemed conclusive, and indeed the method since published by Sundevall (*Tentamen*, pp. 95, 96) differs from it not inconsiderably. Here, however, it will be convenient to follow that of Mr. Sharpe. Externally, which is almost all we can at present say, Kingfishers present a great uniformity of structure. One of their most remarkable features is the feebleness of their feet, and the union (syndactylism) of the third and fourth digits for the greater part of their length; while, as if still further to show the comparatively functionless character of these members, in two of the genera, *Alcyone* and *Ceyx*, the second digit is aborted, and the birds have but three toes. In most forms the bill does not differ much from that of the common *Alcedo ispida*, but in *Syma* its edges are serrated, while in *Carcineutes*, *Dacelo*, and *Melidora* the maxilla is prolonged, becoming in the last a very pronounced hook. Generally the wings are short and rounded, and the tail is in many forms inconspicuous; but in *Tanysiptera*, one of the most beautiful groups, the middle pair of feathers is greatly elongated and spatulate, while this genus possesses only ten rectrices, all the rest having twelve. Sundevall relies on a character not noticed by Mr. Sharpe, and makes his principal divisions depend on the size of the scapulars, which in one form a mantle, and in the other are so small as not to cover the back. The *Alcedinidæ* are a cosmopolitan family, but only one genus, *Ceryle*, is found in America, and that extends as well over a great part of the Old World, though not into the Australian region, which affords by far the greater number both of genera and species, having no fewer than ten of the former and fifty-nine of the latter peculiar to it.[6]

In habits Kingfishers display considerable diversity, though all, it would seem, have it in common to sit at times motionless on the watch for their prey, and on its appearance to dart upon it, seize it as they fly or dive, and return to a perch where it may be conveniently swallowed. But some species, and especially that which is the type of the family, are not always content to await at rest their victim's showing itself. They will hover like a hawk over the waters that conceal it, and, in the manner already described, precipitate themselves upon it. This is particularly the way with those that are fishers in fact as well as in name; but no inconsiderable number live almost entirely in forests, feeding on insects, while reptiles furnish the chief sustenance of others. The last is characteristic of at least one Australian form, which manages to thrive in the dryest districts of that country, where not a drop of water is to be found for miles, and the air is at times heated to a degree that is insupportable by most animals. The limits of this article forbid an entrance upon details of much interest, but the Belted Kingfisher of North America, *Ceryle alcyon*, is too characteristic a bird of that country to be passed in silence, though its habits greatly resemble those of the European species before described; and the so-called "Laughing Jackass" of New South Wales and South Australia, *Dacelo gigas*—with its kindred forms, *D. leachi*, *D. cervina*, and *D. occidentalis*, from other parts of the country—likewise requires special notice. Attention must also be called to the speculations of Mr. Sharpe (*op. cit.*, pp. xliv.–xlvii.) on the genetic affinity of the various forms of *Alcedinidæ*, and it is to be regretted that hitherto no light has been shed by palæontologists on this interesting subject, for the only fossil referred to the neighborhood of the family is the *Halcyornis toliapicus* of Professor Owen (*Br. Foss. Mamm. and Birds*, p. 554) from the Eocene of Sheppey—the very specimen said to have been previously placed by König (*Icon. foss. sectiles*, Fig. 153) in the genus *Larus*. (A. N.)

KINGLET, a name applied in many books to the bird called by Linnæus *Motacilla regulus*, and by most modern ornithologists *Regulus cristatus*, the Golden-crested or Golden-crowned Wren of ordinary persons. This species is the type of a small group which has been generally placed among the *Sylviidæ* or true Warblers, but by certain systematists it is referred to the Titmouse-Family, *Paridæ*. That the Kinglets possess many of the habits and actions of the latter is undeniable, but on the other hand they are not known to differ in any important points of organization or appearance from the former—the chief distinction being that the nostril is covered by a single bristly feather directed forwards. The Golden-crested Wren is the smallest of British birds, its whole length being about 3 inches and a half, and its wing measuring only 2 inches from the carpal joint. Generally of an olive-green color, the top of its head is bright yellow, deepening into orange, and bounded on either side by a black line, while the wing coverts are dull black, and some of them tipped with white, forming a somewhat conspicuous bar. The cock has a pleasant but weak song. The nest is a beautiful object, thickly felted of the softest moss, wool, and spiders' webs, lined with feathers, and usually built under and near the end of the branch of a yew, fir, or cedar, supported by the interweaving of two or three laterally diverging and pendent twigs, and sheltered by the rest. The eggs are from six to ten in number, of a dull white sometimes finely freckled with reddish-brown. The species is particularly social, living for the most of the year in family-parties, and often joining bands of any species of Titmouse in a common search for food. Though to be met with in Britain at all seasons, the bird in autumn visits the east coast in enormous flocks, apparently emigrants from Scandinavia, while hundreds perish in crossing the North Sea, where they are well known to the fishermen as "Woodcock's Pilots." A second and more local European species is the Fire-crested Wren, *R. ignicapillus*, easily recognizable by the black streak on each side of the head, before and behind the eye, as well as by the deeper color of its crown. A third species, *R. maderensis*, inhabits the Madeiras, to which it is peculiar; and examples from the Himalayas and Japan have been differentiated as *R. himalayensis*, and *R. japonicus*. North America has two well-known species, *R. satrapa*, very like the European *R. ignicapillus*, and the Ruby-crowned Wren, *R. calendula*, which is remarkable for a loud song that has been compared to that of a Canary-bird or a Skylark, and for having the characteristic nasal feather in a rudimentary or aborted condition. Under the name of *R. modestus*, or "Dalmatian Regulus" of many English authors, two very distinct species are now known to have been confounded, both belonging really to the group of Willow-Wrens, and having nothing to do with *Regulus*. One, which has occurred in Britain, is the *Motacilla superciliosa* of old or *Phylloscopus superciliosus* of modern authors, and is a native of Northern Asia, visiting Europe nearly every year, and the other, also of Asiatic origin, is the *Motacilla* or *Phylloscopus proregulus*. (A. N.)

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[1] In many of the islands of the Pacific Ocean the prevalent Kingfisher is the object of much veneration.

[2] *Cf.* Eyton, *Contrib. Ornithology*, 1850, p. 80; Wallace, *Ann. Nat. History*, ser. 2, xviii., pp. 201, 205; and Huxley, *Proc. Zool. Society*, 1867, p. 467.

[3] *A Monograph of the* Alcedinidæ *or Family of the Kingfishers*, by R. B. Sharpe, 4to, London, 1868–71.

[4] Some important anatomical points are briefly noticed by Professor Cunningham (*Proc. Zool. Soc.*, 1870, p. 280).

[5] The name of this latter subfamily as constituted by Mr. Sharpe would seem to be more correctly *Ceycinæ*—the genus *Ceyx*, founded in 1801 by Lacépède, being the oldest included in it. The word *Dacelo*, invented by Leach in 1815, is simply an anagram of *Alcedo*, and, though of course without any etymological meaning, has been very generally adopted.

[6] *Cf.* Wallace, *Geog. Distr. Animals*, ii. p. 315.

KINGS, The First and Second Books of, which form the last part of the series of Old Testament histories known as the Earlier Prophets, were originally reckoned as a single book (Josephus; Orig. *ap*. Eus., *H. E.*, vi. 25; Peshito; Talmud), though modern Hebrew Bibles follow the bipartition which we have derived from the Septuagint. In that version they are called the third and fourth books of kingdoms (*βασιλειῶν*), the first and second being our books of Samuel. The division into two books is not felicitous, and even the old Hebrew separation between Kings and Samuel must not be taken to mean that the history from the birth of Samuel to the exile was treated by two distinct authors in independent volumes. We cannot speak of the author of Kings or Samuel, but only of an editor or successive editors whose main work was to arrange in a continuous form extracts or abstracts from earlier books. The introduction of a chronological scheme and of a series of editorial comments and additions, chiefly designed to enforce the religious meaning of the history, gives a kind of unity to the Book of Kings as we now read it; but beneath this we can still distinguish a variety of documents, which, though sometimes mutilated in the process of piecing them together, retain sufficient individuality of style and color to prove their original independence. Of these documents one of the best defined is the vivid and exact picture of David's court at Jerusalem (2 Sam. ix.-xx.), of which the first two chapters of 1 Kings are manifestly a integral part.[1] As it would be unreasonable to suppose that the editor of the history of David closed his work abruptly before the death of the king, breaking off in the middle of a valuable memoir which lay before him, this observation leads us to conclude that the books of Samuel and Kings are not independent histories. They have at least one source in common, and a single editorial hand was at work on both. But the division which makes the commencement of Solomon's reign the beginning of a new book is certainly ancient; it must be older than the insertion of the appendix 2 Sam. xxi.-xxiv., which now breaks the continuity of the original history of David's court. From an historical point of view the division is very convenient. The subject of the book of Samuel is the creation of a united Israel by Samuel, Saul, and David. Under Solomon the creative impulse has already died away; the kingship is divorced from the sympathies of the nation; and the way is prepared for the formation of the two kingdoms of Ephraim and Judah, the fortunes of which up to their extinction by the great empires of the East form the main subject of the book of Kings. It is probable, however, that the editor who made the division had another reason for disconnecting Solomon from David and treating his reign as a new departure. The most notable feature in the extant redaction of the book is the strong interest shown in the Deuteronomic "Law of Moses," and especially in the centralization of worship in the temple on Zion as prescribed in Deuteronomy and enforced by Josiah. This interest did not exist in ancient Israel, and is quite foreign to the older memoirs incorporated in the book; amidst the great variety in style and manner which marks the several parts of the history it is always expressed in the same stereotyped phrases and unvarying style; in brief, it belongs to the editorial comments, not to the original sources of the history. To the Deuteronomistic editor, then, the foundation of the temple, which is treated as the central event of Solomon's reign, is a religious epoch of prime importance (see especially his remarks in 1 Kings iii. 2 *sq.*), and on this ground alone he would naturally make Solomon's reign commence a new book—the history of Israel under the one true sanctuary.[2]

When we say in general that the Book of Kings was thrown into its present form by a Deuteronomistic redactor we do not affirm that he was the first who digested the sources of the history into a continuous work. Indeed the selection of materials, especially in the earlier parts of the narrative, has been thought to point to an opposite conclusion. Nor, on the other hand, must we ascribe absolute finality to his work. He gave the book a definite shape and character, but the recognized methods of Hebrew literature left it open to additions and modifications by later hands. Even the redaction in the spirit of Deuteronomy seems itself to have had more than one stage, as Ewald and other critics recognize. The book was not closed till far on in the exile, after the death of Nebuchadnezzar and Jehoiachin (2 Kings xxv. 27 *seq.*); and the fall of the kingdom of Judah is presupposed in such passages as 2 Kings xvii. 19, 20, xxiii. 26, 27. But these passages are mere interjected remarks, which seem to be added to adapt the context to the situation of the Jews in captivity. The main redaction, though subsequent to the reformation of Josiah, which forms the standard with which all previous kings are compared ("the high places were not removed"), does not point to the time of the captivity. Thus, for example, the words "unto this day," 2 Kings viii. 22, xiv. 7, xvi. 6, are part of the "epitome" composed by the main redactor (see below), and imply that he wrote before the destruction of the Judæan state.

Even the second redaction did not absolutely fix a single authoritative recension of the book, as appears in detail by comparison of the LXX. version with the Hebrew text.

The LXX. of Kings is not a corrupt reproduction of the Hebrew *receptus*, but represents another recension of the text. Neither recension can claim absolute superiority.

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[1] See this proved in detail, Wellhausen-Bleek, *Einl.*, § 114. The verses 1 Kings ii. 1-12 have no connection with the rest of the chapter, and are due to a later hand.

[2] With this it agrees that the later appendix 2 Sam. xxi.-xxiv. does not seem to have passed under the hand of the Deuteronomic redaction. See Wellhausen-Bleek, § 124.

The defects of the LXX. lie on the surface, and are greatly aggravated by the condition of the Greek text, which has suffered much in transmission, and particularly has in many places been corrected after the later Greek versions that express the Hebrew *receptus* of the 2d century of our era. Yet the LXX. not only preserves many good readings in detail, but throws much light on the long-continued process of redaction at the hand of successive editors or copyists of which the extant Hebrew of Kings is the outcome. Even the false readings of the Greeks are instructive, for both recensions were exposed to corrupting influences of precisely the same kind. The following examples will serve to illustrate the treatment through which the book has passed.

1. Minor detached notices such as we should put in footnotes or appendices are inserted so as to disturb the natural context. Thus 1 Kings iv. 27 (Heb. v. 7) must be taken continuously with iv. 19, and so the LXX. actually reads. In like manner the LXX. omits 1 Kings vi. 11–14, which breaks the context of the description of the temple. Again, in the LXX., 1 Kings ix. 26 follows on ver. 14, so that Solomon's dealings with Hiram are continuously recorded. The notices intervening in vers. 15–25 (in a very unnatural order) belong to a class of floating notes about Solomon and his kingdom which seem to have got stranded almost by chance at different points in the two recensions.

2. There are direct or indirect indications of transpositions and insertions on a larger scale. Thus in the LXX. the history of Naboth (1 Kings xxi.) precedes chap. xx. And in fact, chaps. xx. and xxii. are parts of one narrative, obviously quite distinct from the history of Elijah. Again, the story of Abijah's sickness and Ahijah's prophecy (1 Kings xiv.) is not found in the LXX.,[1] but another version of the same narrative appears at xii. 24, in which there is no reference to a previous promise to Jeroboam through Ahijah, but the prophet is introduced as a new character. This version, which places the prophecy of the destruction of Jeroboam's house between his return from Egypt and his elevation to the throne, is no doubt a mere legend, but it goes to prove that there was once a version of the history of Jeroboam in which chap. xi. 29–39 had no place. In truth, after xi. 26–28 there must once have stood some account of a rebellion in which Jeroboam "lifted up his hand" against King Solomon. To such an account, not to the incident of Ahijah and the cloak related in vers. 29–39, ver. 40 is the natural sequel. Thus all that is related of Ahijah falls under suspicion of being foreign to the original history, and it is noteworthy that in a passage peculiar to the LXX. the incident of the tearing of the cloak is related of Shemaiah and placed at the convention of Shechem, showing how much fluctuation there was in the tradition.

These instances show that there was a certain want of definiteness about the redaction. The mass of disjointed materials, not always free from inconsistencies, which lay before the editor in separate documents or in excerpts already partially arranged by an earlier hand, could not have been reduced to real unity without critical sifting, and an entire recasting of the narrative in a way foreign to the ideas and literary habits of the Hebrews. The unity which the editor aimed at was limited to chronological continuity in the events recorded and a certain uniformity in the treatment of the religious meaning of the narrative. Even this could not be perfectly attained under the circumstances, and the links of the history were not firmly enough riveted to prevent disarrangement or rearrangement of details by later scribes.

3. The continued efforts of successive redactors can be traced in the chronology of the book. The chronological method of the narrative appears most clearly in the history after Solomon, where the events of each king's reign are thrown into a kind of stereotyped framework on this type:—"In the twentieth year of Jeroboam, king of Israel, Asa began to reign over Judah, and reigned in Jerusalem forty-one years." . . . "In the third year of Asa, king of Judah, Baasha began to reign over Israel in Tirzah twenty-four years." The history moves between Judah and Israel according to the date of each accession; as soon as a new king has been introduced everything that happened in his reign is discussed, and wound up by another stereotyped formula as to the death and burial of the sovereign; and to this mechanical arrangement the natural connection of events is often sacrificed. In this scheme the elaborate synchronisms between contemporary monarchs of the north and south give an aspect of great precision to the chronology. But in reality the data for Judah and Israel do not agree, and Wellhausen, following Ewald, has shown that the synchronisms were not in the sources, but were calculated from the list of the years of each king (*Jharb. f. D. Theol.*, 1875). It appears further that these latter data are not all derived from historical tradition, but are in part due to conjectural subdivision of the cycle 480 (twelve generations of forty years) which appears in 1 Kings vi. 1 as the period from the Exodus to the foundation of the temple, and according to the Judæan list of kings as the period from the foundation of the temple to the end of the captivity (536 B.C.).[2] In the early part of the Judæan history the first dates not accessions are connected with the temple, and apparently derived from temple records. Of these the most important is the twenty-third year of Joash, which the chronological scheme makes the one hundred and sixty-first year of the temple, trisecting the four hundred and eighty years cycle. Other one hundred and sixty years bring us to the death of Hezekiah, and the last third of the cycle begins with the accession of Manasseh, whose sins are treated as the decisive cause of the exile. Within these limits a few dates were given by the sources; the rest, as can easily be shown, were filled in with reference to a unit of forty years.[3] Again, the duration of the kingdom of Israel, according to the northern lists, was two hundred and forty completed years, viz., eighty years before the first expedition of Benhadad, eighty years of Syrian wars, forty of prosperity under the victorious Jeroboam II., whose first year belongs to the period of war, and forty years of decline. The trisections in each case and the round numbers of 480 and 240 point strongly to a systematization of the chronology on the basis of a small number of given dates, and the proof that it is so is completed when we learn from the exactly kept lists of Assyrian chronology that the siege of Samaria fell in 722, whereas the system dates the captivity from 737 (535 + 480 — 37 — 241).

The key to the chronology is 1 Kings vi. 1, which, as Wellhausen has shown, was not found in the original LXX., and contains internal evidence of post-Babylonian date. In fact, the system as a whole is necessarily later than 535 B.C., the fixed point from which it counts back.

4. Another aspect in the redaction may be called theological. Its characteristic is the application to the old history of a standard belonging to later developments of the Old Testament religion. Thus, as we have already seen, the redactor in 1 Kings iii. regards worship in high places as sinful after the building of the temple, though he knows that the best kings before Hezekiah made no attempt to suppress these shrines. So too his unfavorable judgment on the whole religion of the northern kingdom was manifestly not shared by Elijah and Elisha, nor by the original narrator of the history of these prophets. This feature in the redaction displays itself, not only in occasional comments or homiletical excursuses, but in that part of the narrative in which all ancient historians allowed themselves free scope for the development of their reflections—the speeches placed in the mouths of actors in the history. Here also there is textual evidence that the theological element is somewhat loosely attached to the earlier narrative, and underwent successive additions. We have seen that the LXX. omits 1 Kings vi. 11–14, and that both prophecies of Ahijah belong to the least certain part of the textual tradition. So too an indication that the long prayer of Solomon, 1 Kings viii. 14–53, the Deuteronomic color of which is recognized by all critics, did not stand in the oldest account of the dedication of the temple, is preserved in the fact that the ancient fragment, vers. 12, 13, which in the Hebrew text is imperfect, appears in the LXX. after ver. 53 in completer form and with a reference to the book of Jasher as source (βιβλίον τῆς ᾠδῆς = ספר השיר = ספר הישר). The redactional insertion displaced it in one recension and led to its mutilation in the other. The older parts of this chapter have also been retouched in conformity with later (even post-exile) ritual and law. The Levites who appear at ver. 4 in contrast to the priests, in a way unknown to the pre-exile history, are not named in the LXX., and the post-exile "congregation" (ʿēdah) at ver. 5 is also wanting. The processes illustrated by these examples were doubtless at work in many places where external evidence fails us, and may often be detected by a careful use of internal evidence alone. See especially Wellhausen's detailed analysis in the last edition of Bleek's *Einleitung*.

To gain an exacter idea of the main redaction of Kings and of the nature of the original sources, we may divide the history into three sections:—(1) the conclusion of the "court history," 1 Kings i. ii., the further consideration of which belongs to the criticism of SAMUEL (*q.v.*); (2) Solomon, 1 Kings iii.–xi.; (3)

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[1] In the Alex. and other MSS. it is added from the version of Aquila.

[2] Compare Krey's investigations in *Z. f. w. Th.*, 1877, p. 404 *sq.*

[3] See the details in an article by W. R. Smith, *Journal of Philology*, vol. x. No. 20.

the kingdoms of Ephraim and Judah. For (2) the main source, as we learn from 1 Kings xi. 41, was a book called *Acts of Solomon*. This work can hardly have been a regular chronicle, for the history founded on it contains no continuous narrative. All that is related of Solomon's reign is grouped round the description of the royal buildings, particularly of the temple, and the account of the dedication of the house (chaps. vi.–ix. 9); and the greater part of the latter account is either due to the redactor or largely rewritten. The whole section is descriptive rather than narrative, and the accurate details might have been got by actual observation of the temple at a date long subsequent to Solomon. In fact, they are not all due to a single hand. Thus we can still reconstruct a shorter text of vi. 17–21, which says only that "the house before the oracle was forty cubits long, and the oracle in the midst of the house within where the ark of Jehovah's covenant was to be placed was twenty cubits in length, breadth, and height; and he overlaid it with gold and made an altar of cedar [the table of shewbread] before the oracle and overlaid it with gold." The original author used the book of Jasher for the account of the dedication, and had access to some exact particulars as to dates, the artist Hiram, etc., which may have been contained in the temple records. The immediate environment of this section, if we set aside the floating elements in chap. ix. already referred to, is occupied with Solomon's dealings with King Hiram, who aided him in his architectural schemes and in the commercial enterprises which procured the funds for such costly works (chap. v. [Heb. v. 15–32] and ch. ix. 10 *sq.*). On each side of this context lies a complex of various narratives and notices illustrating Solomon's wisdom and greatness, but also, in chap. xi., his weakness and the incipient decay of his kingdom. It is evident that the rise of the adversaries who, according to xi. 25, troubled Solomon through all his reign cannot originally have been related as the punishment of the sins of his old age. The pragmatism as usual belongs to the redactor (xi. 4). We have seen that there was once another version of the history of Jeroboam.

In the history of the divided kingdom the redactor, as we have seen, follows a fixed scheme determined by the order of accessions, and gives a short epitome of the chief facts about each king, with an estimate of his religious character, which for the schismatic north is always unfavorable. The epitome, as the religious standpoint shows, belongs to the same hand throughout, *i. e.*, to the Deuteronomistic redactor; but so much of it as relates to Judah is plainly based on good written sources, which from the nature of the particulars recorded may be identified with the book of Royal Chronicles referred to under each reign, which seems to have been a digest of official notices.

A similar chronicle is named for the kings of Israel, but if it actually lay before the editor, he at least did not make such excerpts from it as we find in the Judæan history, for the epitome for Ephraim is very bare of concrete details. Besides the epitome, however, and the short excerpts from the Judæan chronicles which go with it, the history includes a variety of longer narratives, which alike in their subject-matter and their treatment are plainly distinct from the somewhat dry bones of the official records. The northern narratives are all distinguished in a greater or less degree by the prominence assigned to prophets. In the southern kingdom we hear less of the prophets, with the great exception of Isaiah; but the temple occupies a very prominent place.

The history of the man of God from Judah (1 Kings xiii.) is indubitably of Judæan origin. Its attitude to the altar at Bethel—the golden calf does not appear as the ground of offence—is not only diverse from that of Elijah and Elisha, but even from that of Hosea.[1] The other narratives that deal with the history of Ephraim are all by northern authors (see, for example, 1 Kings xix. 3; 2 Kings ix. 6), and have their centre in the events of the Syrian wars and the persons of Elijah and Elisha. But they are not all of one origin, as appears most clearly by comparing the account of the death of Naboth in the history of Elijah, 1 Kings xxi., and the history of Elisha and Jehu, 2 Kings ix. In the latter narrative Naboth's "field" lies a little way from Jezreel, in the former it is close to Ahab's palace (*query*, in Samaria?—see ver. 18 and variants of LXX. in ver. 1), and is described as a vineyard. The "burden" quoted by Jehu is not in the words of 1 Kings xxi., and mentions the additional fact that Naboth's sons were killed.[2] In other words, the history of Jehu presupposes events recorded in the extant accounts of Elijah, but not these accounts themselves. And the narrative in 2 Kings seems to be the more accurate; it contains precise details lacking in the other.

Now it is plain that 1 Kings xxi. belongs to the same history of Elijah with chaps. xvii–xix. The figure of the prophet is displayed in the same weird grandeur, and his words (omitting the addition already noted in verses 20b *sq.*) have the same original and impressive force. That history, a work of the highest literary art, has come down to us as a fragment. For in 1 Kings xix. 15 Elijah is commanded to take the desert route to Damascus, *i. e.*, the route east of the Jordan. He could not, therefore, reach Abel Meholah in the Jordan valley, near Bethshean, when he "departed thence" (ver. 19), if "thence" means from Horeb. The journey to Damascus, the anointing of Hazael and Jehu, must once have intervened; but they have been omitted because another account ascribed these acts to Elisha (2 Kings viii. ix.). Now there is no question that we possess an accurate historical account of the anointing of Jehu. Elisha, long in opposition to the reigning dynasty (2 Kings iii.), and always keeping alive the remembrance of the murder of Naboth and his sons (vi. 32), waited his moment to effect a revolution. It is true that the prime impulse in this revolution came from Elijah; but, when the history in 1 Kings represents Elijah as personally commissioned to inaugurate it by anointing Jehu and Hazael as well as Elisha, we see that the author's design is to gather up the whole contest between Jehovah and Baal in an ideal picture of Elijah and his work. In doing this he also places Ahab in a different light from that in which he appears in the other extant histories. Had we only his account we might suppose that Ahab had altogether rejected Jehovah and aimed at introducing a new national worship. But, in fact, we learn from the other records that, while like Solomon before him he gave countenance to his wife's religion, Ahab still regarded Jehovah as the God of Israel, consulted His prophets, and gave to his sons names expressive of devotion to the old faith. The ideal delineation of Elijah conveys a vivid picture of his imposing personality and permanent influence; but it records the impression he left behind him rather than the literal details of his life, and is no doubt of younger date than the more photographic picture of the accession of Jehu, though prior to the rise of the new prophecy under Amos and Hosea.[3]

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[1] The expression "cities of Samaria" (ver. 32) reappears only after the deportation of Ephraim (2 Kings xvii. 24, 26), and seems to have come in here from 2 Kings xxiii. 19. Even in that passage the last clause of ver. 18, which alone refers to details of the history of 1 Kings xiii., is clearly erroneous; the old prophet did not come from Samaria. Another and later Jewish prophet foretold the fall of the altar of Bethel, viz., Amos of Tekoa.

[2] The standing phrases common to 1 Kings xxi. 20b *sq.*, 2 Kings ix. 7–10a, belong to the redaction, as is plain in the latter case from ix. 3.

[3] Some expressions that point to a later date are certainly added by another hand, *e. g.*, the last part of xviii. 18. In old Israel, up to the time of Hosea, the Baalim (pl.) are the golden calves, which have no place in this context. A late insertion also is the definition of time by the stated oblation in the temple at Jerusalem, xviii. 29, 36. At ver. 36 this is lacking in the LXX.; at ver. 29 the longer insertion of the LXX. reveals the motive for the interpolation, viz., to assimilate Elijah's sacrifice to the legal service. The true text says that, when noon was past and there was no answer to the prophets of Baal, Elijah intervened. Thus

The episode of Elijah and Ahaziah, 2 Kings i., is certainly by a different hand, as is seen even from the new feature of revelation through an angel; and the ascension of Elijah, 2 Kings ii., is related as the introduction to the prophetic work of Elisha.

The narratives about Elisha are not all by one hand; for example, iv. 1-7 is separated from the immediately subsequent history by a sharply marked grammatical peculiarity (the suffix כי); moreover, the order is not chronological, for vi. 24 cannot be the sequel to vi. 23; and in general those narratives in which the prophet appears as on friendly terms with the king, and possessed of influence at court (*e. g.*, iv. 13, vi. 9, vi. 21 compared with xiii. 14), plainly belong to the time of Jehu's dynasty, though they are related before the fall of the house of Omri. In this disorder we can distinguish portions of an historical narrative which speaks of Elisha in connection with events of public interest, without making him the central figure, and a series of anecdotes of properly biographical character. The historical narrative embraced 2 Kings iii., vi. 24–vii. 20, ix. 1–x. 28, in fact, the whole account of the reign of Joram and the revolution under Jehu; and as 2 Kings iii. has much affinity to the history of Ahab and Jehoshaphat in 1 Kings xxii., we may add the earlier history of the Syrian wars (1 Kings xx., xxii.) to the series. The evidence of style is hardly sufficient to assign all these chapters to a single hand (for example, רכב is a single chariot in the history of Jehu, but in 1 Kings xx. a collective, the single chariot being מִרכבה); but they are all full of fresh detail and vivid description, and their sympathy with the prophets of the opposition, Micaiah and Elisha, and with the king of Judah, who takes the prophets' part, does not exclude a genuine interest in Ahab and Joram, who are painted in very human colors, and excite our pity and respect. To the historian these chapters are the most valuable part of the northern history; and the most surprising details have received striking verification from modern research. The stone of Mesha supplies details to 2 Kings iii. 5; the method of obtaining water suggested by Elisha (iii. 16, 17) is that which still gives its name to W. el-Hasâ at the southern end of the Dead Sea (see Wetzstein in Delitzsch, *Gen.*, 4th ed., p. 567); and the sudden retreat of the Syrians in 2 Kings x. is very intelligible when we know that they were already at that time pressed by the Assyrians (see on all these points Wellhausen, *op. cit.*).

In the more biographical narratives about Elisha we may distinguish one circle connected with Gilgal, Jericho, and the Jordan valley to which Abel-meholah belongs (iv. 1-7?, 38–44; ch. v.?; vi. 1–7). Here Elisha appears as the head of the prophetic guilds, having his fixed residence at Gilgal. Another circle, which presupposes the accession of the house of Jehu, places him at Dothan or Carmel, and represents him as a person af almost superhuman dignity. Here there is an obvious parallelism with the history of Elijah, especially with his ascension (compare 2 Kings vi. 17 with ii. 11; xiii. 14 with ii. 12); and it is to this group of narratives that the ascension of Elijah forms the introduction.[1]

Of the Judæan narratives there is none to rival the northern histories in picturesque and popular power. The history of Joash, 2 Kings xi., xii., of Ahaz's innovation, xvi. 10 *sq.*, and of Josiah's reformation, xxii. 3–xxiii. 27, have their common centre in the temple on Zion, and may with great probability be referred to a single source. The details suggest that this source was based on official documents. Besides these we have a full history of Hezekiah and Sennacherib and of Hezekiah's sickness, xviii. 13–xx. 19, repeated in a somewhat varying text in Isa. xxxvi.–xxxix. (compare ISRAEL, vol. xiii. p. 423 *sq.*). The history of Amaziah and Joash in 2 Kings xiv., with the characteristic parable from vegetable life, may possibly be of northern origin.

When we survey these narratives as a whole we receive an increased impression of the merely mechanical character of the redaction by which they are united. Though editors have added something of their own in almost every chapter, generally from the standpoint of religious pragmatism, there is not the least attempt to work the materials into a history in our sense of the word; and in particular the northern and southern histories are practically independent, being merely pieced together in a sort of mosaic in consonance with the chronological system, which we have seen to be really later than the main redaction. It is very possible that the order of the pieces was considerably readjusted by the author of the chronology; of this indeed the LXX. still shows traces. But with all its imperfections, as judged from a modern standpoint, the redaction has the great merit of preserving the older narratives in their original color, and bringing us much nearer to the actual life of the old kingdom than any history written throughout from the standpoint of the exile could possibly have done.

Literature.—Since Ewald's *History*, vols. i. and iii., and Kuenen's *Onderzoek*, the most thorough and original investigation of the structure of the book is that in Wellhausen's edition of Bleek's *Einleitung* (1878), with which the corresponding section of his *Geschichte* (1878) should be compared. There are modern commentaries by Thenius (Leipsic, 1849, 2d ed. 1873) and Keil (2d ed. 1876, English translation, 1872); by Bähr in Lange's *Bibelwerk* (1868, English translation, 1877); by Rawlinson in the *Speaker's Commentary;* and in Reuss's *Bible*. The Assyrian material, which is of the highest value, but requires to be still further sifted, is collected in Schrader's *Keilinschriften und altes Testament* (Giessen, 1872), Smith's *Assyrian Eponym Canon*, and other works. Translations of the chief inscriptions are given in *Records of the Past*, London, *v. y.* (W. R. S.)

KING'S COUNTY, an inland county in the province of Leinster, Ireland, is situated between 52° 50′ and 53° 25′ N. lat., and between 6° 59′ and 8° 1′ W. long., and is bounded on the N. by Meath and Westmeath, on the W. by Roscommon, Galway, and Tipperary, on the S. by Tipperary and Queen's county, and on the E. by Kildare. It is oblong in shape, but of very irregular outline. Its greatest breadth from north to south is 39 miles, and its greatest length from east to west 45 miles. The area is 493,019 acres, or about 770 square miles.

Geology.—The greater part of the county is occupied by the limestone strata of the central plain. In the southeast the Slieve Bloom mountains, composed of clay-slate surrounded by sandstone, form the boundary between King's county and Queen's county, and run into the former county from southwest to northeast for a distance of about 20 miles, consisting of a mass of lofty and precipitous crags, through which there are two narrow passes, the Black Gap and the Gap of Glandine. In the northeast Croghan Hill, a beautiful green eminence consisting of trap conglomerate, rises to the height of over 700 feet. The remainder of the county is flat, but a range of low limestone hills crosses its northeastern division to the north of the Barrow. In the centre of the county from east to west a large portion is occupied by the Bog of Allen. Along the Slieve Bloom mountains iron is found in small quantities, and also manganese, ochre, chalk, and potter's clay. Excellent clay-slate flags are quarried. In several places there are bands of foliated limestone, of a greenish hue and granular in texture, which forms a very useful manure.

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we get time for the events which as the text stands could not have all happened the same evening. In 2 Kings iii. 20 for הכנחה read השחר.

[1] The Gilgal of Elisha is near the Jordan—comp. vi. 1 with iv. 38, ישבים לפניו,—and cannot be other than the great sanctuary 2 miles from Jericho, the local holiness of which is still attested in the *Onomastica*. It is true that in 2 Kings ii. 1 Bethel seems to lie between Gilgal and Jericho; but ver. 25 shows that Gilgal was not originally represented as Elisha's residence in this narrative, which belongs to the Carmel-Dothan series. Hence Robinson's Gilgal (Jiljilia) seems not to be Biblical.

Rivers.—The county shares in the advantage of the navigation of the Shannon, which skirts its western side and forms its boundary line with Roscommon and Galway. The Brosna, which issues from Loch Ennell in West Meath, enters the county near the town of Clara, and flowing southwestward across its northwest corner, discharges itself into the Shannon after receiving the Clodagh and the Broughill. A small portion of the northeastern extremity is skirted by the Boyne. The Barrow forms the southeastern boundary with Queen's county. The Little Brosna, which rises in the Slieve Bloom mountains, forms the boundary of King's county with Tipperary, and falls into the Shannon.

Climate, Soil, and Agriculture.—Notwithstanding the large area occupied by bogs, the climate is generally salubrious, and it is less moist than that of several neighboring districts. The soil naturally is not of great fertility except in special cases, but is capable of being rendered so by the judicious application of bog and lime manures according to its special defects. It is generally either a deep bog or a shallow gravelly loam. On the former soil corn crops are late in ripening during wet seasons, which on the other hand are specially suitable for the gravelly soils. On the borders of the Slieve Bloom mountains there are some very rich and fertile pastures, and there are also extensive grazing districts on the borders of West Meath, which are chiefly occupied by sheep. Along the banks of the Shannon there are some fine tracts of meadow land. With the exception of the tract occupied by the Bog of Allen, the remainder of the county is nearly all under tillage, the most productive portion being that to the northwest of the Hill of Croghan.

The following table gives a classification of holdings according to size in 1850 and 1880:—

	Under 1 Acre.	1 to 5 Acres.	5 to 15 Acres.	15 to 30 Acres.	30 Acres and upwards	Total.
1850	1,400	2,755	3,614	2,476	3,078	13,323
1880	1,718	1,930	2,395	2,075	3,333	11,451

The total area under crops in 1881 was 119,751 acres—24.2 per cent. of the total acreage of the county. In 1880 238,667 acres (48.4 per cent.) were under grass, 424 fallow, 8551 woods, 108,773 (the large percentage of 22.1) bog, 6043 mountain, and 16,327 water, roads, and fences. The area under crops in 1850 was 138,538 acres, or 24,314 more than in 1880 and 18,787 more than in 1881. The area under cereals declined between 1850 and 1881 from 70,668 to 40,263, that under wheat decreasing from 20,410 to only 1436, that under oats from 38,787 to 23,082; but that under other cereals, of which nearly the whole acreage is under barley, increased from 11,471 to 15,745. Between 1851 and 1880 the area under grass increased by 46,427 acres, a change due in a considerable degree to reclamation. The area under meadow and clover only increased from 40,348 to 44,765 acres. The area under green crops between 1851 and 1881 diminished from 30,561 to 29,178 acres, that under potatoes diminishing from 17,907 to 15,762, while that under turnips increased from 9418 to 9863. Anciently nearly the whole of the county was covered by a vast forest, and on the borders of Tipperary it is still richly wooded.

Horses, which are a much better breed than the average of Ireland, increased from 12,990 in 1850 to 13,505 in 1881. The number in 1881 used for agricultural purposes was 8889. Mules increased from 817 to 1209, and asses from 4212 to 6221. Cattle in 1850 numbered 47,978, and in 1881 had increased to 68,165. Cows in 1881 numbered 14,749. Dairies are numerous in the northern part of the county on the borders of Meath, but in other districts cattle-feeding is more largely prosecuted than dairy farming. Sheep, which are pastured chiefly on the hilly districts, and have been much improved by crossing, in 1850 numbered 68,552, and in 1880 had increased to 97,570. Goats since 1850 have declined in numbers from 4032 to 3910. Pigs have increased from 15,450 to 20,526, and poultry from 158,154 to 271,873.

According to the corrected summary for 1878 of the landowners' return, the land in 1873 was divided among 1140 owners, of whom 353, or 31 per cent., possessed less than 1 acre. The annual ratable valuation was £243,204, giving an average value per acre of 9s. 11d. Forty-six proprietors possessed more than 2000 acres, thirteen had upwards of 5000 acres, and five upwards of 10,000 acres, viz., Lord Digby, 29,722; Earl of Rosse, 22,513; Earl of Charleville, 20,632; Marquis of Downshire, 13,679; and Col. T. Bernard, 13,153.

Railways, etc.—A branch of the Great Southwestern Railway traverses the county by Portarlington, Clara, and Banagher, and there is also a branch of the same line from Roscrea to Parsonstown. The Grand Canal traverses the county from Edenderry in the east to the Shannon in the west.

Administration.—The county comprises twelve baronies, forty-two civil parishes and nine parts of parishes, and 1160 townlands. It contains portions of five poor-law unions, viz., Edenderry, Mountmellick, Parsonstown, Roscrea, and Tullamore. The county includes part of the parliamentary borough of Portarlington (the remainder being in Queen's county), and two townships, Parsonstown and Tullamore. Assizes are held at Tullamore, and quarter-sessions at Parsonstown, Philipstown, and Tullamore. King's county is in the Dublin military district, and there are barrack stations at Parsonstown, Banagher, Philipstown, Shannon Bridge, and Tullamore. Previous to the Union, King's county returned six members to parliament, two for the county, and two for each of the boroughs of Philipstown and Banagher, but since then only the two county members have been returned.

Population.—The total population of the county in 1659 was 8310, of whom 7085 were Irish and 1225 English. The estimate of De Burgo in 1760 made it 45,618. In 1821 it had increased to 131,088 and in 1841 to 147,551, but in 1851 it had diminished to 112,798, and in 1871 to 75,900, and in 1881 to 72,668, of whom 36,942 were males and 35,726 were females. The number of emigrants from 1st May, 1851, to 31st December, 1880, was 41,798, or 46.4 per cent. of the population in 1861, 21,437 being males and 20,361 being females. The marriage rate in 1880 to every 1000 of the estimated population was 3.9, the birth rate 23.5, and the death rate 18.2. In 1881 the Roman Catholics numbered 64,984, the Protestant Episcopalians 6750, the Presbyterians 285, the Methodists 421, and all other denominations 228. The number of natives of England and Wales in the county in 1841 was 293, which had increased in 1871 to 1087; the natives of Scotland in the same years were 109 and 203. The number in 1871 who could speak Irish and English was 245, and in 1861 it was 396. In 1871 there were 34,360 persons who could read and write, 13,157 who could read but could not write, and 28,383 who could neither read nor write.

History.—King's county, with portions of Tipperary Queen's county, and Kildare, at an early period formed one kingdom under the name of Hy Falgia or Offalia, a title which it retained after the landing of the English. Subsequently it was known as Glenmallery, Western Glenmallery pretty nearly corresponding to the present King's county, and Eastern Glenmallery to Queen's county. The principal septs of the district were the O'Connors and the O'Carrolls, whose estates and those of the other leading families were forfeited about the middle of the 16th century. By a statute of 1557 the western district was constituted a shire under the name of King's county in honor of Philip—the principal town, formerly the seat of the O'Connors, being called Philipstown; and the eastern district at the same time received the name of Queen's county in honor of Mary. The subjugation of King's county was, however, not completely accomplished till about the beginning of the 17th century, when the O'Connors and their followers were totally routed and dispersed by Sir Oliver Lambert. After the Cromwellian wars a large number of estates were forfeited on account of the insurrectionary action taken by the leading gentry.

Antiquities.—Perhaps the oldest antiquarian relic is the large pyramid of white stones in the Slieve Bloom mountains called the Temple of the Sun or the White Obelisk. There are a considerable number of Danish raths, and a chain of moats commanding the passes of the bogs extended throughout the county. The most important ecclesiastical ruins are those of the seven churches of Clonmacnoise on the Shannon in the northwest of the county, where an abbey was founded by St. Kieran in 548. Afterwards it was formed into a see, which was united with that of Meath in 1568. Within the old walls there are several small chapels erected over the graves of ancient chieftains, and also one or two richly ornamented crosses. Adjoining the ecclesiastical ruins are the remains of round towers and of an old castle. Amongst the more famous religious houses in addition to Clonmacnoise were Durrow Abbey, founded by St. Columba in 550; Monasteroris, founded in the 14th century by John Bermingham, earl of Louth;

and Seirkyran Abbey, founded in the beginning of the 5th century. The principal old castles are Rathmore, probably the most ancient in the county; Banagher, commanding an important pass on the Shannon; Leap Castle, in the Slieve Bloom mountains; and Birr or Parsonstown, now the seat of the earl of Rosse, whose father erected there the well-known great telescope.

KINGSLEY, Charles (1819–1875), an English clergyman, poet, and novelist, was born on the 12th June, 1819, at Holne vicarage, Dartmoor, Devon. His early years were spent at his father's living in the Fen country, and afterwards in North Devon. The scenery of both made a great impression on his mind, and was afterwards described with singular vividness in his writings. He was educated at private schools and at King's College, London, after his father's promotion to the rectory of Chelsea. In 1838 he entered Magdalene College, Cambridge, where he took his degree in 1842, first-class in classics, and senior optime in mathematics. In the same year he was ordained to the curacy of Eversley in Hampshire, to the rectory of which he was not long afterwards presented, and this was his home for the remaining thirty-three years of his life, although his residence there was much broken by various domestic circumstances as well as, in later years, by promotion to other offices in the church.

In 1844 he married Fanny, daughter of Pascoe Grenfell, and in 1848, when aged twenty-nine, he published his first volume, *The Saint's Tragedy*. In 1860 he was appointed to the professorship of modern history in the university of Cambridge, which he resigned in 1869, and was soon after appointed to a canonry at Chester. In 1873 this was exchanged for a canonry at Westminster. He died at Eversley, after a short illness, on the 23d January, 1875.

It will be seen that his life had but few incidents. With the exception of occasional changes of residence in England, generally for the sake of his wife's health, one or two short holiday trips abroad, a tour in the West Indies, and another in America to visit his eldest son settled there as an engineer, his life was spent in the peaceful, if active, occupations of a clergyman who did his duty earnestly, and of a vigorous and prolific writer. But in spite of this outward peace he was for many years one of the most prominent men of his time, who both personally and by his works had no little influence on the thought of his generation. Though at no time profoundly learned, he was a man of wide and various information, whose interest and sympathies embraced almost all branches of human knowledge as well as speculations on subjects on which men but slowly learn that speculation avails them nothing. Gifted with great powers of language, both written and in conversation, with a keen wit, and a fund of knowledge far above the average, there were few subjects in which he did not shine, and many in which he excelled. The inherited peculiarities of his opinions and temperament, which made him seemingly though not really inconsistent, excited curiosity, and were in part the reason of his great attractiveness. Sprung on the father's side from an old English race of country squires, and on his mother's side from a good West Indian family who had been slaveholders for generations, he had the keen love of sport and the exceeding sympathy with country folk often fostered by such pursuits, while he had at the same time much of the aristocratic scorn for lower races to be found among those who have been in a dominant position among them.

With the sympathetic organization which made him keenly sensible to the wants of the poor, he threw himself heartily into the movement known as Christian Socialism, of which Mr. Maurice was the recognized leader, and for many years he was considered as an extreme radical in a profession which holds as a rule but few such. While in this phase of mind he wrote his novels *Yeast* and *Alton Locke*, in which, though he pointed out unsparingly the folly of extremes, his sympathies were unmistakably shown to be, not only with the poor as in their strife against the rich, but with much that was done and said by the leaders in the Chartist movement. Yet even then he considered that the true leaders of the people were a peer and a dean, and there was no real inconsistency in the fact that at a later period he was among the most strenuous defenders of Governor Eyre in the measures adopted by him to put down the Jamaican disturbances. In politics he might therefore have been described as a Tory aristocrat tempered by sympathy, or a Radical tempered by hereditary scorn of subject races. The like seeming but not real inconsistencies were to be found in his attitude as a clergyman. He was a man of earnest piety, and lived so near in his own mind to the great realities of the unseen world that he could even afford to speak of serious subjects in a way which in one less reverent than he would have seemed to lack reverence; and, while he held in many respects what would be called a liberal theology, the church, its organization, its creed, its dogma, had ever an increasing hold upon him. Although at one period he certainly shrunk from reciting the Athanasian creed in church, he was towards the close of his life found ready to join an association for the defence of this symbol. With these two influences at work in his mind, it was not unnatural that the more orthodox and conservative should gain the upper hand as time went on, but the careful students of him and his writings will find a deep conservatism underlying all the most radical utterances of his earlier years, while a passionate sympathy for the poor, the afflicted, and weak held possession of him till the last hour of his life.

Both as a writer and in his personal intercourse with men Kingsley was a thoroughly stimulating teacher. He would not probably have wished to found a school, most certainly never did so. As with his own teacher, Mr. Maurice, his influence on other men rather consisted in the fact of his inducing them to think for themselves than that he led them to adopt his own views. Perhaps these were at no time quite definite enough to have been reduced to such system as is demanded for one who would make his disciples think as himself. But his healthy and stimulating influence went far beyond the boundaries of his parish, his canonries, and his wide circle of friends, and was largely attributable to the fact that he gave utterance to the thoughts which were stirring in many minds during the time of his own most vigorous life. His originality, which was great, lay rather in his manner of crystallizing the current thoughts of men, and giving them apt expression, than in any new discoveries in the matters of which he treated. Just because he was completely the product and the mouthpiece of his own time, it may be doubted whether his influence on the future will be very great, and it is possible that men who may read his works by chance some years hence will fail to understand how wide was the influence he exercised.

As a preacher he was vivid, eager, and earnest, equally plain-spoken and uncompromising when preaching to a courtly congregation or to his own village poor. One of the very best of his writings is a sermon called *The Message of the Church to Working Men;* but as a rule his sermons cannot be read with the interest with which they were heard, and none of his later published sermons equal the little volume of *Twenty-five Village Sermons* which he preached in the early years of his Eversley life.

As a novelist his chief power lay in his descriptive faculties. *Yeast* and *Alton Locke* were written out of the heat of strong conviction, and dealt in a brilliant manner with great social questions, but the later novels seem to have been written rather because he wished to say something than because he had something to say, and in spite of new and ever new editions it may be doubted whether the real interest felt in these works is considerable. Few persons read them twice, although it is fair to say that this may partially arise from the fact that the story is so vividly told that it is not forgotten, and therefore needs no second reading. But the descriptions of South American scenery in *Westward Ho*, of the Egyptian desert in *Hypatia*, of the North Devon scenery in *Two Years Ago*, are among the most brilliant pieces of word-painting in English prose writing, and the American scenery is even more vividly and more truthfully described when he had seen it only by the eye of his imagination than in his work *At Last*, which was written after he had visited the tropics.

As a poet he wrote but little, but that little he wrote with singular facility, and there are passages in the *Saint's Tragedy*, and many isolated lyrics, which ought to take their place in all future standard collections of English literature. *Andromeda* is a very successful attempt at naturalizing the hexameter as a form of English verse, and reproduces with great skill the sonorous roll of the Greek original.

In person Charles Kingsley was tall and spare, sinewy rather than powerful, and of a restless excitable temperament. His complexion was swarthy, his hair dark, and his eye bright and piercing. His temper was hot, kept under rigid control, his disposition tender, gentle, and loving as that of a woman, with flashing scorn and indignation against all that was ignoble and impure; he was a good husband, father, and friend.[1]

Kingsley's life has been written by his widow, in two volumes entitled *Charles Kingsley, his Letters and Memories of his Life*, and presents a very touching and beautiful picture of her husband, but perhaps hardly does justice to his humor, his wit, his overflowing vitality and boyish fun.

The following is a list of Kingsley's writings:—*Saint's Tragedy*, a drama, 1848; *Alton Locke*, a novel, 1849; *Yeast*, a novel, 1849; *Twenty-five Village Sermons*, 1849; *Phaeton, or Loose Thoughts for Loose Thinkers*, 1852; *Sermons on National Subjects*, 1st series, 1852; *Hypatia*, a novel, 1853; *Glaucus, or the Wonders of the Shore*, 1854; *Sermons on National Subjects*, 2d series, 1854; *Alexandria and her Schools*, 1854; *Westward Ho!* a novel, 1855; *Sermons for the Times*, 1855; *The Heroes*, Greek fairy tales, 1856; *Two Years Ago*, a novel, 1857; *Andromeda and other Poems*, 1858; *The Good News of God*, sermons, 1859; *Miscellanies*, 1859; *Limits of Exact Science applied to History* (Inaugural Lectures), 1860; *Town and Country Sermons*, 1861; *Sermons on the Pentateuch*, 1863; *Water-Babies*, 1863; *The Roman and the Teuton*, 1864; *David and other Sermons*, 1866; *Hereward the Wake*, a novel, 1866; *The Ancient Régime* (Lectures at the Royal Institution), 1867; *Water of Life and other Sermons*, 1867; *The Hermits*, 1869; *Madam How and Lady Why*, 1869; *At Last*, 1872; *Town Geology*, 1872; *Discipline and other Sermons*, 1872; *Prose Idylls*, 1873; *Plays and Puritans*, 1873; *Health and Education*, 1874; *Westminster Sermons*, 1874; *Lectures delivered in America*, 1875. He was a large contributor to periodical literature; many of his essays are included in *Prose Idylls* and other works in the above list. But no collection has been made of some of his more characteristic writings in the *Christian Socialist* and *Politics for the People*, many of them signed by the pseudonym he then assumed, "Parson Lot." (C. K. P.)

KINGSTON, the chief city of Ulster county, New York, United States, is situated on the west bank of the Hudson, about 90 miles north of New York. Its harbor is formed by the navigable portion of Rondout Creek. Among the chief buildings are the city hall, the music-hall, the almshouses, and the county buildings. Kingston is a very busy shipping centre, with 4 miles of wharfage, and steam and other shipping representing a considerable aggregate tonnage. As the centre of the bluestone region, Kingston ships an immense quantity of that mineral; and, possessing the largest cement factory in the country, its out-turn of that material, together with bricks, ice, lime, timber, and other goods, swells the amount of its exports to upwards of a quarter of a million tons per annum. The manufactures of the town include salt, tobacco, glue, carriages, beer, boats, and bricks. The population in 1880 was 18,344.

Kingston city was incorporated in 1872. The first settlement on the spot was made about 1665. At Kingston was framed the first Constitution of New York State, in 1777. In September, 1777, the British, under Sir Henry Clinton, scattered the State legislature which had met at Kingston and in October burned the village.

KINGSTON, the chief city of Frontenac county, Ontario, Canada, is situated at the northeastern extremity of Lake Ontario, at the point where the St. Lawrence issues from it, and at the mouth of the Cataraqui Creek, about 160 miles east of Toronto by the Grand Trunk Railway. Of the many fine buildings the chief are the city-hall, the market, the custom-house, the court-house and jail, the post-office, and the university. Among the charities are a hospital, an orphanage, a combined hospital and orphanage, a house of industry, and a house of refuge. The penitentiary and the lunatic asylum are at a little distance from the city. Kingston is the seat of Queen's university and college, and of a medical college affiliated to the university. The Roman Catholic Regiopolis college has been closed since 1869. The royal military college of the Dominion is at Kingston. The harbor is deep, spacious and sheltered, and brisk trade is carried on. As a naval station Kingston occupies an important position. It commands the entrance to the Rideau Canal, and is strongly fortified. Shipbuilding, iron-founding, and the manufacture of locomotives, steam-engines, and machinery, leather, soap, and candles, boots and shoes, cotton, and wooden goods are carried on by the inhabitants. Kingston is the seat of an Anglican and of a Roman Catholic bishop. The population in 1881 was 14,093.

Kingston occupies the site of the old French fort Frontenac. It received its present name after it was taken by the British in 1762. For three years (1841–44) it was the capital of Canada.

KINGSTON, the capital of Jamaica. See JAMAICA.

KINGSTON-ON-THAMES, a municipal borough and market-town of England, county of Surrey, extends for about a mile and a half along the right bank of the Thames, and is distant from London about 20 miles on the river and 12 miles by rail and road. The ancient wooden bridge over the river, which was in existence as early as 1224, was superseded by a structure of stone in 1827. The town is irregularly built, but its suburbs contain many fine houses and villas embosomed in trees, and of late years it has been rapidly increasing. Public walks and gardens have been constructed along the river. The parish church of All Saints, chiefly Perpendicular in style, contains several brasses of the 15th century; the grammar school, rebuilt in 1878, was originally founded as a chantry by Edward Lovekyn in 1305, and converted into a school by Queen Elizabeth. Near the parish church stood until 1779 the chapel of St. Mary, where, it is alleged, the Saxon kings were crowned. The ancient stone said to have been used as a throne at these coronations was removed to the market-place in 1850. A town-hall in the Italian style was erected in 1840, the former building having been a very ancient structure. There are several foundation schools and a large number of charities. The growth of the town has been owing chiefly to the increasing number of London business men who have made it their residence, its proximity to Richmond park and Hampton Court no doubt aiding its popularity. There are large market gardens in the neighborhood, and the town possesses oil-mills, flour-mills, breweries and brick and tile works. A little distance up the river are the works of several London water companies. An annual cattle fair is held in November, and the county assizes are held at Lent. The population of the municipal borough in 1881 was 19,875.

Kingston doubtless derives its name from the fact that at an early period it was a royal demesne. On digging the foundation for the new bridge a large number of important Roman remains were discovered, and on this account many believe that it was at this spot that Cæsar crossed the Thames when in pursuit of Cassivelaunus. In 838 it was the seat of a witenagemot convened by King Egbert. From

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[1] [His brother Henry (1830-76), novelist, editor of *Daily Review*, war-correspondent in France (1870), was also known as a literary critic in periodicals.—AM. ED.]

Edwin in 901 to Ethelred in 978 it was the place where the Anglo-Saxon kings were crowned. Kingston returned members to parliament from the 4th of Edward II. to the 47th of Edward III. It received a charter of incorporation from King John, which was confirmed and extended by several subsequent monarchs. In 1264 the castle of Kingston, no trace of which now remains, was taken by Henry III. In 1648 it was made the rendezvous of forces designed for the release of Charles I. from the Isle of Wight, but in the skirmish near the town the Royalists were defeated, and Lord Francis Villiers was killed.

See Roots, *Charters of the Town of Kingston*, 1797, and the histories of the town by Anderson, 1818, and Biden, 1852.

KINGSTON-UPON-HULL. See Hull, vol. xii. p. 354.[1]

KINGSTON, William Henry Giles (1814-1880), boys' novelist, was born in London, February 28, 1814. Much of his youth was spent at Oporto, where his father was a merchant, but when he joined his father in business, and afterwards when he carried on business for himself, he lived chiefly in London. In 1844 his first book, *The Circassian Chief*, appeared, and its success led to the publication in 1845 of *The Prime Minister, a Story of the Days of the Great Marquis of Pombal*. The *Lusitanian Sketches* that appeared soon after described Kingston's travels in Portugal. In 1851 *Peter the Whaler*, his first book for boys, came out. That and its immediate successors were received with such unequivocal popularity that Kingston retired from business, and devoted himself to the production of tales of adventure for boys. Within thirty years he wrote upwards of one hundred and thirty such books. He travelled at various times in many of the countries of Europe, and lived for a while in Portugal during the civil war there. His *Western Wanderings*, published in 1856, describes a tour in Canada. In all philanthropic schemes Kingston took deep interest; he was the promoter of the mission to seamen; and he acted as secretary of a society for promoting an improved system of emigration. He was a supporter of the volunteer movement in England from the first. For his services in bringing about a commercial treaty between Portugal and Britain he was knighted by the queen of Portugal; and his literary merits were recognized at home by a grant from his own sovereign. He died at Willesden, August 5, 1880.

Kingston's boyish ambition had been to enter the navy, and he always kept his affection for the sea. As he advanced in life he had opportunities of cruising in men-of-war, besides sailing in merchantmen and his own yacht; and it was thus that he gained the knowledge of practical seamanship that he used so graphically in his books. Most of his stories are stories of the sea; and he generally laid his plots in the old romantic days before England's wooden walls had given place to ironclads. He was a master of the simple romance in which boys delight, and he knew well how to draw the peculiar compound of valor and magnanimity that forms the hero to healthy boyhood. He had great assimilative power in using the accounts of travellers in countries where he had never been; and his imagination supplied him abundantly with gallant adventures, thrilling dangers, and hair-breadth escapes. His books are useful in insinuating knowledge whilst they are giving pleasure, and they are valuable inasmuch as their whole tone is pure, wholesome, and manly. Characteristic specimens of his works are *The Three Midshipmen; The Three Lieutenants; The Three Commanders;* and *The Three Admirals*. Occasionally his books were not in the form of a story; and some of them are designed for adult readers.

KINGSTOWN, a seaport town of Ireland, in the county of Dublin, is situated at the southeastern extremity of Dublin Bay, 6 miles southeast from Dublin by railway. It is a large seaport and favorite watering-place, and possesses several fine streets and terraces commanding picturesque sea views. The original name of Kingstown was Dunleary, which was exchanged for the present designation after the embarkation of George IV. at the port on his return from Ireland in 1821, an event which is also commemorated by a granite obelisk erected near the harbor. The town was a mere fishing village until the construction of an extensive harbor, begun in 1817 from designs by Rennie, and finally completed in 1859 at a cost of £825,000. The eastern pier has a length of 3500 feet, and the western of 4950 feet, the total area inclosed being about 250 acres, with a varying depth of from 15 to 27 feet. Kingstown is the station of the mail packets to Holyhead in connection with the London and Northwestern Railway. It has a large export and import trade both with Great Britain and foreign countries, but as its shipping returns are now included in those of the port of Dublin, it is impossible to give accurate details. The principal exports are cattle, and the principal imports corn and provisions. The harbor revenue exceeds £2000 annually. By the Towns' Improvement Act of 1854, Kingstown, with several surrounding districts, was formed into a township having an area of 1450 acres. The population in 1861 was 14,257, which in 1871 had increased to 16,378 and in 1881 to 18,230.

KING-TIH CHIN, a town near Foo-leang Heen, in the province of Keang-se, China, and the principal seat of the porcelain manufacture in that empire. Being situated on the south bank of the river Chang, it was in ancient times known as *Chang-nan Chin*, or "town on the south of the river Chang." It is unwalled, and stretches along the bank of the river in a somewhat straggling way. The streets are narrow, and crowded with a population which is reckoned at a million, the vast majority of whom find employment at the porcelain factories. Since the Ch'in dynasty (557-589) this has been the great trade of the place, which was then called by its earlier name. In the reign of King-tih of the Sung dynasty (1004-1007) a manufactory was founded there for making vases and objects of art for the use of the emperor. Hence its adoption of its present title. Since the time of the Ming dynasty a magistrate has been specially appointed to superintend the factories and to dispatch at regular intervals the imperial porcelain to Pekin. The town is situated on a vast plain surrounded by mountains, and boasts of three thousand porcelain furnaces. These constantly-burning fires are the cause of frequent conflagrations, and at night give the city the appearance of a place on fire. The people are as a rule orderly, though they have on several occasions shown a hostile bearing towards foreign visitors. This is probably to be accounted for by a desire to keep their art as far as possible a mystery, and is after all only an extreme interpretation of the law which forbids strangers to lodge in the town. This feeling appears less unreasonable when it is remembered that the two kinds of earth of which the porcelain is made are not found at King-tih Chin, but are brought from K'i-mun in the neighboring province of Gan-hwuy, and that there is therefore no reason why the trade should be necessarily maintained at that place. The two kinds of earth are known as pih-tun-tsze, which is a fine fusible quartz powder, and kaou-lin, which is not fusible, and which it is said gives strength to the ware (see Kaolin). Both materials are prepared in the shape of bricks at K'i-mun, and are brought down the Chang to the seat of the manufacture.

KINO, an astringent drug introduced into European medicine in 1757 by Fothergill, an eminent physician and patron of economic botany. When described by him it was believed to have been brought from the river Gambia in West Africa. According to Moore (1733), a factor to the Royal African Company, the tree yielding the drug is known in the Mandingo language as "kano." When first imported, however, it was sold in England as *Gummi rubrum astringens Gambiense*. It was introduced into the Edinburgh pharmacopœia in 1776 under the above name, and into the London pharmacopoeia in 1787 under the name of *Resina kino.* Specimens of the plant sent home by Mungo Park in 1805 were recognized as identical with *Pterocarpus erinaceus*, Poiret. In 1811 the African drug was no longer to be met with in English commerce, its place being supplied by several other kinds.

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[1] The population of the municipal borough amounted in 1881 to 154,260, and that of the parliamentary borough of Hull to 161,519.

The drug which is at present recognized as the legitimate kind is East Indian, Malabar, or Amboyna kino, and is obtained from *Pterocarpus Marsupium*, Roxb. (*Leguminosæ*). It is collected in the Government forests of the Malabar coast, the collectors being required to pay a small fee for the privilege, and to perform the tapping carefully and without injuring the timber. The mode of obtaining the kino is by making a perpendicular incision, with lateral ones leading into it, in the trunk, a vessel being placed at the foot of the incision to receive the juice. When exuding it resembles red currant jelly,[1] but hardens in a few hours after exposure to the air and sun. When sufficiently dried it is packed into wooden boxes for exportation. When these are opened it breaks up into angular brittle fragments of a blackish-red color and shining surface. In cold water it is only partially dissolved, leaving a pale flocculent residue, which is soluble in boiling water, but deposited again on cooling. In spirit of wine, sp. gr. .838, it is entirely soluble, affording a solution having an acid reaction, but the liquid by long keeping assumes a gelatinous condition. It is also soluble in caustic alkalies and to a large extent in a saturated solution of sugar, but is wholly insoluble in ether. In chemical composition kino appears to be nearly allied to Pegu catechu, but differs from it in not yielding catechin when exhausted by ether, but only a minute quantity of scaly prismatic crystals of a substance which is soluble in cold water, and thus more nearly resembles pyrocatechin. Pyrocatechin is, however, not present in the fresh bark or wood of the tree. Etti (1878) states that he has obtained kinoin, $C_{14}H_{12}O_6$, from Malabar kino, while Hanbury and Fluckiger failed to obtain it from that drug, but found it in Australian kino. According to Bentley, kino-tannic acid, catechin (or probably pyrocatechin), and kino red are the essential constituents of Malabar kino. The first of these is precipitated from an aqueous solution of the drug by dilute mineral acids, and the last by boiling an aqueous solution of kino-tannic acid for some time, when it separates as a red precipitate. The chemical constitution of Malabar kino is therefore only imperfectly known. The quantity of kino collected in Madras is comparatively small, and is supposed not to exceed a ton or two annually, but it is often shipped from Cochin.

Bengal, Butea, or Palas kino—obtained from *Butea frondosa*, Roxb. (*Leguminosæ*), a native of India and Burmah, well known under the name of the Palas or Dhak tree, and remarkable for its large orange papilionaceous flowers—also finds its way occasionally into British commerce. A portion is also obtained from *Butea superba*, Roxb., and *Butea parviflora*, Roxb. Butea kino does not stick to the teeth when chewed like ordinary kino, although like the latter it gives a red tinge to the saliva. It is usually more or less mixed with small fragments of bark. It is almost completely soluble in water, and to the extent of 46 per cent. in boiling alcohol, but different specimens vary in solubility. It is believed to contain about half its weight of kino-tannic acid, the remainder consisting of a soluble mucilaginous substance, and a minute quantity of pyrocatechin, which can be extracted by ether. In India Butea kino is used instead of the Malabar kino, and is called by the Hindus kueni or kuenee.

Botany Bay, Australian, or Eucalyptus kino is a more or less resinous astringent exudation obtained from several species of *Eucalyptus*. It is found in flattened cavities in the trunks, and is mostly collected by sawyers and wood-splitters. It frequently comes into the London market, and the best variety, probably the product of *E. corymbosa*, Sm., is used under the name of "red gum" in the preparation of astringent lozenges for sore throat. According to Wiesner of Vienna, Australian kino contains a little catechin (a statement doubted by Fluckiger) and pyrocatechin, no pectinous matter, but a gum nearly allied to that of acacia. Fluckiger also obtained from it kinoin, $C_{14}H_{12}O_6$, which he regards as the methylated gallic ether of pyrocatechuic acid, viz., $C_6H_4(OCH_3)C_7H_5O_5$.

Between 1808 and 1820 a substance was met with in French commerce under the name of Jamaica kino, which is said to have been prepared by inspissating the juice of the seaside grape, *Coccoloba uvifera*, L. (*Polygonaceæ*). When powdered it has a somewhat bituminous odor and an astringent, slightly bitter taste. It is but little soluble in cold water or alcohol, but dissolves almost entirely in boiling water, and to the extent of about 75 per cent. in hot alcohol. In thin laminæ it is only semi-transparent, the fragments usually met with in commerce being quite opaque. In 1835 an article appeared in French commerce under the name of "kino de la Colombie," which is stated in *Histoire des Drogues* to be in all probability an extract of the bark of *Rhizophora Mangle*, L. A liquid kino is obtained from *Pterocarpus indicus*, which does not harden like that obtained from *P. Marsupium.* Although used in India, it is not imported into Europe. Other varieties of kino are mentioned in the same work, but they must be regarded rather in the light of curiosities than as articles of commerce.

Kino is used in medicine as an astringent, chiefly in the form of tincture; but, owing to its tendency to gelatinize, that preparation is much less used than formerly.

See Dr. Fothergill, *Med. Obs.*, 1757, p. 358; F. Moore, *Travels into the Inland Parts of Africa*, 1737, p. 160, 209, 267; *Histoire des Drogues*, 7th ed., tom. iii., p. 426–439; Lewis, *Materia Medica*, 1784, p. 366; Daniell, *Pharmaceutical Journal* (1), xiv, p. 55; *Pharmacographia*, 2d ed., p. 195; Pereira, *Mat. Med.*, 4th ed., vol. ii., p. 325; Bentley and Trimen, *Medicinal Plants*, Nos. 79–81.

KINROSS, a small inland county of Scotland, is situated between 56° 8′ and 56° 18′ N. lat., and 3° 14′ and 3° 35′ W. long. It is of an irregular circular form, and in outline somewhat resembles a toothed wheel, lying between Perthshire on the northwest and Fife on the southeast. Its breadth from west to east is about 12 miles, and its length from north to south about 10 miles; the area is 49,812 acres, or about 78 square miles. Next to Clackmannan it is the smallest county in Scotland.

The surface consists principally of an oval and level plain, which is bounded on the N. W. by the Ochils, on the E. by Bishop Hill and the Lomonds, on the S. by Benarty Hill, and on the S. W. by the Cleish Hills. This plain opens out on the west along the Devon valley towards Stirling, on the northeast towards the valley of the Eden, and more narrowly on the south between the Cleish Hills and Benarty. Kinross is touched by the river Devon at the Crook of Devon, not far from the Rumbling Bridge; and the river Leven, which has its source in the loch of that name, flows for about half a mile in Kinross before entering Fife. Of the streams which flow into Lochleven the principal are the Gairney, the South Queich, and the North Queich. Lochleven, the area of which has been lessened by extensive reclamation works undertaken in 1826, has still a surface of 3406 acres, and its trout fishing is the best of any loch in Scotland. The loch contains several islands, the principal being Queen Mary's Island, 8 acres in extent, Reed Bowers, 1 acre, and the Island of St. Serf, 80 acres.

Geology and Agriculture.—The greater part of the county belongs to the upper strata of the Old Red

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[1] African kino is very liquid and of an extremely pale red color when it first flows out, but soon coagulates and becomes of a deep blood-red hue.

Sandstone, but a portion in the northwest to the porphyry formation of the Ochils, while on the east there is a narrow boundary of the Coal-measure slightly interrupted by trap. Coal is wrought in the southern part of the county, but only to a small extent; limestone is very abundant, and sandstone is obtained for building purposes.

The lower part of the county is generally well sheltered, and suitable for all kinds of crops. In this region the soil is generally of a mossy character, but when well drained and cultivated is very fertile. The eminences are devoted chiefly to the pasturage of sheep and the rearing of cattle. Much land has been reclaimed within recent years, and the methods of farming are now quite equal to those of the most advanced districts of Scotland.

A great proportion of the land is held in fee by small proprietors who farm their own properties. The following table gives a classification of holdings according to size in 1880 and 1875:

	50 Acres and under.		From 50 to 100 Acres.		From 100 to 300 Acres.		From 300 to 500 Acres.		From 500 to 1000 Acres.		Above 1000 Acres.		Total.	
	No.	Acres.	No.	Acres.	No.	Acres.	No.	Acres.	No.	Acres.	No.	Acres.	No.	Acres.
1880	136	1,068	82	7,823	102	18,680	21	2,861	2	1,445	...	......	293	31,877
1875	143	1,543	29	2,074	118	21,556	25	9,307	1	580	...	......	316	35,010

According to the agricultural returns for 1881, the total area under crops was 31,459 acres, of which 7296 acres were under corn crops, 3698 under green crops, 11,348 under rotation grasses, 9100 permanent pasture, and 17 fallow. 2576 acres were under woods. The percentage of cultivated area in 1870 was 67.9, and in 1880 it was 63.0. The area under permanent pasture has increased very much of late years, while there is an unusually large percentage under rotation grasses. 5801 acres, or more than two-thirds of the area under corn crops, is occupied by barley and bere, while oats had 1350 and wheat only 112 acres. Nearly the whole area under green crops was occupied either by turnips and swedes or potatoes, turnips and swedes having 2663 and potatoes 957 acres.

The total number of horses in 1881 was 1039. Of these 699 were used solely for agricultural purposes, and 340, a very large proportion, were unbroken horses or mares kept solely for breeding. Cattle in 1881 numbered 5555. Milch cows numbered 984, less than one-fifth of the whole. A considerable number of cattle are pastured on the lowland farms. They are chiefly a native breed which has been much improved by crossing. Sheep in 1881 numbered 26,530. They are chiefly pastured on the hills, but a considerable number are also wintered on the lowland farms. Pigs in 1881 numbered 504.

In 1872–73 the land was divided between 728 proprietors, and its gross annual value was £64,671 14s. Of the owners, 468 or 64.3 per cent. possessed less than 1 acre, and the average value per acre was £1 8s. 10½d. There were nine proprietors who held more than 1000 acres, the largest estates being those of the Right Hon. W. P. Adam, 2869 acres, and Sir Graham Montgomery, 2336.

Manufactures and Trade.—Tartan plaids, shawls, and other woollen goods are manufactured at Kinross, which also possesses corn-mills and a brewery. There is a large linen factory at Milnathort, as well as manufactories for woollen goods.

Administration.—The county sheriff courts are held weekly or fortnightly. Kinross is now joined with Clackmannan and Linlithgow in one sheriffdom, and quarter sessions are held on the first Tuesday of March, July, August, and October. The county unites with Clackmannan in returning a member to parliament.

Population.—Kinross has the smallest population of any county in Scotland. From 6725 in 1801 it rose to a maximum of 9072 in 1831, from which it fell in 1841 to 8763, and although in 1851 it rose to 8924, it gradually diminished till in 1871 it was 7198, while in 1881 it was 6699, of whom 3112 were males and 3587 females. The principal villages are Kinross (population in 1881, 1960), the capital of the county and a market-town; Milnathort (1269), with linen and woollen manufactures; Kinnesswood (250); and a portion of Kelty, the remainder being in Fife.

History and Antiquities.—The early history of Kinross-shire is given in the article FIFE. There are traces of an ancient fort or camp on the top of the hill of Dumglow in the parish of Cleish, and a remarkable cairn called Cairn-a-vain on a hill on the northern boundary of the parish of Orwell, in the centre of which a rude stone cist was discovered with an urn full of bones and charcoal. In 1857 a hoard of seven hundred Roman coins was dug up in the vicinity of the county town. The priory of Portmoak, properly situated on the island of St. Serf in Lochleven, although the prior and canons often resided at Kinnesswood, was originally the oldest Culdee establishment in Scotland,—being a gift of the Pictish kings after their conversion. Some time before 961 it was made over to the bishop of St. Andrews, and shortly after 1144 a body of canons regular was established in it in connection with the priory of canons regular established in that year at St. Andrews. The castle of Lochleven was a royal residence as far back as 1257. In it Archibald, earl of Douglas, was imprisoned in 1429, and Queen Mary from June 16, 1567, to May 2, 1568. A short distance northeast of Kinross stands the ruined castle of Burleigh.

KINSALE, a parliamentary borough and seaport town of Ireland, in the county of Cork, is situated on the estuary of the Bandon, 24 miles south from Cork by rail. The town occupies chiefly the acclivity of Compass Hill, and, while possessing a striking and picturesque appearance, is built in a very irregular manner, the streets being narrow and so precipitous that in many instances conveyances have to take a very circuitous course. The principal buildings are the castle fort, completed by the duke of Ormonde at a cost of £70,000, and captured by the earl of Marlborough in 1690; the parish church, an ancient but inelegant structure, erected as a conventual church about the 14th century; the assembly-rooms, the barracks, the Carmelite friary, and the convent of the sisters of mercy. Kinsale is much frequented by summer visitors, and is also an important fishery station, the number of boats employed in the division of which it is the principal port being about 350, employing over 1700 men and boys. It possesses also a commodious harbor, but the trade has become almost extinct owing to the proximity of Cork. The population in 1881 was 4976.

Kinsale is said to derive its name from *cean taile*, the headland in the sea. At an early period the town belonged to the De Courceys, a representative of whom was created baron of Kinsale in 1181. It received a charter of incorporation from Edward III., having previously been a borough by prescription, and its privileges were confirmed and extended by various subsequent sovereigns. For several centuries previous to the Union it returned two members to parliament, but since then it has returned only one. It was the scene of an engagement between the French and English fleets in 1380, was forcibly entered by the English in 1488, was partly consumed by fire in 1594, was captured by the Spaniards and retaken by the English in 1601, was entered by the English in 1641, who expelled the Irish inhabitants, was the scene of the landing of James II. and of the French army sent to his assistance in 1689, and was taken by the English in the following year.

KIÔTO, KIYÔTO, MIAKO, or SAIKIO, the ancient sacred capital of Japan, is situated on the main island of the Japanese archipelago. It occupies the level bottom of a valley between the ridges Hujei-zan and Higushiyama on the east, and of Tenno-san on the west, and is so girt by the streams Kamogawa and Kalunagawa as to have an almost insular position. With Tôkio, to the northeast, it is connected by two highways, the Tôkaidô, 307 miles long, and the Nakasendô, 323 miles long. To Ozaka on the coast a railway line was opened in 1877. Kiôto is regularly and compactly built on the rectangular system, the immense number of Shintô and Buddhist shrines and temples being almost entirely beyond the city proper. The large suburb beyond the Kamogawa, which is crossed by many bridges, is the finest in respect of inns and temples. The houses, chiefly of wood, are small, and are further dwarfed by the great width of the streets. Tea-houses and pleasure-gardens abound, and the whole air of the city is pleasant. "With its schools, hospitals, lunatic asylum, prisons, dispensaries, almshouses, fountains, public parks, and gardens, exquisitely beautiful cemeteries, and streets of almost painful cleanliness, Kiyôto is the best-arranged and best-managed city in Japan."[1] The chief building is, of course, the imperial palace, surrounded by beautiful gardens. Formerly forbidden to even most natives, it is now occupied as a museum of Japanese arts and manufactures. Among the other buildings are the former residences of the taikun and of the mikado's nobility, the various normal training and other schools for both sexes and all ages, the hospital, etc. Under the city government of Kiôto there was founded in 1870 an industrial department to foster the industries of the place. There are divisions for the encouragement of gardening, shoe-making, silk and other weaving, paper-making, leather-making, the manufacture of mineral waters, and many other branches of industry. Kiôto supports also a pauper colony. The silk-factories, though on a small scale, are numerous. Crape, bronze goods, and porcelain (largely for the English market) are also produced in the city. The population in 1870 was estimated at 370,000.

Kiôto is much the oldest of the three great cities of Japan, but Tôkio and Ôzaka have far outstripped it in importance. In the reign of the Emperor Kuwammu, towards the end of the 8th century, Nara was superseded as the capital by Kudzuno, afterwards called Kiôto, and sometimes called Miako; and this last town became identified with the mikado, as Yedo was with the shôgun. It was the scene of the first contests of the Taira and Minumoto clans. In the 16th century Xavier preached in its streets; and in the 17th Kaempfer twice visited it. In 1864 a fierce contest, followed by a conflagration, resulted from an attack upon it by the Chôsiu clan and Kiheitai. After the revolution in 1869 the mikado and his court migrated to Yedo, thenceforth called Tôkio or eastern capital. Kiôto also received an alternative name,—Saikio, or western capital; but it is never used. Kiôto is not a treaty port; and foreigners are not allowed to reside in it unless they are in Japanese employ.

KIPPIS, Andrew (1725–1795), a learned and laborious compiler, was born at Nottingham, March 28, 1725. From school at Sleaford in Lincolnshire he passed at the age of sixteen to spend a five years' course in the Dissenting academy at Northampton, of which Dr. Doddridge was then president. In 1746 Kippis became minister of a church at Boston; in 1750 he removed to Dorking in Surrey; and in 1753 he became pastor of a dissenting congregation at Westminster, where he remained till his death on 8th October, 1795. Kippis took a prominent part in the affairs of the body with which he was connected. From 1763 till 1784 he was classical and philological tutor in Coward's training college; and when another institution of the same kind was opened at Hackney he was prevailed upon, somewhat against his will, to serve as tutor there for a few years. In 1767 he received the degree of D.D. from Edinburgh university; in 1778 he was elected a fellow of the Antiquarian Society, and a fellow of the Royal Society in 1779. He left a reputation for piety, learning, and active virtue.

Kippis was a very voluminous writer. He contributed largely to *The Gentleman's Magazine*, *The Monthly Review*, and *The Library;* and he had a good deal to do with the establishment and conduct of *The New Annual Register*. He published also a number of sermons and occasional pamphlets; and he prefixed a life of the author to a collected edition of Dr. Nathaniel Lardner's *Works* (11 vols. 8vo, 1788). He wrote a life of Dr. Doddridge, also, which is prefixed to Doddridge's *Exposition of the New Testament* (6 vols. 8vo, 1792). His chief work is his edition of the *Biographia Britannica*, of which, however, he only lived to publish 5 vols. (folio, 1778–1793). Many new lives were inserted, written for the most part by the editor himself; and extensive additions and corrections were made. These last were given in the form of footnotes to the original text,—a plan which often gives the work the air of a long controversy, and swelled it beyond reasonable bounds. As a monument of the painstaking erudition of the editor the work is interesting; and as a mere storehouse of facts it possesses a genuine value. Kippis's *Life and Voyages of Captain James Cook* was reprinted from this book, 4to, 1788. See notice by A. Rees, D.D., in *The New Annual Register* for 1795.

KIRBY, William (1759–1850), entomologist, was born at Witnesham in Suffolk, September 19, 1759. From the village school of Witnesham he passed to Ipswich grammar school, and thence to Caius College, Cambridge, where he graduated B.A., in 1781, not becoming M.A., till 1815. Taking orders in 1782, he spent his entire life in the peaceful seclusion of an English country parsonage, till 1796 as curate, afterwards as rector, of Barham in Suffolk. Although Kirby was once and again induced to use his pen against the spirit of free-thinking then reacting from France upon England, he had little taste for controversy. His favorite study was natural history; and eventually entomology engrossed all his leisure. His first work of importance was his *Monographia Apum Angliæ* (2 vols. 8vo, 1802), which as the first scientific treatise on its subject brought him into notice with the leading entomologists of his own and foreign countries. Latreille, Fabricius, Illiger, and Walckenaer were among his correspondents; and his opinion and advice were sought by many less illustrious. The practical result of a friendship formed in 1805 with Mr. Spence, a scientific gentleman of Hull, was the jointly-written *Introduction to Entomology* (4 vols. 8vo, 1815–26, 7th ed. 1856), one of the most popular books of science that have ever appeared, and still highly valuable. In 1830 Kirby was chosen to write one of the *Bridgewater Treatises*, his subject being *The History, Habits, and Instincts of Animals*. This, published in 2 vols. in 1835, undeniably fell short of his earlier works in point of scientific value. On July 4, 1850, William Kirby died, after a long life of piety, benevolence, and diligence. He was an original member of the Linnæan Society; and his name was on the rolls of all the chief scientific associations in England and abroad.

Besides the books already mentioned, Kirby was the author of many papers in *The Transactions of the Linnæan Society*, *The Zoological Journal*, and other periodicals; of *Strictures on Sir James Smith's Hypothesis respecting the Lilies of the Field of our Saviour, and the Acanthus of Virgil*, 1819; of *Seven Sermons on our Lord's Temptations, etc.*, 1829; and of the sections on insects in the *Account of the Animals seen by the late Northern Expedition while within the Arctic Circle*, 1821, and in *Fauna Boreali-Americana*, 1837. *The Life of the Rev. William Kirby, M.A.*, by Rev. John Freeman, was published in 1852. It contains a list of Kirby's works.

KIRCHER, Athanasius (1602–1680), a learned scholar and accomplished mathematician, was born May 2, 1602, at Geisa near Fulda, was educated at the Jesuit College of Fulda, and entered upon his novitiate in that order at Mainz in 1618. After continuing his studies at Paderborn, Münster, Cologne, Coblenz, and Mainz, he became professor of philosophy, mathematics, and Oriental languages at Würzburg, whence he was driven (1631) by the troubles of the Thirty Years' War to Avignon. Through the influence of Cardinal Barberini he next (1635) settled in Rome, where for eight years he taught mathematics in the Collegio Romano, but ultimately resigned this appointment in order that he might devote the closing years of his life entirely to the study of hieroglyphics and other archæological subjects. He died November 28, 1680.

Kircher was a man of wide and varied learning, but singularly devoid of judgment and critical discernment. His voluminous writings in philology, natural history, physics, and mathematics often accordingly have a good deal of the historical interest which attaches to pioneering work, however imperfectly performed; otherwise they now take rank as curiosities of literature merely. They include *Ars Magnesia*, 1631; *Magnes, sive de arte magnetica opus tripartitum*, 1640; and *Magneticum naturæ regnum*, 1667; *Prodromus Coptus*, 1636; *Lingua Ægyptiaca restituta*, 1643; *Obeliscus Pamphilius*, 1650; and *Œdipus Ægyptiacus, hoc est universalis doctrinæ hieroglyphicæ instauratio*, 1652–55,—works which may claim the merit of having first called the attention of the learned to the Egyptian hieroglyphics; *Ars magna lucis et umbræ in mundo*, 1645–46; *Musurgia universalis, sive ars magna consoni et dissoni*, 1650; *Polygraphia, seu artificium linguarum quo cum omnibus mundi populis poterit quis respondere*, 1663; *Mundus subterraneus, quo subterrestris mundi opificium universæ denique naturæ divitiæ, abditorum effectuum causæ demonstrantur*, 1665–78; *China illustrata*, 1667; *Ars magna sciendi*, 1669; and *Latium*, 1669, a work which may still be consulted with advantage. The *Specula Melitensis Encyclica* (1638) gives an account of what may be described as a kind of a calculating machine of his invention. The valuable collection of antiquities which he bequeathed to the Collegio Romano has been described by Buonanni (*Musæum Kircherianum*, 1709; republished by Battara in 1773).

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[1] Miss Bird, *Unbeaten Tracks in Japan*, vol. ii. p. 252.

KIRCHHEIM-UNTER-TECK, chief town of a district in the Danube circle of Würtemberg, is prettily situated on the Lauter, not far from the Teck, and about 15 miles southeast of Stuttgart. Its castle was built in 1538. The manufactures include cotton goods, damask, pianofortes, machinery, lanterns, chemicals, cement, etc. The town also has wool-spinning establishments and breweries, and a corn exchange. It is the most important wool market in South Germany, the annual turn-over averaging about 1,650,000 lb. The population in 1875 was 6197.

KIRGHIZ, a large and wide-spread division of the Mongolo-Tatar family, of which there are two main branches, the Kara-Kirghiz of the uplands and the Kirghiz-Kazaks of the steppe. To the same group belong the Kipchaks, forming a connecting link between the nomad and settled Turki peoples of Ferghana and Bokhara, and the Kara-Kalpaks on the southeast side of the Aral Sea, who are intermedite between the Kazaks and Uzbegs. The Kirghiz jointly number about 3,000,000, and occupy an area of perhaps the same number of square miles, stretching from Kulja westwards to the Lower Volga, and from the head streams of the Ob southwards to the Pamir and the Turcoman country. In the Mongolo-Tatar family their position is peculiar, they being closely allied ethnically to the Mongolians and in speech to the Tatars. To understand this phenomenon, it should be remembered that both Mongols and Tatars belonged themselves originally to one racial stock, of which the former still remain the typical representatives, but from which the latter have mostly departed and become largely assimilated to the regular "Caucasian" type. But the Kirghiz have either remained nearly altogether unmixed, as in the uplands, or else have intermingled in the steppe mainly with the Volga Calmucks in the west, and with the Zungarian nomads in the east, all alike of Mongol stock. Hence they have everywhere to a large extent preserved the common Mongolian features, while retaining their primitive Tatar speech. Physically they are a middle-sized, square-built race, inclined to stoutness, especially in the steppe, mostly with long black hair, scant beard or none, small, black, and oblique eyes, though blue or gray also occur in the south, broad Mongoloid features, high cheek bones, broad, flat nose, small mouth, brachycephalous head, very small hands and feet, dirty brown or swarthy complexion, often yellowish, but also occasionally fair. These characteristics, while affiliating them directly to the Mongol stock, also betray an admixture of foreign elements, probably due to Finnish or Chudic influences in the north, and Tajik or Iranian blood in the south. Their speech also, while purely Turkic in structure, possesses, not only many Mongolian and a few Persian and even Arabic words, but also some terms unknown to the other branches of the Mongolo-Tatar linguistic family, and which should perhaps be traced to the Kiang-Kuan, Wu-sun, Ting-ling, and other extinct Chudic peoples of South Siberia partly absorbed by them. These relations to the surrounding Asiatic races will be made clearer in the subjoined detailed account of the Kara-Kirghiz and Kirghiz-Kazaks.

The Kara-Kirghiz.—The Kara or "Black" Kirghiz, so called from the color of their tents, are known to the Russians either as Chernyie ("Black") or Dikokammenyie ("Wild, Stone" or "Rocky") Kirghiz, and are the Black Kirghiz of some English writers. They are on the whole the purest and best representatives of the race, and so true is this that, properly speaking, to them alone belongs the distinctive national name Kirghiz or Krghiz. This term is commonly traced to a legendary chief, Kirghiz, sprung of Oghuz-Khan, ninth in descent from Japhet. It occurs in its present form for the first time in the account of the embassy sent in 569 by Justin II. to the Uighur Khan, Dugla-Ditubulu, where it is stated that this prince presented a slave of the "Kerghiz" tribe to Zemark, head of the mission. In the Chinese chronicles the word assumes the form Ki-li-ki-tz', and the writers of the Yuan dynasty (1280–1367) place the territory of these people 10,000 li northwest of Pekin; about the head streams of the Yenisei. In the records of the Thang dynasty (618–907) they are spoken of under the name of Kha-kia-tz', (pronounced Khaka, and sometimes transliterated Haka), and it is mentioned that these Khakas were of the same speech as the Khoei-khu. From this it follows that they were of Mongolo-Tatar stock, and are wrongly identified by some ethnologists with the Kiang-Kuan, Wu-sun, or Ting-ling, all of whom are described as tall, with red hair, "green" or gray eyes, and fair complexion, and must therefore have been of Finnish stock, akin to the present Soyotes of the Upper Yenisei.

The Kara-Kirghiz are by the Chinese and Mongolians called *Burut*, where *ut* is the Mongolian plural ending, as in Tangut, Yakut, modified to *yat* in Buryat, the collective name of the Siberian Mongolians of the Baikal district. Thus the term *Bur* is the common Mongolian designation both of the Baikal Mongols and of the Kara-Kirghiz, who occupied this very region and the Upper Yenisei valley, generally till comparatively recent times. For the original home of their ancestors, the Khakas, lay in the south of the present governments of Yeniseisk and Tomsk, stretching thence southwards beyond the Sayan range to the Tannuola hills in Chinese territory. Here the Russians first met them in the 17th century, and by the aid of the Kazaks exterminated all those east of the Irtish, driving the rest further west and southwestwards. Most of them took refuge with their kinsmen, the Kara-Kirghiz nomad highlanders, whose homes, at least since the 13th century, have been the Ala-tau range, the Issik-kul basin, the Tekes, Chu, and Talass river valleys, the Tian-shan range, the uplands draining both to the Tarim and to the Jaxartes and Oxus, including Khokand, Karategin, and Shignan southwards to the Pamir table-land, visited by them in summer. They thus occupy most of the uplands along the Russo-Chinese frontier, between 35° and 50° N. lat. and between 70° and 85° E. long., where they have been recently joined by some Chiliks, Kipchaks, Naimans, and Kitars from Andijan and the Kazak steppes.

The Kara-Kirghiz are all grouped in two main sections—the On or "Right" in the east, with seven branches (Bogu, Sary-Bagishch, Son-Bagishch, Sultu or Solye, Cherik, Sayak, Bassinz), and the Sol or "Left" in the west, with four branches (Kokche or Kûchy, Soru, Mundus, Kitai or Kintai). The Sol section occupies the region between the Talass and Oxus head streams in Ferghana (Khokand) and Bokhara, where they come in contact with the Galchas or Highland Tajiks. The On section lies on both sides of the Tian-shan, about Lake Issik-kul, and in the Chu, Tekes, and Narin (Upper Jaxartes) valleys.

Each of the On tribes comprises a number of stocks or septs, which are further divided into auls or families, of which, however, the lists are complete for the Bogu and Sary-Bagishch alone. Of the Bogu there are six stocks, with 11,000 tents, and numbering 55,000 to 60,000 souls. Of the Sary-Bagishch there are four stocks, with 16,500 tents, or 80,000 to 90,000 souls. The Sayak numbers 10,000 tents, or about 50,000 souls, making a total of 200,000 in Russian territory. The Sol section, with the independent On tribes, is roughly estimated at about 200,000, making 400,000 Kara-Kirghiz altogether.

All are essentially nomads, occupied mainly with stock breeding, chiefly horses of a small but hardy breed, sheep of the fat-tailed species, oxen used both for riding and as pack animals, some goats, and camels of both species. Agriculture is limited chiefly to the cultivation of wheat, barley, and millet, from the last of which a coarse vodka or brandy is distilled. Trade is carried on chiefly by barter, cattle being taken by the dealers from China, Turkestan, and Russia in exchange for manufactured goods.

The Kara-Kirghiz are governed by the "manaps," or tribal rulers, who enjoy almost unlimited authority, and may even sell or kill their subjects. In religious matters they differ little from the Kazaks, whose practices are described below. Although generally recognizing Russian sovereignty since 1864, they pay no taxes, and merely furnish certain raw products to the Russian troops on their passage through the country.

The Kazaks.—Though not unknown to them, the term Kirghiz is never used by the steppe nomads, who always call themselves simply Kazaks, that is, "riders," as the word is commonly interpreted. The first authentic reference to this name is by Firdousi (1020), who speaks of the Kazak tribes as much dreaded steppe marauders, all mounted and armed with lances. From this circumstance the term Kazak came to be gradually applied to all freebooters similarly equipped, and it thus spread from the Aralo-Caspian basin to South Russia, where it still survives under the form of "Kossak." Hence though Kazak and Cossack are originally the same word, the former now designates a Mongolo-Tatar nomad race, the latter various members of the Great and Little Russian Slav family. No satisfactory explanation of its origin has been given. Since the 18th century the Russians have used the compound expression Kirghiz-Kazak, chiefly in order to distinguish them from their own Cossacks, at that time overrunning Siberia. Herbertstein (1520) is the first European who mentions them by name, and it is noteworthy that he speaks of them as "Tartars," that is, a people rather of Turki than Mongolian stock. In their present homes, the so-called "Kirghiz steppes," they are far more numerous and wide-spread than their Kara-Kirghiz kinsmen, stretching almost uninterruptedly from Lake Balkash round the Aral and Caspian Seas westward to the Lower Volga, and from the river Irtish southward to the Lower Oxus and Ust-Urt plateau. Their domain, which is nearly 2,000,000 square miles in extent, thus lies mainly between 45° and 55° N. lat. and from 45° to 80° E. long. Here they came under the sway of Jenghiz Khan, after whose death they fell to the share of his son Juchi, head of the Golden Horde, but continued to retain their own khans. When the Usbegs acquired the ascendency, many of the former subjects of the Juchi and Jagatai hordes fell off and joined the Kazaks. Thus were formed about 1500 two powerful states in the Kipchak and Cheteh steppes, the Moghul-Uluss and the Kazak, the latter of whom, under their khan Arslane, are said by Sultan Baber to have had as many as 400,000 fighting men. Their numbers continued to be swollen by voluntary or enforced accessions from the fragments of the Golden Horde, such as the Kipchaks, Naimans, Konrats, Jalairs, Kankly, whose names are still preserved in the tribal divisions of the Kazaks. And as some of these peoples were undoubtedly of true Mongolian stock, their names have given a color to the statement that all the Kazaks were rather of Mongol than of Turki origin. But the universal prevalence of a nearly pure variety of the Turki speech throughout the Kazak steppes is almost alone sufficient to show that the Tatar element must at all times have been in the ascendant.

The Kirghiz-Kazaks have long been grouped in three large "hordes" or encampments, further subdivided into a number of so-called "races," which are again grouped in tribes, and these in sections, branches, and auls, or communities of from five to fifteen tents. The division into hordes has been traditionally referred to a powerful khan, who divided his states amongst his three sons, the eldest of whom became the founder of the Ulu-Yuz, or Great Horde, the second of the Urta-Yuz, or Middle Horde, and the third of the Kachi-Yuz, or Little Horde. The last two under their common khan Abulkhair voluntarily submitted in 1730 to the czarina Anne. Most of the Great Horde were subdued by Yunus, khan of Ferghana, in 1798, and all the still independent tribes finally accepted Russian sovereignty in 1819. The races, range, and numerical strength of these hordes are shown in the following table:—

Races.	Range.	Tents.	Souls.
Great Horde.—*Uisün, Tulatai, Sargan, Konrat.*	Chiefly south of Lake Balkash and near the Tian-Shan; between Semipalatinsk and Semiryechensk.	85,000	450,000
Middle Horde.—*Arghyne, Naiman, Kipchak, Uvak-Ghirei.*	Chiefly on the low hilly watershed between the Ob and Aralo-Caspian basins, from Aral Sea to Lake Balkash; governments of Semipalatinsk and Akmolinsk, West Siberia.	175,000	1,100,000
Little Horde.—*Alimuly, Baiuly, Jetirurug.*	From Kara-Kum desert to Lower Volga, north of Aral Sea, and in governments of Orenburg, Uralsk, Turgay, and Astrakhan.	170,000	1,000,000

Since 1801 a fourth division, known as the Inner or Bukeyevskaya Horde, from the name of their first khan, Bukei, has been settled in the Orenburg steppe. It is estimated at 40,000 tents or 200,000 souls, giving for all the Kazaks 470,000 tents and 2,750,000 souls.

But these divisions affect the common people alone, all the higher orders and ruling families being broadly classed as White and Black Kost or Bones. The White Bones comprise only the khans and their descendants, besides the issue of the khojas or Moslem "saints." The Black Bones include all the rest, except the *Telengut* or servants of the khans, and the *Kûl* or slaves.

The Kazaks are an honest and trustworthy people, but heavy, sluggish, sullen, and unfriendly. Even the hospitality enjoined by the Koran is displayed only towards the "faithful," that is, exclusively to the members of the orthodox Sunnite sect. So essentially nomadic are all the tribes that they cannot adopt a settled life without losing the very sentiment of their nationality, and becoming rapidly absorbed in the Slav population. They dwell exclusively in the kibitka or yurt, a semicircular tent consisting of a light wooden framework, and red cloth or felt covering, with an opening above for light and ventilation. It is usually furnished with a large family clothes chest, felt carpet, wooden bedstead, leather bottles for kumis (fermented mare's milk), a tea service, and a few domestic utensils. Yet it may easily be pitched or struck in half an hour, and is rapidly transported on camels across the steppe. The camp life of the Kazaks seems almost unendurable to Europeans in winter, when they are confined altogether to the tent, and exposed to endless discomforts. In summer the day is spent mostly in sleep or drinking kumis, followed at night by feasting and the recital of tales, varied with songs accompanied by the music of the flute and balalaika. But horsemanship is the great amusement of all true Kazaks, who may almost be said to be born in the saddle. Hence though excellent riders, they are bad walkers, and, though hardy and long-lived, uncleanly in their habits and often decimated by small-pox and Siberian plague. They have no fixed meals, and live mainly on mutton and goat and horse flesh, and instead of bread use the so-called balamyk, a mess of flour fried in dripping and diluted in water. The universal drink is kumis, which is wholesome, nourishing, and a specific against all chest diseases.

The dress consists of the chapân, a flowing robe of which one or two are worn in summer and several in winter, fastened with a silk or leather girdle, in which are stuck a knife, tobacco pouch, seal, and a few other trinkets. Broad silk or cloth pantaloons are often worn over the chapân, which is of velvet, silk, cotton, or felt, according to the rank of the wearer. Large black or red leather boots, with round white felt pointed caps, complete the costume, which is much the same for both sexes.

Like the Kara-Kirghiz, the Kazaks are nominally Sunnites, but Shamanists at heart, worshipping, besides the Kudai or good divinity, the Shaitan or bad spirit. Their faith is strong in the *talchi* or soothsayer and other charlatans, who know everything, can do everything, and heal all disorders at pleasure. But they are not fanatics, though holding the abstract doctrine that the "Kafir" may be lawfully oppressed, including in this category not only Buddhists and Christians, but even Mohammedans of the Shiah sect. There are no fasts or ablutions, mosques or mollahs, or regular prayers. Although Mussulmans since the beginning of the 16th century, they have scarcely yet found their way to Mecca, their pilgrims visiting instead the more convenient shrines of the "saints" scattered over Eastern Turkestan. Unlike the Mongolians, the Kazaks treat their dead with great respect, and the low steppe hills are often entirely covered with monuments raised above their graves.

Letters are neglected to such an extent that whoever can merely write is regarded as a savant, while he becomes a prodigy of learning if able to read the Koran in the original. Yet the Kazaks are naturally both musical and poetical, and possess a considerable number of national songs, which are usually repeated with variations from mouth to mouth.

The Kazaks still choose their own khans, who, though confirmed by the Russian Government, possess little authority beyond their respective tribes. The real rulers are the elders or umpires and sultans, all appointed by public election. Brigandage and the *barantas* or raids arising out of tribal feuds, which were formerly recognized institutions, are now severely punished, sometimes even with death. Capital punishment, usually by hanging or strangling, is inflicted for murder and adultery, while three, nine, or twenty-seven times the value of the stolen property is exacted for theft.

The domestic animals, daily pursuits, and industries of the Kazaks differ but slightly from those of the Kara-Kirghiz. Some of the wealthy steppe nomads own as many as 20,000 of the large fat-tailed sheep. Goats are kept chiefly as guides for these flocks; and the horses, though small, are hardy, swift, light-footed, and capable of covering from 50 to 60 miles at a stretch. The total live-stock was thus estimated in 1872 by Tillo:—camels, 120,000; horses, 1,720,000; oxen, 600,000; sheep, 2,000,000; goats, 180,000. Amongst the Kazaks there are a few workers in silver, copper, and iron, the chief arts besides being skin dressing, wool spinning and dyeing, carpet and felt weaving. Trade is confined mainly to an exchange of live stock for woven and other goods from Russia, China, and Turkestan.

Since their subjection to Russia, the Kazaks have become less lawless, but scarcely less nomadic. A change of habit in this respect is opposed alike to their tastes and to the climatic and other outward conditions. Hence the progress of culture can here lead only to the depopulation of the steppe wherever incapable of being irrigated, and to the gradual extinction or absorption of the Kirghiz-Kazaks by their Slav rulers.

Literature.—Alexis Levshin, *Description des Hordes et des Steppes des Kirghiz-Kazaks*, translated from the Russian by Ferry de Cigny, 1840; Radloff, *Proben der Volkslitteratur der Türkischen Stämme Südsiberiens*; Ch. de Ujfalvy, *Le Kohistan, le Ferghanah, et Kouldja*; also *Bul. de la Soc. de Géo.*, 1878-79; Semenoff, paper in Petermann's *Mittheilungen*, 1859, No. 8; Valikhanov's *Travels in 1858-59*; Madame de Ujfalvy, papers in *Tour du Monde*, 1874; Vambéry, *Die primitive Cultur des Turko-Tatarischen Volkes*. (A. H. K.)

KIRIN, Girin, or in Chinese Chwen-Chang, the chief town of the province of Central Manchuria or Kirin, is situated at the foot of the Lau-Ye-Ling mountains, at the edge of a wide and well-wooded plain, and on the left bank of the Girin-ula or Sungari, there 300 yards in breadth. The situation is one of exceptional beauty; but the streets are narrow and irregular. Tobacco is the principal article of trade, the kind grown in the province being greatly prized throughout the Chinese empire under the name of "Manchu leaf." Formerly ginseng was also an important staple, but the supply from this quarter of the country has been exhausted. Outside of the town lies a plain "thickly covered with open coffins containing the dead bodies of Chinese emigrants exposed for identification and removal by their friends; if no claim is made during ten years the remains are buried on the spot." Kirin was chosen by the emperor Kanghi as a military post during the wars with the Eleuts; and it owes its Chinese name of Chwen-Chang, *i. e.*, Naval Yard, to his building there the vessels for the transport of his troops. The population was estimated at 300,000 in 1812; at present it is about 120,000.

See Palladius, "Expedition through Manchuria," in *Journ. Roy. Geog. Soc.*, 1872; Williamson, *Journeys in North China.*

KIRKCALDY, a royal and parliamentary burgh and seaport on the southeast coast of Fifeshire, Scotland, 12 miles north from Edinburgh. The chief topographical feature of the town is its length, which is nearly 4 miles within the municipal boundary, as extended by Act of Parliament in 1876. Formerly there was little besides one main street, with lanes and shorter streets branching from it, but during the last five-and-twenty years a large number of new streets and villas have been built along the high ground to the north. The parish, however, is a very small one, the landward part (now Abbotshall) having been disjoined in 1650. In population and most other statistical respects Kirkcaldy is the principal town in the county, and the tenth in Scotland, ranking next after Perth and Kilmarnock. The valuation of the burgh in 1881, including railways, was £87,622, and the census of the same year showed a population of 23,632. Besides some importations of flax, timber, whiting, etc., the chief regular trade of the port is that carried on by means of coasting vessels with Leith, Glasgow, and London. The annual harbor revenue is about £2000, and that of the custom-house £52,000.

The linen manufacture, begun in the early part of the 18th century, has long been the staple industry, the town being one of the chief centres of the trade in Scotland. The spinning of flax by machinery was introduced into the district in 1792, and in 1807 steam was added as a motive power. At present there are six mills with 18,830 spindles, employing when in full operation about 1450 persons. There is also an extensive net factory. Twelve power-loom factories, with an aggregate of 2100 looms, broad and narrow, employ fully that number of operatives. In these, as in the spinning mills, a large proportion of the workers, about 80 per cent., are females. Hand-loom weaving has almost entirely disappeared. The principal fabrics manufactured are sheetings, ticks, hollands, towellings, diapers, dowlas, etc.; and one or two firms are now making cotton goods to some extent. There are three bleachfields, with 180 workpeople. Next in importance to the various branches of the linen manufacture are the floor-cloth works. First introduced by the late Mr. Michael Nairn, the production of floor-cloth at Kirkcaldy has for some years been the largest in the world. There are six factories, employing about 930 workpeople. The linoleum manufacture has also been successfully established. In 1877 the Messrs. Nairn built the first factory in Scotland for this branch of industry, and its success has resulted in the formation of other two companies. The three firms employ an aggregate of nearly 450 hands. A large amount of machinery, including steam-engines, boilers, sugar-mills, rice-mills, and the like, is also manufactured in Kirkcaldy. There are eight works in operation, several of them extensive, and about 800 men and lads are employed. Among miscellaneous works may be noted two potteries (one of them including a tile-work with 400 operatives), malting barns, flour-mills, several dye-works, a brewery, and a large printing and lithographic business.

The educational, ecclesiastical, and literary institutions of Kirkcaldy are numerous. There are seven public schools, with 3490 children on the roll, and nearly as many private and ladies' schools, with about 350 in attendance. In addition there are three schools belonging to Philp's trust, at which 500 children receive gratuitous education and clothing; the revenue of the trust for the purposes of these three schools was £2115 in 1880. There are twenty-six churches,—the finest architecturally being St. Brycedale Free church. The town has two public libraries, one of them with nearly 10,000 volumes; and there are three weekly newspapers.

For much of its recent prosperity Kirkcaldy is indebted to the water scheme, for which an Act was obtained in 1867, and an Amendment Act in 1870. The sum authorized to be expended by these bills was £53,000, but an Extension Act was passed in 1881 giving power to raise £40,000 additional when required. An extensive system of drainage is also in process. A sheriff-substitute has recently been appointed for the Kirkcaldy district.

Kirkcaldy, with Dysart, Kinghorn, and Burntisland, returns one member to parliament.

An *Ecclesia de Kirkcaldie* is mentioned in the list printed by Sibbald of the churches in the county of Fife in the year 1176. In 1240 it was bestowed by David, Bishop of St. Andrews, on the abbey of Dunfermline. The name of Kirkcaldy also occurs in the map of the civil divisions of Scotland in the 13th century prefixed to Professor Cosmo Innes's *Scotland in the Middle Ages*. In 1334 the town, with its harbor, was given by David II. to the abbey of Dunfermline, and in 1450 it was "disponed" by Richard, abbot of Dunfermline, to the bailies and council of Kirkcaldy.

The commerce of the place has suffered many fluctuations. In 1573, as we learn from the *Register of the Privy Council*, the district of Kirkcaldy had the largest manufacture of salt in Scotland, and about 1650 it was assessed as the sixth town in the kingdom. About 1644 there were one hundred ships belonging to the port, in 1760 only three, in 1792 the number had risen to twenty-nine, and in 1843 to ninety-one. Since then, chiefly owing to the abandonment of the whale-fishing, and the insufficiency of the harbor to admit large vessels, the trade of the port has considerably declined. The number of vessels belonging to it may be stated at twenty-seven. A considerable extension of the present harbor is among the possibilities of the future.

Adam Smith, whose great work *The Wealth of Nations* formed an era in the history of political economy; James Oswald of Dunnikier, a schoolfellow of Adam Smith, and a statesman of much promise; George Gillespie, a leading member of the Westminster Assembly; and Balnaves of Halhill, a lord of session in the time of Queen Mary, were natives of Kirkcaldy. Michael Scot, of wizard fame, was born about a mile from the burgh boundary. (T. H.)

KIRKCUDBRIGHT, a maritime county of Scotland, known as the "Stewartry of Kirkcudbright," and also as East Galloway, is situated between 54° 43′ and 55° 19′ N. lat., and between 3° 33′ and 4° 34′ W. long., and is bounded on the N. and N.W. by Ayr, E. and N.E. by Dumfries, S. by the Solway Firth and the Irish Sea, and W. by Wigtownshire and Wigtown Bay. Its extreme length from northwest to southeast is about 45 miles, and its breadth varies from 21 to 31 miles. The total area comprises 610,343 acres, or about 954 square miles.

The larger half of the county in the northwest direction consists of a rugged and mountainous table-land, with lofty summits of every variety of aspect, intersected often by deep glens. The scenery of this region is for the most part wild and bleak, its solitary desolation being heightened by the presence of many small lochs and tarns, but almost totally unrelieved by a single tree or shrub, although the peat deposits give evidence that the district was at one time covered by an extensive forest. The most elevated regions are generally covered with heath, but at the northern boundary there is a range of grassy hills. Many of the mountains have an elevation of over 2000 feet, the highest summits being Mearroch (2762 feet) in the parish of Minnigaff, and Corserine (2668), Carlin's Cairn (2650), and Cairnsmure in Carsphairn (2612)—all in the parish of Carsphairn The southeastern half of the county is for the most part level but undulating, its uniformity being broken by frequent rocky knolls or small rounded hills, and in the southeastern corner rising into several elevated summits, the highest of which is Criffel, 1867 feet. The greater part of this district is finely wooded, and abounds in picturesque scenery, especially towards the sea-coast and in the neighborhood of the rivers and numerous lochs. The southern coast is usually bold and rocky, and is much indented by the estuaries of various rivers, which form a number of natural harbors. Owing to the shallowness of the sea-bed, large stretches of sand are exposed in the Solway Firth at ebb tide, and the rapid flow of the tide has often occasioned loss of life to the unwary.

Geology.—Geologically Kirkcudbright forms part of the Silurian belt of the south of Scotland, but this formation is interrupted in the county by several upheavals of granite, one in the northwest, south of Loch Doon, another near the centre immediately west of Loch Ken, and a third round Criffel, on the shores of the Solway Firth. The lofty table-land is supposed to have been at one time the seat of an immense ice-bed (see paper by W. Jolly, in *Trans. Edin. Geol. Soc.*, 1868), whose action has doubtless in part created the isolated round-backed ridges of granite in the valley of the Urr, the finest example in Scotland of the *Roches moutonnées*, which constitute a peculiar feature in Alpine scenery (A. Somervail in *Trans. Edin. Geol. Soc.*, 1879). A more striking result of the glacial action was the dispersion of Kirkcudbrightshire granite to Cumberland, to North Wales, and even so far south as the neighborhood of Wolverhampton (D. Mackintosh in *Quart. Journ. Geol. Soc.*, 1879). The Silurian strata are for the most part of a slaty character, but in some places are composed of a species of red sandstone. Especially in the neighborhood of the granite the strata are very much contorted, and give evidence of having at one time been subjected to the action of intense heat. The granite is principally of a pale gray resembling that of Aberdeen, but a red variety also occurs. The principal quarries are at Dalbeattie and Creetown. Strata of lead are believed to stretch between Minnigaff and the Leadhills in Dumfriesshire, but the metal is but very little worked. Iron ore exists in different parts of the county, but from the absence of coal is almost wholly unutilized. Copper and barytes are also found, especially in the parish of Urr. Marl is obtained in large quantities from a number of the lochs.

Rivers.—The Nith, which rises in Ayrshire and flows through Dumfriesshire, forms for about 12 miles the boundary between Dumfries and Kirkcudbright, an equal distance of boundary to the northwest being formed by its tributary the Cluden water. The Urr, which rises in Loch Urr on the borders of Dumfriesshire, flows southeastward by Dalbeattie to the Solway Firth, where it forms a small bay. The Ken rises in Dumfriesshire, and after being joined from the west by the Deugh water, flows southeast into Loch Ken, the stream that issues from the loch taking the name of the Dee, and after a beautiful course southwestward falling into the Solway Firth. The Fleet, which rises in Loch Fleet, after a course of about 7 miles, falls into Wigtown Bay, where it forms an estuary. The Cree, which has its origin in two streams in Ayrshire, and forms the boundary of Kircudbright with Ayrshire and afterwards with Wigtownshire, flows southeast by Minnigaff and Newton Stewart, and falls into Wigtown Bay at Creetown.

Agriculture.—A considerable proportion of the land in the higher regions of Kirkcudbright is unsuitable for tillage, and yields a very small return as pasturage. In many cases also the soil is very marshy. In the lower regions it is generally dry but rocky. Much has been done of late years to increase the value of the land by draining the swamps, by the removal of stones and by deepening the soil and enriching it with manures. Generally the climate and soil are not adapted for the rearing of grain, but are especially suited for grass and green crops.

According to the agricultural returns for 1881 the area under crops was 179,237 acres, or 29 per cent. of the whole area. The area under corn crops was 32,349 acres; under green crops, 18,091; under rotation grasses, 71,091; under permanent pasture, 57,471 acres. The area under woods was 19,741 acres. The system of cropping is generally as follows:—first year, in breaking up from pasture, barley, or more generally oats; second year, green crop; third year, wheat, oats, or barley; fourth year, hay or pasture, which is generally continued for three additional years. It is now becoming a very common practice to sow out in grass after turnips without taking a corn crop, the soil being also frequently allowed the advantage of the manure of the sheep which have eaten the turnips on the ground. Of corn nearly the whole area is under oats, which in 1881 occupied 31,061 acres, while only 933 were under barley and bere, and 146 under wheat. Of green crops the area under turnips and swedes in 1881 was 14,596 acres; under potatoes 2847, mangolds 91, carrots 38, cabbage, kohl-rabbi, and rape 402, and vetches 117.

The total number of horses in 1881 was 5395. Of these 3789 are stated to be used solely for agricultural purposes, and 1606 to be unbroken horses and mares kept solely for breeding. The breeding of Clydesdale horses has of late years been increasing. Cattle in 1881 numbered 40,737. The Ayrshire breed of cattle was introduced into Galloway about the beginning of the century, and has risen rapidly in favor, being now the principal stock in West Galloway. Polled or Galloway cattle is a common breed in East Galloway, especially on inferior farms, and is still preferred for dairy purposes on many low country farms. The number of cows in 1881 was 12,071, of other cattle above two years of age, 14,002, and of cattle under two years of age 14,664. The number of cattle to every 100 acres under cultivation was 22.8, the average for Scotland being 23. Within recent years the increase in the number of cows has been very great, cheese-making, in which much progress has been made, now occupying the chief attention of the farmer. Cattle feeding is also largely practised, and for this purpose large quantities of lean cattle are imported from Ireland. Sheep in 1881 numbered 362,289, an average of 202.1 to every hundred acres under cultivation, the average for Scotland being 141.3. Blackfaced sheep are the most common on the high grounds, and even on the lower parts the Cheviot breed is decreasing, owing to the low price of wool. In some districts crosses of a Leicester tup with a blackfaced or Cheviot ewe are common. Pigs, which are kept principally on dairy farms, are generally fed on whey and Indian corn. In 1881 they numbered 5667.

The following table gives a classification of holdings according to size in 1875 and 1880:

	50 Acres and under.		From 50 to 100 Acres.		From 100 to 300 Acres.		From 300 to 500 Acres.		From 500 to 1000 Acres.		Above 1000 Acres.		Total.	
	No.	Acres.	No.	Acres.	No.	Acres.	No.	Acres.	No.	Acres.	No.	Acres.	No.	Acres.
1875	761	11,377	265	19,874	416	75,218	113	43,049	29	18,453	1	2,014	1,585	169,985
1880	775	11,458	254	19,481	451	82,601	120	45,699	25	15,844	1	2,022	1,626	177,105

In 1872–73 the land was divided among 2386 proprietors, and amounted to 571,950 acres, with a gross annual value of £360,960. Of the owners 1908, or 79 per cent., possessed less than 1 acre, and the average value was 12s. 8d. per acre. There were three proprietors who possessed upwards of 40,000 acres, viz., the earl of Galloway, 55,981; H. G. Murray Stewart, 45,367; and William Forbes, 40,445. Other eight possessed upwards of 10,000 acres.

Manufactures.—The principal ports are Kirkcudbright, Creetown, and Gatehouse. Linen, woollen, and cotton goods are manufactured in the towns and villages, and there are also breweries, distilleries, tanneries, and paper-mills. Shipbuilding is carried on to a small extent at Kirkcudbright. Lead is obtained at Woodhead and Minnigaff; there are extensive granite works at Dalbeattie and Creetown; and at Dalbeattie there are brick and tile works. Deep-sea fishing is prosecuted in the Solway, and salmon fisheries at the mouths of the rivers.

Railways.—A line from Dumfries to Castle Douglas is continued by Gatehouse and Creetown to Newton Stewart, and a branch line runs south from Castle Douglas to Kirkcudbright.

Administration.—The county includes twenty-eight parishes. Quarter sessions are held on the first Tuesday of March, May, and August, and the last Tuesday of October; and justice of peace small debt courts are held at Kirkcudbright, New Galloway, Castle Douglas, Maxwelltown, Gatehouse of Fleet, and Creebridge. The county forms a portion of the sheriffdom of Dumfries and Galloway. A sheriff court is held twice a week. A sheriff circuit small debt court is held at Castle Douglas, Maxwelltown, New Galloway, and Creetown, and a small debt court for the whole stewartry at Kirkcudbright. The county returns one member to parliament, and the burgh of Kirkcudbright unites with Annan, Dumfries, and Lochmaben in returning another, New Galloway uniting with Wigtown, Stranraer, and Whithorn in returning a third, while Maxwelltown, a portion of which is in the county, forms part of the burgh of Dumfries.

Population.—From 29,211 in 1801 the population gradually increased till it was 43,121 in 1851. Since then it decreased in 1861 to 42,495 and in 1871 to 41,859, but in 1881 it was 42,126 of whom 19,796 were males and 22,330 females. None of the towns exceed 3000 in population. Kirkcudbright, a royal and parliamentary burgh, has a population of 2571. New Galloway, Maxwelltown, Castle Douglas, Dalbeattie, and Gatehouse are police burghs. The principal villages are Auchencairn, Creetown, Crossmichael, Dalry, Haugh of Urr, Kirkpatrick-Durham, and New Abbey.

History and Antiquities.—Anciently Kirkcudbrightshire formed part of the kingdom of Strathclyde, being occupied partly by the Novantæ, who held the whole of Galloway westward from the Dee, and partly by the Selgovæ, whose territory stretched eastward from the Dee to Northumbria. One of the towns of the Selgovæ, Carbantorigum, in all probability occupied the site of the stronghold called the Moat of Urr. In 79 B.C. Agricola landed on the shores of the Solway Firth and overran Strathclyde, but the district was not completely subjugated by the Romans till the building of the wall of Severus in 208. Many traces of Roman camps are still to be seen, and a very perfect one exists at Pulcree in the parish of Anwoth. Some suppose that the important indications of human occupation in the caves on the coast were due to the fact that some of the inhabitants betook themselves to these during the Roman occupation (see "Accounts of the Exploration of the Borness Cave" in *Proc. Soc. Antiq. Scot.* 1874, 1875, 1877). The Pictish tribe which, according to Bede, inhabited Galloway in 608, is supposed by Skene to have been the original *Novantæ*,—a tribe, he thinks, of Gaedel or Gaelic Fichts who retained their independence because of the isolated position of the country. In the 7th century the region was invaded by the Angles, but their rule over it ceased about the end of the 8th century. In 740 Alpin, king of the Scots of Dalraida, was slain in battle, probably near the site of the present town of Kirkcudbright. The name Galloway, by which the country occupied by Kirkcudbright and Wigtownshire is now known, seems first to have been applied to it while it formed part of the Anglian kingdom of Northumbria, the word Galwetha being formed from Galwyddel, the Welsh equivalent of Gallgaidhel, the word meaning the Gaels under the dominion of foreigners. Of the ancient inhabitants of Galloway, there are in Kirkcudbrightshire a large number of relics. In several of the lochs crannogs or lake dwellings, as well as canoes and a variety of implements and other remains, have been found. Druidical circles are very common, and among the numerous cairns may be mentioned that of Drumlawhinnie, on the moor of Barclay in Minnigaff parish, which is 891 feet in circumference. Of the Pictish kilns there are several specimens in the parish of Minnigaff and in other places. The most notable old forts are a very ancient one on a sea-cliff near Borgue, an old Pictish tower at Rattra in the same parish, a circular fort with vitrified walls at Castle Gower, parish of Buittle, and others on the hill of Halfarne, Crossmichael; the hill of Dunguile, Kelton, and on Benarty hill. An old wall known as the Devil's dyke, supposed to have been built previous to the Roman invasion, passed through Galloway from Lochryan into Dumfriesshire. In the 9th century the district was invaded by the Danes, and so much harassed that many of the inhabitants emigrated to Wales. In the following century Galloway along with Strathclyde was subdued by Edmund and brought under the rule of Malcolm I. of Scotland. Some time in the 11th century it was subdued by the Danes and the Norwegians, but in the beginning of the 12th century they were overpowered by a Celtic chief Fergus, who founded a line of lords of Galloway, some of whom asserted their independence of the Scotch crown. The line became extinct in the male branch in 1234, after which Galloway was for some time under the rule of Edward I. of England. The lordship in the female line became divided between two families, one of whose representatives, John Baliol, laid claim to the crown of Scotland, but in 1308 the district was freed of the English and brought under allegiance to Robert Bruce, after which the lordship of Galloway was conferred upon Edward Bruce. Later in the 14th century Galloway again espoused the pretensions of the Baliols to the throne of Scotland, but the district was finally completely subjugated in 1353 by Sir William Douglas, whose descendant Archibald received from the crown in 1371–72 the lordship of Galloway. After the forfeiture of the estates of the Baliols, Kirkcudbright was placed under the immediate rule of the crown, and was governed by the royal steward, whence it has still the name of the "stewartry," but it appears that the stewardship was afterwards transferred to the Douglases, and was not restored to the crown until the forfeiture of their estates in 1455.

The principal old castles are Threave Castle on the Dee, the seat of the Douglases, for the reduction of which during the siege of 1455 it is said that the famous cannon Mons Meg was manufactured; Cardross Castle on the west side of the Fleet; and the castle of Kirkcudbright, which belonged to the lords of Galloway, and was frequently the residence of royalty.

The principal monastic buildings were the Cistercian abbey of Dundrennan, founded in 1142; Tongland Abbey, founded by the Premonstratensians under the auspices of Fergus, in the reign of David I.; the priory of St. Mary's Isle, founded also by Fergus, and subsequently united as a dependent cell to the abbey of Holyrood; the New Abbey founded for Cistercian monks, in 1275; the priory of Lincluden, founded by Uchtred, lord of Galloway, for Benedictine nuns; a convent for Franciscans or Greyfriars, founded at Kirkcudbright in the reign of Alexander II.; and a nunnery in the parish of Kirkcudbright.

See Symson, *A Large Description of Galloway*, 1684, new ed. 1823; Murray, *Literary History of Galloway*, 1822; and the *Histories of Galloway*, by Mackenzie, 1841, and Mackerlie, 1870–78.

KÍRKÍ, or Kirkee, a town and military cantonment in Poona district, Bombay, India, 18° 33′ N. lat., 73° 54′ E. long. The town with its adjoining suburbs and the military cantonments, contains a total population of upwards of 31,000 inhabitants.

KIRKINTILLOCH, a burgh of barony and market town of Dumbartonshire, Scotland, about 7 miles north of Glasgow. The town is rather irregularly built. The cruciform parish church dates from 1644. The Broomhill house for incurables is situated near the town. Traces of the wall of Antoninus are to be discerned behind the church. The inhabitants are chiefly employed in the chemical and iron-works on the banks of the Forth and Clyde Canal, and in coal-mining, which is being rapidly developed in the district. Weaving to a small extent is also carried on. Kirkintilloch became a burgh of barony by grant of William the Lion. Since 1871 it has been under the General Police Act of 1862. The population in 1881 was 10,582.

KIRK-KILISSIA, or Kirk-Kilisseh, a town in the vilayet of Adrianople, Turkey, is situated on a feeder of the Erkene, which is an affluent of the Maritza, about 35 miles east of Adrianople. It has its chief importance from its position at the southern outlet of the Fakhi defile over the Strandja mountains, through which passes the shortest road from Shumla to Constantinople. It contains six mosques, several Greek churches, and a large bazaar. A special kind of confection is made at Kirk-Kilissia; and a considerable quantity of butter and cheese is sent thence to Constantinople. The population is estimated at about 16,000.

KIRKWALL, a royal and parliamentary burgh of Scotland, and the chief town of the Orkney Islands, is situated near the centre of the island group at the southeast corner of a well-sheltered bay on the east side of the island of Pomona, 240 miles north of Edinburgh by steamer, 58 north of Wick, and 54 north of Thurso. It consists principally of an irregular street about a mile in length running along the margin of the bay, and so narrow that carts and similar vehicles in many places cannot pass each other. The houses are generally substantially built, with the gables facing the street nearly as frequently as the fronts. In courts leading from the main street there are many ancient buildings, formerly occupied during winter by the leading families of the islands. The more modern portion of the town is built with great regularity, and in the suburbs there are several good villas surrounded by gardens. The most prominent feature of the town is the cathedral, dedicated to St. Magnus, the patron saint of Orkney, a stately cruciform structure with a length of 226 feet from east to west and a breadth of 56 feet. It was founded by Earl Ronald in 1137, and the older portion, embracing the greater part of the present building, is in the Norman style of architecture. The choir was lengthened by Bishop Stewart in 1511, and the western extremity of the nave was completed by Bishop Reid, who succeeded to the bishopric in 1540. The building has undergone extensive repairs during the present century. The choir is used as the parish church. The bells were presented by Bishop Maxwell, the predecessor of Bishop Reid, but the larger or tenor bell was recast in 1862. The cathedral contains a number of old monuments. Adjoining it are the ruins of the bishop's palace, where King Haco died in 1263, and also the earl's palace, which after the forfeiture of the earl of Orkney was given to the bishops for their residence. There is a grammar school, which was endowed by Bishop Reid, and also several charitable institutions. The town has no manufactures of importance, and its prosperity depends chiefly on its being the capital and principal port of the islands. It is often touched by ships passing to Norway and the Baltic. The harbor is amply sufficient for the shipping of the port, and a fine iron pier was erected in 1867. There is regular steam communication with Lerwick, and with Leith by Aberdeen and Wick. Kirkwall (a name derived from *kirk*, church, and *vágr* or *vaag*, bay), was a place of some size when the islands were in the possession of the Norsemen, and by James III. it was created a royal burgh. It unites with the other burghs in the Wick district in returning a member to parliament. The population of the parliamentary burgh in 1881 was 3923.

KIRMÁN, the ancient Karmania, a province of South Persia, bounded on the east by Sistán and Balúchistán, on the W. by Farsistán, N. by Khórásán, on the S. by Láristán Makrán, and the strait of Ormuz. It is of very irregular shape, expanding in the north towards Khórásán, and gradually contracting in the south to the narrow coast district of Mogistan; the extreme length between Sistán and Fars east and west is 400 miles; the greatest breadth from south of Yezd to the coast at Bandar-Abbas is 300 miles; and the total area is estimated at 55,000 to 60,000 square miles. It is generally described as consisting of two parts, an uninhabitable desert region in the north, and a habitable mountainous region in the south. But the recent explorations of Khanikoff, Goldsmid, Lovett, St. John, and others, require this view to be considerably modified. There are mountains and desert tracts in all parts, while much of what appears on the maps as forming the western portion of the great Kirmán desert consists of the fertile upland plateau of the Kuh-Banán, stretching along the eastern base of the lofty range which runs from Yezd southeast to Khabís. West of and parallel to this range are two others, one culminating north of Bam in the Kuh-Hazár, 14,550 feet, the other continued at about the same elevation under the name of the Jamal Báris southeastwards to the Kohistán highlands on the Makrán frontier. These chains traverse the fertile Nurmanshahr district, dividing it into several longitudinal valleys of considerable length, but not averaging more than 12 miles in width. Snow lies on their slopes to a great depth for the better part of the year, feeding the springs and "karez" or underground irrigation rills, by means of which large tracts in this almost rainless region in summer are kept under cultivation. Still further west the Kuh-Dinár range is continued from Farsistán also in a southeasterly direction to the valley of the Mináb, which is the only river worthy of the name in the whole province.

Between the southwestern highlands and the Jamal Barís there is much arid and unproductive land. But the true desert of Kirmán lies mainly in the north and northeast, where it merges northward in the desert of Lut,[1] which stretches far into Khórásán. These southern deserts differ from the Great Kavír, or Salt Desert of North Khórásán, mainly in three respects: they are far less saline, are more sandy and drier, and present in some places tracts of from 80 to 100 miles almost absolutely destitute of vegetation. Yet they are crossed by a well-known track running from Kirmán northeastward to Herát, which is traversed by couriers at great risk in about eighteen days. It appears from recent observation that these sandy wastes are continually encroaching on the fertile districts, and this is the case even in Nurmanshahr, which is being invaded by the sands of the desolate plains stretching thence westward to Bam. There are also some "kafeh" or salt swamps, answering to the kavír of Khórásán, but occurring only in isolated depressions, and nowhere of any great extent. The desert of Kirmán lies about 500 or 600 feet above the sea, apparently on nearly the same level as the desert of Lut, from which it cannot be geographically separated.

The climate, which varies much with the relief of the land, has the reputation of being the most unhealthy in Persia, the fever-stricken districts of the Caspian alone excepted. The cool air from the snowy ranges is usually attended by chills and agues, so that the people on the whole prefer the sultry heat of the plains. Still some of the sheltered upland valleys in Nurmanshahr and elsewhere enjoy a genial climate like that of Shíráz.

The chief products are cotton, wheat, barley, gums, dates of almost unrivalled flavor from Mogistan, and wool both of sheep and goats (*kurk*) noted for its extreme softness. This wool is used in the manufacture of the Kirmán shawls, which yield in delicacy of texture only to those of Kashmír, while often surpassing them in design, color, and finish. A shawl of the finer quality, 3 yards long, is sold on the spot for from £20 to £24. Spinning and dyeing are also practised, so that the province completes the manufacture of its own raw material. Its carpets and felts are also unsurpassed for richness of texture and durability. Besides these woven goods it exports mainly cotton, grain, and dates, receiving in return from India chintzes, muslins, indigo, tea, gold-cloth, china, glass, sugar; from Turkestan madder, rhubarb, drugs, gums, furs, silks, Bokhara furs, steel, copper, tea. Bandar-Abbas is the natural outport; but, since shipping has shown a preference for Bushire further north, the trade of Kirmán has greatly fallen off.

The inhabitants, numbering altogether about 500,000, consist of Tajiks in the towns and agricultural districts, some Túrki, Rind, and Balúchi nomads in the east and southeast, and numerous Kúrd tribes, here called Leks. Shiel gives a list (incomplete) of twenty-one of these Lek tribes, dwelling partly in houses, partly in tents and numbering altogether about 200,000 souls.

The chief towns are Kirmán (the capital), Regan, Kruk, Kúm, Bam, Khabís, Khánú, and Bandar-Abbas.

KIRMÁNSHÁHÁN, or KERMANSHAH (Arabic, *Karmísín*), a town and district of West Persia, lying between Ardelán and Lúristán north and south. The town is the chief place in what is known as Persian Kúrdistán, an expression, however, which has no administrative significance. It lies in 34° 18′ N. lat., and 46° 37′ E. long., on a rising ground connected with the Zagros hills, which stretch southeastward to the Bakhtiari range. Here it occupies an important strategical position near the right bank of the river Kernah, 250 miles southwest of Tehrán, 262 northwest of Ispahán, 220 northeast of Baghdad, and 280 south of Tabríz. Although surrounded by fortifications with five gates and 3 miles in circuit, it is now practically an open town, for the walls are in ruins and the moat choked with rubbish. During Muhammad Ali Mirza's administration it was a very flourishing place, with a population of 35,000 and a large local and transit trade between Baghdad and Tehrán. Since then it has suffered more than most towns in Persia from misgovernment, under which its few buildings have gone to decay, its bazaars have become empty, and its trade reduced to a local traffic in the excellent fruits produced in the surrounding gardens and orchards. The rich and beautiful carpets and rugs for which it was formerly noted are no longer to be had, and the population has fallen to about 12,000, exclusive of a garrison of 5000 usually maintained at this important frontier station.

Kirmánsháhán is governed by a royal prince, with jurisdiction over the district, which occupies an extensive tract between Mount Elwend and the Turkish border. Here the plains are well watered and very fertile, while the hills are covered with rich pastures which support large flocks of sheep and goats, besides horses of a good breed crossed with Arab blood. About 70,000 sheep are yearly taken to Tehrán by the Kúrd shepherds, who form the vast majority of the inhabitants of the district, residing some in houses some in tents, and numbering altogether about 180,000.

KIRRIEMUIR, a burgh of barony and market-town of Forfarshire, Scotland, is beautifully situated on an eminence, above the glen through which the Gairie flows. It lies about 5 miles northwest of Forfar, and about 62 miles north of Edinburgh. The town, consisting of several narrow diverging streets, is tolerably well built. Its educational advantages are good; by the Henry bequest a number of boys are maintained at the public school; and by the Webster bequest a school has been endowed and erected. The special industry of the town is linen-weaving, for which large power-loom factories have recently been built. The population in 1881 was 6588.

KIRSANOFF, a town of Russia, in the government of Tamboff, 61 miles east of the government town, near the junction of the Pursavka with the Vorona, with a station on the railway between Saratoff and Kozloff. The population, which increased from 5699 in 1862 to 7200 in 1872, is mainly engaged in agriculture and trade, the only manufactures of importance being those of wax and tallow. There is a nunnery with nearly one hundred nuns in the town. Kirsanoff owes its origin to the opening of iron-works in 1733. It became a district town in 1779.

KISFALUDY, KÁROLY or CHARLES (1788–1830), one of the most genial, prolific, and gifted poets of Hungary, and especially celebrated as the regenerator of the national drama, was born on the 6th of February, 1788, at Tét, in the county of Győr. His birth cost his mother her life, which unfortunate circumstance preyed upon the father's mind and caused him to view the child with feelings akin to aversion. The austerity of his father and the loss of his mother were, however, in a great measure made amends for to Károly by the love of his elder sister Teréz, who tended him during his early years with maternal care, and remained devoted to him through his whole life. In 1799 he was sent to the gymnasium at Győr (Raab), where he made only moderate progress in his studies, whilst the impetuosity of his disposition often involved him in trouble. Placed as a cadet in Duke Eszterházy's regiment in 1804, he saw a good deal of service, rising to the rank of captain. In 1811 he quitted the army with the intention of marrying. Offended at this step, his father withdrew from him all support, and his affianced bride rejected him upon finding him at variance with his father. His sister, then the wife of Captain Gábor Farkas, offered him an asylum in her home, where he remained during the winter of 1811–12; but, unwilling to eat the bread of dependence, Károly removed to Pest and afterwards to Vienna, where he tried to live by his skill in painting. He at this time began assiduously to study the works of Shakespeare, Schiller, and Lessing, became a frequent visitor at the Vienna theatre, and made the acquaintance of its official poet Theodore Körner, whose drama *Zrinyi* was written at Kisfaludy's suggestion. Rendered impatient by ill success, he soon left Vienna, and for over four years wandered, mostly on foot, through Germany, Switzerland, France, and Italy as far as Rome, obtaining as before a precarious livelihood as an artist. At length subdued by misfortune, and longing for his home and a more honorable career, he in 1817 sought by the aid of his sister reconciliation with his father, who, though still hard to be entreated, allowed him a slight pecuniary assistance. Although not without friends at Pest, where he now took up his abode, he continued to support himself by his brush until the spring of 1819. It was on the 3d of May in this year that the successful performance at Pest of his national drama, in five acts, *The Tatars in Hungary*, placed the name of Károly Kisfaludy on the roll of literary fame. It was rapidly followed by other dramas, all of which met with popular favor. Not only was he now admired by his own countrymen, but by means of the German translations of Gaal in the *Theater der Magyaren* (Brünn, 1820) he soon became known abroad. Freed from pecuniary embarrassment, Károly Kisfaludy was now able to devote his best energies to literature, poetry, and the drama. In 1822 he started an annual under the name of *Aurora*, which he continued to edit until the year of his death. Although its success was great and his popularity continued to increase, he became ever more and more critical with regard to his own productions; and if his earlier pieces must be regarded rather as the outcome of natural talent than as the result of matured consideration, his latter productions bear evidence to the high culture of his mental powers. In recognition of his exceptional literary merit, he was in 1826 rewarded with the prize of the Marczibányi foundation; about this time also he came into possession of the estate at Tét through the death of his father. Towards the close of 1829 his health began to fail, and, though he rallied for a time, consumption, accelerated by the news of his sister's death, brought his career to a close on the 21st November, 1830, at the early age of forty-two, while his friends were rejoicing at the tidings of his election as a member of the Hungarian academy of sciences. The first edition of his collected works was published by Toldy in 10 vols. (Buda, 1831). To the *Kisfaludy Károly élete*, prefixed to the Pest edition of 1872, we are indebted for many of the foregoing particulars.

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[1] The term *lut* means simply arid, waterless, and has nothing to do with the Lot of Holy Writ, as some have supposed.

KISFALUDY, Sándor or Alexander (1772–1844), elder brother of Károly Kisfaludy, whom he excels as a lyric poet though not as a dramatist, was born on the 27th of September, 1772, at Sümeg in the county of Zala, Hungary. Choosing the career of a soldier, he entered the army in 1793, and was soon appointed to a lieutenancy in the Hungarian life guards at Vienna. There he employed his spare time in literary pursuits, and especially in the study of Italian poets. Upon the death of his patron Prince Anton Eszterházy, Kisfaludy was sent back to Hungary. Soon after this, at a vintage festival in Badacsony, he made the acquaintance of Rozalia Szegedy, whom, notwithstanding a subsequent long estrangement, he eventually married, and who under the name of Liza is the subject of his *Himfy*. During the Italian campaign of 1796 Kisfaludy was stationed at Milan, and upon the surrender of that city he was sent as a prisoner of war to Vaucluse, where he began to write the series of love sonnets for which he afterwards became so famous, and which were suggested to his mind by the songs of Petrarch. After his release at the peace of Campo Formio (17th October, 1797), Kisfaludy was posted as captain in a regiment quartered at Würtemberg, and in 1799 he took part in the battles of Stockach, Winterthur, and Zürich. In 1800 he left the army, and stayed for five years at Kám in the county of Vas, subsequently removing to his native place, Sümeg, where he devoted himself to agricultural and literary pursuits. By this time Kisfaludy had gained the highest reputation as a lyric poet by his *Loves of Himfy*, the first part of which, published anonymously at Buda in 1801, was received with such applause as had never before been accorded to any Magyar work. The second part appeared under his own name in 1807. On the "insurrectio," or general rising of the Hungarian nobles against Napoleon, in 1809, Kisfaludy accepted the post of major of cavalry, and was also nominated by the palatine one of his adjutants. After his return to private life Kisfaludy wrote several dramatic pieces, and from 1820 contributed largely to his brother's annual *Aurora*. In 1818 he gained the Marczibányi prize for his *Ballads* (2d edition, Buda, 1818), which work was translated into German by Gaal (Vienna, 1820); and in 1831 he was elected member of the Hungarian academy of sciences, in the formation of which he had taken an active part. He died on the 28th of October, 1844, at the age of seventy-two. His collective works, in 6 vols., were published at Pest in 1847 by Toldy. Exquisite metrical English renderings of several verses from the *Himfy* will be found in Sir John Bowring's *Poetry of the Magyars* (London, 1830).

See J. Ferenczy, *Magyar Irók. Életrajz-Gyüjtemény*, Pest, 1856.

KÍSH, or Kais (the first form is Persian and the second Arabic), an island in the Persian Gulf, which rose to importance in the 12th and 13th centuries, and flourished on the fall of Síráf as a chief station of the Indian trade with the West. Edrísí in the 12th century describes it as the capital of a pirate chief who had acquired great wealth and power, and ravaged the coasts far and wide. He also drew a tribute from the pearl fisheries of the gulf. In the following century Yákút describes it from personal observation as a beautiful and flourishing island, the seat of the lord of 'Omán, sovereign of those seas, and the station for ships trading between India and Fársistán. The lord of Kísh was respected even in India for his wealth and maritime power. According to Ibn el Athír he was at constant war with the sovereign of Hormuz, and the rise of the latter port seems to have been fatal to the importance of Kísh (Ibn Batuta, i. 244, and note in Paris edition; Kazwíní, ed. Wüstenf., ii. 161). The island is generally identified with the modern Kenn and the Kataia of Arrian. See Vincent, *Voyage de Néarque*; Ouseley's *Travels*, i. 169 *sq.*

KISHANGARH, or Krishnagarh, a native state in Rájputána, India, lying between 26° 17′ and 26° 59′ N. lat., 74° 43′ and 75° 13′ E. long., with an area of about 724 square miles, and an estimated population of 105,000. It was founded in the reign of the emperor Akbar, by a younger son of the rájá of Jodhpur. In 1818 Kishangarh first came into direct relations with the British Government, by entering into a treaty together with the other Rájput states, having for its object the suppression of the Pindári marauders by whom the country was at that time overrun. The estimated revenue in 1875 was £30,000.

KISHINEFF, the Kishlanow of the Moldavians, a town of Russia, capital of the province of Bessarabia, on the right bank of the Byk, a tributary of the Dniester, situated on the railway between Odessa and Jassy in Roumania, 118 miles northwest from the former. At the beginning of this century it was but a poor village, and in 1812, when it was acquired by Russia from Moldavia, it had but 7000 inhabitants; twenty years later its population numbered 35,000, while in

1862 it had, with suburbs, 92,000 inhabitants, and now its population is more than 110,000, composed of the most varied nationalities—Moldavians, Wallachs, Russians, Jews, Bulgarians, Tartars, Germans, and Tsigans. The town consists of two parts—the old or lower town, on the banks of the Byk, and the new or high town, situated on high crags, 450 to 500 feet above the level of the river. The wide suburbs are remarkable for their gardens, which occupy about 12,000 acres, and produce great quantities of fruits (especially plums, which are dried and exported), tobacco, and wine. The buildings of the town are, however, very plain, and the streets remain mostly unpaved. Kishineff is the seat of the archbishop of Bessarabia, and has an ecclesiastical seminary with 800 students, a college, and several secondary and primary schools. There are several tallow-melting houses, steam flour-mills, candle and soap works, distilleries, and tobacco factories. The trade is very active and yearly becomes more important, Kishineff being now a centre for the whole Bessarabian trade in grain, wine, tobacco, tallow, wool, and skins, exported to Austria and to Odessa. The fairs, which are held twice a week, are very animated, and their yearly return is estimated at £300,000. The town played an important part in the late war between Russia and Turkey, as the chief centre of the Russian invasion.

KISHM, or Ṭawílah (*i.e.*, Long Island), an island at the mouth of the Persian Gulf, separated from the coast of the Persian province of Kirmán by Clarence Strait, which at its narrowest point has a breadth of less than 2 miles. The island has a length of about 55 miles, its main axis running northeast and southwest; and the area is estimated at 640 square miles. A range of hills from 300 to 600 feet in height, and with strongly marked escarpments, runs nearly parallel to the southern coast; they are largely composed, like those of Hormuz and the neighboring mainland, of rock salt, which is regularly excavated in one or two places, and forms one of the chief products of the island, finding its way first to Muscat and thence to India and Africa. The rest of the island consists of sandstones and marls. In its general aspect it is parched and barren-looking, like the south of Persia, but it contains fertile portions which produce grain, dates, grapes, melons, etc. Naphtha springs exist near the village of Saluk on the south coast. Kishm, the largest of the towns, lies at the eastern extremity of the island; Bassidore, the next in importance, at the western extremity; and Láfit (Luft, Leit) about midway along the northern coast. The town of Leit was reduced by a British fleet in 1809. Politically the island belongs to Persia, but the shah has long farmed it to the sultan of Muscat. The inhabitants are reckoned at 5000 or 6000.

Kishm is the ancient Oaracta, or Uorochtha, a name said to survive in a village called Brokt. The old Arabic word is Barkáwán or Bany-Káwán. Mas'udy (ch. x.), who mentions its capture by 'Amr ibn el 'Áṣ, says that it also bore the name of Láfit.

See Wellsted's *Travels to the City of the Caliphs*, 1840, vol. i. p. 65 *sq.*; Pelly, in *Journ. Roy. Geog. Soc.*, 1864; Sprenger, *Alte Geog. Arabiens*, p. 119 *sq.*; and Ouseley's *Travels*, i. 162.

KISSINGEN, the chief town of a department in the government district of Lower Franconia and Aschaffenburg, Bavaria, is situated on the Franconian Saale, 656 feet above sea-level, and about 62 miles east of Frankfort-on-the-Main. Its streets are regular, and its houses attractive. A stone bridge spans the Saale at the town. It has a local court, a commercial school, a theatre, and various benevolent institutions, besides all the usual buildings for the lodging, cure, and amusement of the 10,000 annual visitors who are attracted to this the most popular watering-place in Bavaria. In the Kurgarten, a tree-shaded expanse between the Kurhaus and the handsome colonnaded Conversations-Saal, are the three principal springs, Rakoczi, Pandur, and Maxbrunnen, of which the first two, strongly impregnated with iron and salt, have a temperature of 51.26° Fahr.; and the last (50.72°), is like Selters or Seltzer water. At short distances from the town are the intermittent artesian spring Soolensprudel, the Schonbörnsprudel, and the Theresienquelle; and in the same valley as Kissingen are the minor spas of Bocklet and Brückenau. The waters of Kissingen are prescribed for both internal and external use in a great variety of diseases, such as chronic catarrh, rheumatism, scrofula, affections of the bowels, of the lungs, and also of the eyes and ears. They are all highly charged with salt, and productive government saltworks were at one time stationed near Kissingen. The manufactures of the town, chiefly carriages and furniture, are unimportant. The population in 1875 was 3471.

The salt springs were known in the 9th century, and their medicinal properties were recognized in the 16th, but it was only within the first half of the 19th century that Kissingen became a popular resort. On July 10, 1866, the Prussians defeated the Bavarians with great slaughter near Kissingen. The town was the scene of the attempted assassination of Prince Bismarck by Kullman, July 13, 1874.

KISTNA, or Krishna, a district in the Madras Presidency, India, lying between 15° 35′ and 17° 10′ N. lat., and between 79° 14′ and 81° 34′ E. long., and bounded on the N. by Godávari, on the E. by the Bay of Bengal, on the S. by Nellore, and on the W. by the Nizám's Dominions and Karnúl. Kistna is, speaking generally, a flat country, but the interior is broken by a few low hills, the highest being 1857 feet above sea-level. The principal rivers are the Kistna, which cuts the district into two portions known as the Masulipatam and Gantúr divisions, and the Munyeru, Paleru, and Naguleru (tributaries of the Gundlakamma and the Kistna); the last only is navigable. The Kolar Lake, which covers an area of 21 by 14 miles, and the Romparu swamp are natural receptacles for the drainage on the north and south sides of the Kistna respectively. Iron and copper exist, and at one time the mines were worked; but the smelting of copper is now a thing of the past, and that of iron is also dying out. Diamond mines are still worked, to a very slight extent, in five villages belonging to the nizám; and at other places there are traces of mines which were abandoned long ago. Garnets and small rubies are also found. There are no forests in the district. Every variety of the game birds of India, except the pheasant, woodcock, and hill partridge, abounds. The most deadly of poisonous snakes, the Russell viper, is common about Masulipatam. The cobra, carpet snake, and one kind of *bangaras* (*Arcuatus*) are also met with.

The census of 1871 returned the population of Kistna district at 1,452,374 (1,373,089 Hindus, 78,937 Mohammedans, 90 Europeans, 218 Eurasians, and 36 "others"). As a whole the people are poor, except in the fertile Godávari delta. The cultivated area, exclusive of *samíndári* estates, in 1875–76, was returned at 1,907,213 acres, cultivable but not under tillage 981,377 acres, and waste 1,215,853 acres. The principal agricultural products are rice, maize, *rági*, pulses, hemp, flax, cotton, tobacco, gingelly, oil-seeds, chilies, wheat, garlic, indigo. The delta is irrigated by the Kistna river, which in 1875 watered 218,029 acres. A considerable trade is carried on in dressed hides at Bezwára. The inland villages carry on weaving from native hand-made cotton or silk thread. The chief exports are cotton and indigo. The total revenue in 1870–71 amounted to £548,469, of which £359,172 was derived from the land. The number of cultivators' holdings in 1871 was 137,880, owned by 169,036 proprietors or coparceners.

The early history of Kistna is inseparable from that of the northern Circars and Godávari district. Dharánikotá and the adjacent town of Amarávati were the seats of early Hindu and Buddhist Governments; and the more modern Rájámahendri (Rajahmundry) owed its importance to later dynasties. The Chalukyas here gave place to the Ganapatis, who in turn were ousted by the Reddi chiefs, who flourished during the 14th century, and built the forts of Bellamkondá, Kondavír, and Kondapallí. On the death of one of these, at the commencement of the 15th century, Deva Ráyalu, of the Vijayanagar dynasty, seized the country and held it until Mohammed II. (1463–86), a Moslem king of the Báhmani line, wrested this portion of his kingdom from him. The power of the Báhmani dynasty failed towards the end of the 15th century. Kulí Kutab Sháh became king of Golconda about 1512 A.D., and his kingdom included the whole of what is now the Masulipatam portion of Kistna district. On the other side of the Kistna, Narasinha Deva Ráyalu ruled at this time. His territory, which included Gantúr, was annexed to Golconda by Kutab Sháh's great-grandson, about 1600. This line of kings ended with Tanisha, who was dethroned by Aurangzeb in 1687. Meantime the English had, in 1622, established a small factory at Masulipatam, where they traded with varying fortune till 1750, when the French took possession of it. From 1759, when it was recaptured by Colonel Forde, with a force sent by Lord Clive from Calcutta, the power of the English in the greater part of the district was complete. In 1765 the entire administration was assumed by the Company; but the absolute right of sovereignty was not obtained until 1823.

KISTNA, or KRISHNA, a large river of Southern India, stretching almost across the entire peninsula from west to east. It rises near the Bombay sanatarium of Mahábaleshwar in the Western Gháts, only about 40 miles from the Arabian Sea. Its source is held sacred, and is frequented by pilgrims in large numbers. From Mahábaleshwar the Kistna runs southward in a rapid course into the Nizám's Dominions, then turns to the east, and ultimately falls into the sea by two principal mouths. Along this part of the coast runs an extensive strip of land, which has been entirely formed by the detritus washed down by the Kistna and Godávari. The river channel is throughout too rocky and the stream too rapid to allow even of small native craft. In utility for irrigation the Kistna is also inferior to its two sister streams, the Godávari and Káveri (Cauvery). By far the greatest of its irrigation works is the Bezwára anicut, commenced in 1852. Bezwára is a small town at the entrance of the gorge by which the Kistna bursts through the Eastern Gháts, and immediately spreads over the alluvial plain. The channel there is 1300 yards wide. During the dry season the depth of water is barely 6 feet, but sometimes it rises to as much as 36 feet, the maximum flood discharge being calculated at 1,188,000 cubic feet per second. Of the two main canals connected with the dam, that on the left bank breaks into two branches, the one running 39 miles to Ellore, the other 49 miles to Masulipatam. The canal on the right bank proceeds nearly parallel to the river, and also sends off two principal branches, to Nizámpatam and Comamur. The total length of the main channel is 254 miles, and the total irrigated area 225,000 acres, yielding a revenue of £89,000.

KIT-CAT-CLUB, a convivial association of Whig wits, painters, politicians, and men of letters, founded in the reign of James II. The name, according to Defoe, was derived from the keeper of the house in which the club met, Christopher Catt, a pastry cook in Shire Lane, which now no longer exists, but formerly ran parallel with Chancery Lane near Temple Bar. The pies of Christopher were the principal dish of the club, and the *Spectator* (No. 9) derives the name not from the maker of the pies, but from the pies themselves, which were of a species generally known as "kit-cats." According to another authority, the meeting-place of the club was at the sign of the Cat and Fiddle in Gray's Inn Lane, kept by a person of the name of Christopher. The locale of the club was afterwards changed to the Fountain tavern in the Strand, and latterly to a room specially built for the purpose at Barn Elms, the residence of the secretary, Jacob Tonson. In summer the club met at the Upper Flask, Hampstead Heath. The club consisted of thirty-nine noblemen and gentlemen, and included among other distinguished men the duke of Marlborough, Lords Halifax and Somers, Sir Robert Walpole, Vanbrugh, Congreve, Steele, and Addison. The portraits of many of the members were painted by Sir Godfrey Kneller, himself also a member, of a uniform size, less than half length, which is known as the kit-cat size. The club was dissolved about 1720.

KITE,[1] Anglo-Saxon *Cyta*, the *Falco milvus* of Linnæus and *Milvus ictinus* of modern ornithologists, once perhaps the most familiar bird of prey in Great Britain, and now one of the rarest. Three or four hundred years ago foreigners were struck with its abundance in the streets of London, and the evidence of two of them, one being the eminent naturalist Belon, has already been given (BIRDS, vol. iii. p. 638, note). It was doubtless the scavenger in ordinary of that and other large towns (as a kindred species now is in Eastern lands), except where its place was taken by the Raven; for Sir Thomas Browne (*circa* 1662) wrote of the latter at Norwich—"in good plentie about the citty which makes so few Kites to be seen hereabout." Wolley has well remarked of the modern Londoners that few "who see the paper toys hovering over the parks in fine days of summer, have any idea that the bird from which they derive their name used to float all day in hot weather high over the heads of their ancestors." Even at the beginning of the present century the

> "Kites that swim sublime
> In still repeated circles, screaming loud,"

formed a feature of many a rural landscape in England as they had done in the days of Cowper. But an evil time soon came upon the species. It must have been always hated by the henwife, but the resources of civilization in the shape of the gun and gin were denied to her. They were, however, employed with fatal zeal by the gamekeeper; for the Kite, which had long afforded the supremest sport to the falconer, was now left friendless,[2] and in a very few years it seems to have been exterminated throughout the greater part of England, certain woods in Huntingdonshire and Lincolnshire and in the Western Midlands, as well as Wales, excepted. In these latter a small remnant still exists; but the well-wishers of this beautiful species are naturally chary of giving information that might lead to its further persecution. In Scotland there is no reason to suppose that its numbers suffered much diminution until about 1835 or even later, when the systematic destruction of "vermin" on so many moors was begun. In that kingdom, however, it is now as much restricted to certain districts as in England or Wales, and those districts it would be most inexpedient to indicate.

The Kite is, according to its sex, from 25 to 27 inches in length, about one-half of which is made up by its deeply forked tail, capable of great expansion, and therefore a powerful rudder, enabling the bird while soaring on its wide wings, more than 5 feet in extent, to direct its circling course with scarcely a movement that is apparent to the spectator below. Its general color is pale reddish-brown or cinnamon, the head being grayish-white, but almost each feather has the shaft dark. The tail-feathers are broad, of a light red, barred with deep brown, and furnish the salmon-fisher with one of the choicest materials of his "flies." The nest, nearly always built in the crotch of a large tree, is formed of sticks intermixed with many strange substances collected as chance may offer, but among them rags[1] seem always to have a place. The eggs, three or four in number, are of a dull white, spotted and blotched with several shades of brown, and often lilac. It is especially mentioned by old authors that in Great Britain the Kite was resident throughout the year; whereas on the Continent it is one of the most regular and marked migrants, stretching its wings towards the south in autumn, wintering in Africa, and returning in spring to the land of its birth.

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[1] *Glede*, cognate with glide, is also another English name.

[2] George, third earl of Orford, died in 1791, and Colonel Thornton, who with him had been the latest follower of this highest branch of the art of falconry, broke up his hawking establishment not many years after There is no evidence that the pursuit of the Kite was in this or any other country reserved to kings or privileged persons, but the taking of it was quite beyond the powers of the ordinary trained Falcons, and in older days practically became limited to those of the sovereign. Hence the Kite had attached to it, especially in France, the epithet of "royal," which has still survived in the specific appellation of *regalis* applied to it by many ornithologists. The scandalous work of Sir Antony Weldon (*Court and Character of King James*, p. 104) bears witness to the excellence of the Kite as a quarry in an amusing story of the "British Solomon," whose Master-Falconer, Sir Thomas Monson, being determined to outdo the performance of the French king's falconer, who, when sent to England to show sport, "could not kill one Kite, ours being more magnanimous than the French Kite," at last succeeded, after an outlay of £1000, in getting a cast of Hawks that took nine Kites running—"never missed one." On the strength of this, James was induced to witness a flight at Royston, "but the Kite went to such a mountee as all the field lost sight of Kite and Hawke and all, and neither Kite nor Hawke were either seen or heard of to this present."

There is a second European species, not distantly related, the *Milvus migrans* or *M. ater* of most authors,[2] smaller in size, with a general dull blackish-brown plumage and a less forked tail. In some districts this is much commoner than the red Kite, and on one occasion it has appeared in England. Its habits are very like those of the species already described, but it seems to be more addicted to fishing. Nearly allied to this Black Kite are the *M. ægyptius* of Africa, the *M. govinda* (the Pariah Kite of India),[3] the *M. melanotis* of Eastern Asia, and the *M. affinis* and *M. isurus;* the last is by some authors removed to another genus or sub-genus as *Lophoictinia*, and is peculiar to Australia, while *M. affinis* also occurs in Ceylon, Burmah, and some of the Malay countries as well. All these may be considered true Kites, while those next to be mentioned are more aberrant forms. First there is *Elanus*, the type of which is *E. cœruleus*, a beautiful little bird, the Black-winged Kite of English authors, that comes to the south of Europe from Africa, and has several congeners—*E. axillaris* and *E. scriptus* of Australia being most worthy of notice. An extreme development of this form is found in the African *Nauclerus riocourii*, as well as in *Elanoides furcatus*, the Swallow-tailed Kite, a widely-ranging bird in America, and remarkable for its length of wing and tail, which gives it a marvellous power of flight, and serves to explain the unquestionable fact of its having twice appeared in Great Britain. To *Elanus* also *Ictinia*, another American form, is allied, though perhaps more remotely, and it is represented by *I. mississippiensis*, the Mississippi Kite, which is by some considered to be but the northern race of the Neotropical *I. plumbea*. *Gampsonyx*, *Rostrhamus*, and *Cymindis*, all belonging to the Neotropical Region, complete the series of forms that seem to compose the subfamily *Milvinæ*, though there may be doubt about the last, and some systematists would thereto add the Perns or Honey-Buzzards, *Perninæ*. (A. N.)

KITTO, John (1804–1854), the author of various works connected with Biblical literature, was the son of a mason at Plymouth, where he was born December 4, 1804. In childhood he was weak and sickly, and he received only a very meagre school education; but his untoward and miserable circumstances did not prevent the growth of a passionate love of books and an eager thirst for learning. By a fall sustained while assisting his father in his trade he received severe general injuries and lost permanently the sense of hearing. No longer able to support himself by manual labor, he endeavored to do so by preparing rude drawings and colored cards in large capital letters, but at last in November, 1819, he found it necessary to seek refuge in the workhouse, where he was employed in making list shoes. In 1821 he was bound apprentice to a shoemaker in Plymouth, who, however, treated him with such oppressive tyranny that he appealed to the magistrates, and got his indenture cancelled, upon which he again obtained admission to the workhouse. Not long afterwards a fund was raised in his behalf, and in 1823 he was sent to board with the clerk of the guardians, having his time at his own disposal, and the privilege of making use of a public library. After preparing a small volume of miscellanies, which was published by subscription, he became a pupil of Mr. Groves, a dentist in Exeter, and in this art rapidly acquired proficiency. Through the same gentleman he in 1825 obtained more congenial employment in the printing office of the Church Missionary Society at Islington, from which he was after two years transferred to the same society's establishment at Malta. There he remained only six months, but shortly after his return to England he accompanied Mr. Groves in the capacity of tutor to his two sons on a Christian mission to Baghdad, where he obtained that personal knowledge of Oriental life and habits which he afterwards applied with such tact and skill in the illustration of Biblical scenes and incidents. On account of the ravages of the plague the missionary establishment was broken up, and in 1832 Kitto returned to England. On arriving in London he was engaged in the preparation of various serial publications of the Society for the Diffusion of Useful Knowledge, the most important of which were the *Pictorial History of Palestine* and the *Pictorial Bible*. Henceforth his life was one of congenial but incessant literary labor. The *Cyclopædia of Biblical Literature*, edited under his superintendence, appeared in two volumes, 1843–45, and has passed through three editions; and his *Daily Bible Illustrations* (8 vols., 1849–53) still retain a wide popularity among general readers. On the morning after he had finished the last volume of this work Kitto was seized with a paralytic stroke, and from that time he was incapacitated for literary work. In 1850 he had received an annuity of £100 from the royal civil list; and on his illness an additional fund was raised in his behalf. In the autumn of 1854 he removed with his family to Cannstatt on the Neckar, where on the 25th November he was seized with an attack which in a few hours proved fatal.

See Dr. Kitto's own work *The Lost Senses*, 1845; Ryland's *Memoirs of Kitto*, 1856; and Eadie's *Life of Kitto*, 1857.

KITZINGEN, a town in the government district of Lower Franconia and Aschaffenburg, Bavaria, is situated on the Main, 95 miles southeast of Frankfort by rail. A bridge, 950 yards long, connects it with its suburb Etwashausen on the left bank of the river. A railway bridge also spans the Main at this point. Kitzingen has walls and towers, an old church of the 15th century, a trade school and a grammar school, a town house, a hospital (since 1344), and two old convents. Breweries (with large export of beer), a steam-mill for grain, tan, and timber, and manufactories of casks, chocolate, etc., employ the inhabitants. Considerable trade in wine, fruit, grain, and timber is carried on by boats on the Main. The population in 1875 was 6393.

KIUNG-CHOU-FOO. See Hainan.

KIWI, or Kiwi-Kiwi, the Maori name—first apparently introduced to zoological literature by Lesson in 1828 (*Man. d'Ornithologie*, ii. p. 210, or *Voyage de la "Coquille" Zoologie*, p. 418), and now very generally adopted in English—of one of the most characteristic forms of New Zealand birds, the *Apteryx* of scientific writers. This remarkable bird was unknown till Shaw, as almost his latest labor, very fairly described and figured it in 1813 (*Nat. Miscellany*, pls. 1057, 1058), from a specimen brought to him from the southern coast of that country by Captain Barcley of the ship "Providence." At Shaw's death, in the same year, it passed into the possession of the then Lord Stanley, afterwards thirteenth Lord Derby, and president of the Zoological Society, and it is now with the rest of his collection in the Liverpool Museum.

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[1] Thus justifying the advice of Autolycus (*Winter's Tale*, act iv. sc. 3)—"When the Kite builds, look to lesser linen"—very necessary no doubt to the laundresses of former days when the bird commonly frequented their drying grounds.

[2] Mr. Sharpe (*Cat. Birds Brit. Museum*, i. p. 322) calls it *M. korschun;* but the figure of S. G. Gmelin's *Accipiter korschun*, whence the name is taken, unquestionably represents the Moor-Buzzard, *Circus æruginosus*.

[3] The Brahminy Kite of India, *Haliastur indus*, seems to be rather a fishing Eagle.

Kiwi.

Considering the state of systematic ornithology at the time, Shaw's assignment of a position to this new and strange bird, of which he had but the skin, does him great credit, for he said it seemed "to approach more nearly to the Struthious and Gallinaceous tribes than to any other." And his credit is still greater when we find the venerable Latham, who is said to have examined the specimen with Shaw, placing it some years later among the Penguins (*Gen. Hist. Birds*, x. p. 394), being apparently led to that conclusion through its functionless wings and the backward situation of its legs. In this false allocation Stephens also in 1826 acquiesced (*Gen. Zoology*, xiii. p. 70). Meanwhile in 1820 Temminck, who had never seen a specimen, had assorted it with the Dodo in an Order to which he applied the name of *Inertes* (*Man. d' Ornithologie*, i. p. cxiv.). In 1831 Lesson, who had previously (*loc. cit.*) made some blunders about it, placed it (*Traité d' Ornithologie*, p. 12), though only, as he says, "par analogie et *a priori*," in his first division of Birds, "Oiseaux Anomaux," which is equivalent to what we now call *Ratitæ*, making of it a separate Family "Nullipennes." At that time no second example was known, and some doubt was felt, especially on the Continent, as to the very existence of such a bird[1]—though Lesson had himself when in the Bay of Islands in April, 1824 (*Voy.* "*Coquille*," *ut supra*), heard of it; and a few years later Dumont d'Urville had seen its skin, which the naturalists of his expedition procured, worn as a tippet by a Maori chief at Tolaga Bay (Houa-houa),[2] and in 1830 gave what proves to be on the whole very accurate information concerning it (*Voy.* "*Astrolabe*," ii. p. 107). To put all suspicion at rest, Lord Derby sent his unique specimen for exhibition at a meeting of the Zoological Society, 12th February, 1833 (*Proc. Zool. Society*, 1833, p. 24), and a few months later (*tom. cit.*, p. 80) Yarrell communicated to that body a complete description of it, which was afterwards published in full with an excellent portrait (*Trans. Zool. Society*, i. p. 71, pl. 10). Herein the systematic place of the species, as akin to the Struthious birds, was placed beyond cavil, and the author called upon all interested in zoology to aid in further research as to this singular form. In consequence of this appeal a legless skin was within two years sent to the society (*Proceedings*, 1835, p. 61) obtained by Mr. W. Yate of Waimate, who said it was the second he had seen, and that he had kept the bird alive for nearly a fortnight, while in less than another couple of years additional information (*op. cit.*, 1837, p. 24) came from Mr. T. K. Short to the effect that he had seen two living, and that all Yarrell had said was substantially correct, except underrating its progressive powers. Not long afterwards Lord Derby received and in March, 1838, transmitted to the same society the trunk and viscera of an *Apteryx*, which, being intrusted to Professor Owen, furnished that eminent anatomist, in conjunction with other specimens of the same kind received from Drs. Lyon and George Bennett, with the materials of the masterly monograph laid before the society in instalments, and ultimately printed in its *Transactions* (ii. p. 257, iii. p. 277). From this time the whole structure of the Kiwi has certainly been far better known than that of nearly any other bird, and by degrees other examples found their way to England, some of which were distributed to the various museums of the Continent and of America.[3]

In 1847 much interest was excited by the reported discovery of another species of the genus (*Proceedings*, 1847, p. 51), and though the story was not confirmed, a second species was really soon after made known by Gould (*tom. cit.*, p. 93; *Transactions*, iii. p. 379, pl. 57), under the name of *Apteryx oweni*—a just tribute to the great master who had so minutely explained the anatomy of the group. Three years later Mr. Bartlett drew attention to the manifest difference existing among certain examples, all of which had hitherto been regarded as specimens of *A. australis*, and the examination of a large series led him to conclude that under that name two distinct species were confounded. To the second of these, the third of the genus (according to his views), he gave the name of *A. mantelli* (*Proceedings*, 1850, p. 274), and it soon turned out that to this new form the majority of the specimens already obtained belonged. In 1851 the first Kiwi known to have reached England alive was presented to the Zoological Society by Mr. Eyre, then lieutenant-governor of New Zealand. This was found to belong to the newly described *A. mantelli*, and some careful observations on its habits in captivity were published by Wolley and another (*Zoologist*, pp. 3409, 3605).[4] Subsequently the society has received several other live examples of this form, besides one of the real *A. australis* (*Proceedings*, 1872, p. 861), some of *A. oweni*, and one of a supposed fourth species, *A. haasti*, characterized in 1871 by Mr. Potts (*Ibis*, 1872, p. 35; *Trans. N. Zeal. Institute*, iv. p. 204; v. p. 195).[5]

The Kiwis form a group of the Subclass *Ratitæ* to which the rank of an Order may fitly be assigned, as they differ in many important particulars from any of the other existing forms of Ratite birds. The most obvious feature the *Apteryges* afford is the presence of a back toe, while the extremely aborted condition of the wings, the position of the nostrils—almost at the tip of the maxilla—and the absence of an after-shaft in the feathers, are characters nearly as manifest, and others not less determinative though more recondite will be found on examination. The Kiwis are peculiar to New Zealand, and it is believed that *A. mantelli* is the representative in the North Island of the southern *A. australis*, both being of a dark reddish-brown, longitudinally striped with light yellowish-brown, while *A. oweni*, of a light grayish-brown transversely barred with black, is said to occur in both islands. About the size of a large domestic fowl, they are birds of nocturnal habit, sleeping, or at least inactive, by day, feeding mostly on earth-worms, but occasionally swallowing berries, though in captivity they will eat flesh suitably minced. Mr. Buller writes (*B. New Zealand*, p. 362):

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[1] Cuvier in the second edition of his *Règne Animal* only referred to it in a footnote (i. p. 498).

[2] Cruise in 1822 (*Journ. Residence in New Zealand*, p. 313) had spoken of an "Emeu" found in that island, which must of course have been an *Apteryx*.

[3] In 1842, according to Broderip (*Penny Cyclopædia*, xxiii. p. 146), two had been presented to the Zoological Society by the New Zealand Company, and two more obtained by Lord Derby, one of which he had given to Gould. In 1844 the British Museum possessed three, and the sale catalogue of the Rivoli Collection, which passed in 1846 to the Academy of Natural Sciences at Philadelphia, includes a single specimen—probably the first taken to America.

[4] This bird in 1859 laid an egg, and afterwards continued to lay one or two more every year. In 1865 a male of the same species was introduced, but though a strong disposition to breed was shown on the part of both, and the eggs, after the custom of the *Ratitæ*, were incubated by him, no progeny was hatched (*Proceedings*, 1868, p. 329).

[5] A fine series of figures of all these supposed species is given by Rowley (*Orn. Miscellany*, i. pls. 1-6). Some others, as *A. maxima*, *A. mollis*, and *A. fusca* have also been indicated, but proof of their validity has yet to be adduced.

> "The Kiwi is in some measure compensated for the absence of wings by its swiftness of foot. When running it makes wide strides and carries the body in an oblique position, with the neck stretched to its full extent and inclined forward. In the twilight it moves about cautiously and as noiselessly as a rat, to which, indeed, at this time it bears some outward resemblance. In a quiescent posture, the body generally assumes a perfectly rotund appearance; and it sometimes, but only rarely, supports itself by resting the point of its bill on the ground. It often yawns when disturbed in the daytime, gaping its mandibles in a very grotesque manner. When provoked it erects the body, and, raising the foot to the breast, strikes downward with considerable force and rapidity, thus using its sharp and powerful claws as weapons of defence. . . . While hunting for its food the bird makes a continual sniffing sound through the nostrils, which are placed at the extremity of the upper mandible. Whether it is guided as much by touch as by smell I cannot safely say; but it appears to me that both senses are used in the action. That the sense of touch is highly developed seems quite certain, because the bird, although it may not be audibly sniffing, will always first touch an object with the point of its bill, whether in the act of feeding or of surveying the ground; and when shut up in a cage or confined in a room it may be heard, all through the night, tapping softly at the walls. . . . It is interesting to watch the bird, in a state of freedom, foraging for worms, which constitute its principal food; it moves about with a slow action of the body, and the long, flexible bill is driven into the soft ground, generally home to the very root, and is either immediately withdrawn with a worm held at the extreme tip of the mandibles, or it is gently moved to and fro, by an action of the head and neck, the body of the bird being perfectly steady. It is amusing to observe the extreme care and deliberation with which the bird draws the worm from its hiding-place, coaxing it out as it were by degrees, instead of pulling roughly or breaking it. On getting the worm fairly out of the ground, it throws up its head with a jerk, and swallows it whole."

The foregoing extract refers to *A. mantelli*, but there is little doubt of the remarks being equally applicable to *A. australis*, and probably also to *A. oweni*, though the different proportion of the bill in the last points to some diversity in the mode of feeding. Did space allow, much more should be said of the Kiwis—perhaps to ornithologists the most interesting group of birds now existing, and the more interesting in regard to the melancholy doom of extinction which almost inevitably awaits them. (A. N.)

KIZLIAR, **Kizlyar**, or **Kizlar**, a town of Russia, in the government of Stavropol, 325 miles east of the government town, in the low-lying delta of the river Terek, about 35 miles from the shores of the Caspian. It lies to the left of the main stream between two of the larger secondary branches, and the whole is subject to flooding. The town proper, which spreads out round the citadel, has its Tartar, Georgian, and Armenian quarters; the Russians for the most part live in the soldiers' "sloboda" or village. Of the public buildings it is sufficient to mention the Greek cathedral, dating from 1786; the Greek nunnery of the Elevation of the Cross, founded by the Georgian chief Daniel in 1736; the Armenian church of SS. Peter and Paul, remarkable for its size and riches. The population, which has increased from 8309 in 1861 to 9176 in 1872, is mainly supported by the gardens and vineyards irrigated by canals fed by the river. A Government vineyard and school of viniculture are situated 3½ miles from the town. About 1,200,000 gallons of Kizliar wine are sold annually at the fair of Nizhni Novgorod. Kizliar is mentioned as early as 1616, but the most notable accession of inhabitants (Armenians, Georgians, and Persians) took place in 1715; and its importance as a fortress dates from 1736, when it received the garrison formerly stationed at Sv. Kresta, on the Sulak in Daghestan. In 1785 it was made a district town. The incursion of Kazni Mulla in 1821, and the inundation in 1863, are the chief facts of more recent note. The fortress is no longer kept in repair.

KLADNO, a mining town in the district of Smichov, Bohemia, lies about 15 miles west-northwest of Prague, with which it is connected by the Buschtierad line of railway. There are few buildings of special interest, and the importance of the town is mainly due to the wealth of its iron-mines and coal-fields, which afford employment for some three thousand men. The average annual yield of iron is from 25,000 to 30,000 tons, and of coal 300,000 tons. About 2 miles to the north is the imperial chateau of Buschtierad. Population in 1880, 14,085.

KLAGENFURT, capital of the duchy of Carinthia, Austria, and seat of the provincial administration, financial direction, and court of appeal, is situated upon a plain at an elevation of 1450 feet above the sea-level, and about 40 miles north-northwest of Laibach, with which, as with Vienna, Gratz, Innsbruck, and other centres, it is connected by railway, in 46° 37′ N. lat., 14° 19′ E. long. Klagenfurt is for the most part well and symmetrically built, and comprises an inner town quadrangular in form, and four suburbs—St. Veit (north), Viktring (south), Völkermarkt (east), and Villach (west), the last communicating with Lake Wörth by means of the Lend Canal. Among the more noteworthy edifices are the parish church of St. Ægidius (erected 1709), with a tower 298 feet in height; the cathedral of SS. Peter and Paul (1582–93, burnt 1723, restored 1725); the churches of the Benedictines (1613), of the Capuchins (1646), and of the order of St. Elizabeth (1710); and the fine structure standing in the Villach suburb, and belonging to the Protestant community. To these must be added the palace of the prince bishop of Gurk, originally built for the sisters of the emperor Joseph II., and containing in its chapel some fine fresco paintings completed in 1798 by the Carinthian artist Joseph von Pichler; the municipal hospital; the lunatic asylum; the *burg* or castle, existing in its present form since 1777; and the *Landhaus* or house of assembly, dating from the end of the 14th century, and containing a museum of natural history and the Klagenfurt Historical Society's library, and collection of minerals, antiquities, seals, paintings, and sculptures. The most interesting public monument is the great *Lindwurm* or Dragon, standing in the principal square (1590). Among the many educational establishments of Klagenfurt are an upper and lower gymnasium with public library; a theological seminary for priests; monastic and conventual houses; agricultural, industrial, technical, and mining schools; and an asylum for the instruction of the deaf and dumb. The industrial establishments comprise factories for the preparation of white lead, tobacco, woollen cloth, muslins, silk fabrics, and leather; also machine and iron foundries. Klagenfurt possesses, moreover, several banks, a chamber of industry and commerce, a central board of mining control, and a few scientific associations. The transit trade, which is considerable, owing to the wealth of the mineral products of the province, is much facilitated by the position of Klagenfurt at a junction of the Crown-Prince-Rudolph and Austrian Southern Railways. The civil population in 1880 was 16,592; with the military, it was 18,749.

Upon the Zollfeld to the north of the city once stood the ancient Roman town of Virunum. In the middle of the 7th century the surrounding country was overrun by the Avars. During the Middle Ages Klagenfurt became the property of the crown, but by a patent of Maximilian I. of the 24th of April, 1518, it was conceded to the Carinthian estates, and has since then taken the place of St. Veit as the capital of Carinthia. In 1535, 1636, 1723, and 1796 Klagenfurt suffered from destructive fires, and in 1690 from the effects of an earthquake. On March 29, 1797, the French took the city, and upon the following day it was occupied by Napoleon as his headquarters. The fortifications constructed in 1530 were destroyed by the French in 1809, and the ground that they formerly occupied is now laid out as a public promenade.

See Amthor und Jabornegg-Gamsenegg, *Kärntnerführer*, Gera, 1874; G. von Ankershofen, *Handbuch der Geschichte des Herzogthums Kärnten*, Klagenfurt, 1857-74, bd. i.-iv.; *Umgebungskarte von Klagenfurt*, Vienna, 1873.

KLAPROTH, Heinrich Julius von (1783–1835), one of the founders of Oriental scholarship in Europe, was born at Berlin, October 11, 1783. His father, Martin Heinrich Klaproth (1743–1817), not only desired him to pursue the chemical studies by which he had himself attained to position and fame, but did all in his power to frown away what he deemed a foolish attachment to a profitless subject. But the boy-philologist received from a more indulgent or wiser mother the means of secretly satisfying his natural instinct, and by the time that in ordinary course he ought to have passed the gymnasial examination he was able to retort, when upbraided with ignorance of the usual subjects, that at least he knew Chinese. He was still in his teens when he published his *Asiatisches Magazin* (Weimar, 1802); and immediately after he was called to St. Petersburg as an adjunct to the academy of Oriental languages. In 1805 he accompanied Count Golowin's embassy to China; and though the travellers were stopped at the frontier, he had a splendid opportunity of becoming acquainted with the tribes and languages of Southern Asiatic Russia. On his return he was dispatched by the academy to the Caucasus for the purpose of ethnographical and linguistic exploration (1807–1808), and when this mission was completed he was employed for several years in connection with the academy's Oriental publications. In 1811 he came to Berlin; but in 1815 he settled in Paris, and in 1816 W. von Humboldt procured him from the king of Prussia the title and salary of professor of Asiatic languages and literature, with permission to remain in Paris as long as was requisite for the publication of his works. He died in that city August 23, 1835.

The principal feature of Klaproth's erudition was the vastness of the field which it embraced. To enormous industry he joined a somewhat reckless intellectual aggressiveness, and where more solid footing failed was ready to bridge the chasm by adventurous hypothesis. His great work *Asia polyglotta* (Paris, 1823, with *Sprachatlas*) not only served as a resumé of all that was known on the subject, but formed a new departure for the classification of the Eastern languages, more especially of the Russian empire. To a great extent, however, his work is now superseded. That he was sometimes not over-scrupulous in the use he made of his erudition is matter of more than suspicion. The *Itinerary of a Chinese Traveller*, which he published in 1821, a series of documents in the military archives of St. Petersburg purporting to be the travels of George Ludwig von ——, and a similar series obtained from him in the London Foreign Office, are all judged to be spurious; and the learning displayed in the forgery was possessed by no one but himself.

A list of Klaproth's works will be found in *Nouv. Journ. Asiat.*, vol. xvii., and in Quérard, *La France littéraire*, vol. vi. Compare M. C. Landresse's "Notice" in *Nouv. Journ. Asiat.*, 1835.

KLATTAU (Latin, *Clatovia;* Bohemian, *Klatovy*), chief town of a district of the same name in Bohemia, lies about 70 miles southwest of Prague, and on the railway between Pilsen and Eisenstein, in 49° 23′ N. lat., 13° 22′ E. long. Klattau has six churches, an upper gymnasium, two hospitals, a large steam brewery, and an old-fashioned town-hall dating from the 16th century, and containing in its tower a bell weighing over 5 tons. Population 8067.

Klattau was an ancient Bohemian fortress, and afterwards became a royal free town. In 1421 it was desolated by the Bohemian leader Ziska. Having refused to assist the emperor Ferdinand I., it was in 1546 deprived of many of its privileges. In 1620 it was taken by the emperor Maximilian. Until the early part of the 17th century it was a thriving place; but the depredations committed by the Swedes in 1641, 1645, and 1648, and the many conflagrations which from time to time ravaged it, so seriously affected the town that it has never recovered its former prosperity.

KLAUSENBURG, or **Clausenburg** (Hungarian, *Kolozsvár;* Latin, *Claudiopolis*), a royal free town of Hungary, the capital of the county of Kolozs, and also of the whole Transylvanian circle, is situated in a picturesque valley on the banks of the Little Szamos, and on the Hungarian eastern railway, 72 miles north-northwest of Hermannstadt, in 46° 44′ 8″ N. lat., 23° 34′ 51″ E. long. Klausenburg is the seat of a Unitarian bishop, of the superintendent of the Calvinists for the Transylvanian circle, of a royal court of justice, of a chamber of commerce, and of the county administration, as also the headquarters of the *honvéd* (militia) and regular infantry regiments of the military district. Klausenburg consists of an inner town (quadrangular in form, and divided into the old and new towns) and five suburbs now united with it in consequence of the removal of the old walls. With the exception of the old quarter, Klausenburg is generally well laid out, and contains many broad and fine streets, several of which diverge at right angles from the principal square or market-place, where stands a fine old Roman Catholic church, often described as a cathedral (Gothic style), dedicated to St. Michael, and founded by king Sigismond in the year 1414. Besides several other Roman Catholic, Calvinist, Lutheran, Unitarian, Greek Catholic, and Greek Orthodox churches, and a Jewish synagogue, Klausenburg comprises among its public edifices a national museum, county and town halls, a national theatre, several hospitals, a workhouse, and barracks. The educational establishments include the university (with four faculties, founded in 1872), the Unitarian college (with seminary), Calvinist and Roman Catholic upper gymnasia, training institutes, and many others. A special feature of Klausenburg is the large number of elegant private mansions belonging to the Transylvanian nobles who reside here during the winter months. The greater part of the town lies on the right bank of the river, while upon the other side is the so-called "Bridge Suburb" and the citadel. Klausenburg bears in general more the character of a seat of learning than of a business centre; but there are factories for the preparation of woollen and linen cloth, paper, tobacco, candles, and bone dust, as well as breweries, distilleries, oil mills, and beetroot sugar refineries; and furrying, and hat, cap, and boot making are largely carried on. The fairs are well attended, especially for the purchase of horses and prepared skins, dressed furs, felt goods, delf, and crockery ware. The chief agricultural products of the neighborhood are wheat, beetroot, and forage. On the more elevated portions of the communal lands are extensive vineyards and woods. At the end of 1880 the civil population amounted to 29,929 (with military it was 30,869); by far the greater majority were Magyars by nationality, the remainder being composed of Roumanians, Germans, Armenians, and Jews. Outside the town, upon the slope of the citadel hill, there is a Gypsy quarter.

Klausenburg is believed to occupy the site of a Roman settlement named *Claudia*, whence its modern Latin appellation of *Claudiopolis*. Colonized by Saxons in 1178, it then received its German name of *Klausenburg* from the old word *Klause*, signifying a "mountain pass." In 1443 Matthias Corvinus, king of Hungary, was born here. Subsequent to the defeat of the Hungarians by the Turks at Mohács (1526), Transylvania came under the protection of the Porte, and owing to the trade from the East passing through the principality to Dantsic, the prosperity of Klausenburg much increased. Between the years 1545 and 1570 large numbers of the Saxon population left the town in consequence of the introduction of Unitarian doctrines. In 1603 it fell into the hands of the usurper Moses Székely, but was soon regained by the imperialists under General Basta. In 1662 it was ineffectually besieged by the Transylvanian prince Michael Apaffi I., but two years later it came into his power. The burgh or citadel was erected between 1715–23, during the reign of King Charles III. (as emperor, Charles VI.). In 1798 the town was to a great extent destroyed by fire. As capital of Transylvania and the seat of the Transylvanian diets, Klausenburg from 1830–48 became the centre of the national movement in the grand principality;

and in December, 1848, it was taken and garrisoned by the Hungarians under the Polish General Bem. After the conclusion of the war it was degraded from its position as capital of Transylvania, and subordinated to Nagyszeben (Hermannstadt), but in 1861 it was reinstated in its former rank. The official name is *Kolozsvár*.

KLAUSTHAL, or Clausthal, in the circle of Zellerfeld and the district of Hildesheim, Prussia, is the chief town and mining centre of the Upper Harz. It is situated on a bleak plateau, 1860 feet above sea-level, and unites to form one town with Zellerfeld on the opposite bank of the Zellbach. The streets are broad, opportunity for improvement having been given by fires in 1844 and 1854; the houses are mostly of wood. Klausthal has a famous mining college, with a mineralogical museum, and a mine-surveying and a mining school. There is also a disused mint. The men of the town are mainly employed in the neighboring mines and smelting works; of the latter the most important is the Frankenscharner silver smelting house, where American as well as German ore is worked. The population in 1875 was 8539; including Zellerfeld, it was 12,799.

Klausthal was founded about the middle of the 16th century, after the erection of the Benedictine monastery at Cella. Mining was carried on by the monks, and more energetically by the dukes of Brunswick, who brought miners from Franconia.

KLÉBER, Jean Baptiste (1753–1800), was born at Strasburg in 1753 or 1754, where his father was a builder. He was meant to be an architect, but his opportune assistance to two German nobles in a tavern brawl obtained for him a nomination to the military school of Munich. He soon obtained a commission, but resigned it in 1783 on finding his humble birth in the way of his promotion. On returning to France he was appointed inspector of public buildings at Belfort, where he studied fortification and military science. In 1792 he enlisted in the Haut-Rhin volunteers, and was from his military knowledge at once elected adjutant. At the siege of Mainz under Merlin de Thionville, he so distinguished himself that he was made general of brigade in July, 1793. In that capacity he commanded in the Vendean war, and was instrumental in winning the victories of Torfou, Chollet, Le Mans, and Savenay. For openly expressing his opinion that lenient measures ought to be pursued towards the Vendeans he was recalled; but in April, 1794, he was made general of division, and sent to the army of the North. Under Jourdan he commanded the left wing at Fleurus, June 26, 1794, and Aldenhaven, October 2, and took Maestricht after a short siege on November 8. During the winter of 1794–95 he besieged Mainz, and on June 4, 1796, gained the victory of Altenkirchen over the prince of Würtemberg. Kléber now considered he had a fair claim to a command in chief, and, not receiving one in the spring of 1797, he resigned his division in disgust, and retired to Paris. There he allied himself with the reactionary party, and, according to Mathieu Dumas, even offered to command any forces that could be raised against the coup d'état of Fructidor, 1797, but there were no forces to command. He gladly accepted a division in the expedition to Egypt under Bonaparte, but was wounded in the head at Alexandria in the very first engagement, which prevented his taking any further part in the campaign of the Pyramids, and caused him to be appointed governor of Alexandria. In the Syrian campaign of 1799, however, he commanded the vanguard, took El-Arish, Gaza, and Jaffa, and bore the brunt of the battle of Mount Tabor, April 15, 1799. Being left by Bonaparte in command of the army in Egypt, he made the convention of El-Arish, and, when Lord Keith refused to ratify the terms, attacked the Turks at Heliopolis, though with but 10,000 men against 60,000, and utterly defeated them on March 20, 1800. He then retook Cairo, which had revolted from the French, and was assassinated there by a fanatic on June 14, 1800, the very day on which Desaix fell at Marengo. Kléber was undoubtedly one of the greatest generals of the French revolutionary epoch, but hardly had a chance of showing his powers against a capable adversary; Napoleon's ejaculation on hearing of his death was "Eh bien; a rival the less."

Ernouf, the grandson of Jourdan's chief of the staff, published in 1867 a valuable biography of Kléber. See also Reynaud's *Life of Merlin de Thionville*, Ney's *Memoirs*, Dumas's *Souvenirs*, Napoleon's *Memoirs*, dictated at St. Helena, and Martha-Becker's *Desaix*.

KLEIN, Julius Leopold (1804–1876), a German writer of Jewish origin, was born at Miscolcz, in Hungary, in 1804. He was educated at the gymnasium in Pest, and studied medicine in Vienna and Berlin. After travelling in Italy and Greece, he settled as a man of letters in Berlin, where he remained until his death in 1876. He was the author of many dramatic works, among others the historical tragedies *Maria von Medici*, *Luines*, *Zenobia*, *Moreto*, *Maria*, *Strafford*, and *Heliodora*, and the comedies *Die Herzogin*, *Ein Schützling*, and *Voltaire*. These plays were published between 1841 and 1867. The tendency of Klein as a dramatist was to become bombastic and obscure, but many of his characters are vigorously conceived, and in nearly all his tragedies there are passages of brilliant rhetoric. He is chiefly known as the author of an elaborate *Geschichte des Dramas* (1865–1876), in which he undertook to record the history of the drama both in ancient and in modern times. He died when about to enter upon the Elizabethan period, to the treatment of which he had looked forward as the chief part of his task. The work, which is in 12 bulky volumes, gives proof of immense learning, but is marred by many eccentricities of style.

KLINTZY, a town in Russia, situated in the government of Tchernigoff, 203 miles northeast of the capital of the province. It is one of the most important industrial centres in Little Russia. Its 8000 inhabitants are engaged in the manufacture of woollen cloth and knitted woollen goods (to the value of more than £100,000 per annum), morocco-leather, leather, and cast-iron wares.

KLOPSTOCK, Friedrich Gottlieb (1724–1803), German poet, was born at Quedlinburg on the 2d of July, 1724. He was educated partly at the gymnasium of his native town, partly at Schulpforta. After studying theology for a short time at Jena, he went in 1746 to the university of Leipsic, where he made the acquaintance of Cramer, Schlegel, Rabener, and other young men of letters, who were conducting the *Bremische Beiträge*. At Schulpforta Klopstock had become conscious of a talent for poetry, and had resolved to write a great epic. His original intention was to make Henry the Fowler his hero, but this was soon abandoned in favor of the scheme to which he devoted the best years of his life. The first three cantos of *The Messiah*, which were planned in prose in Jena, he finished in Leipsic; and they were published anonymously in the *Bremische Beiträge* in 1748. The name of the author was soon known, and Klopstock suddenly found himself the most popular poet of his generation. In 1748 he accepted the position of tutor to a private family in Langensalza, and in 1750 he went to Zürich, whither he was invited by Bodmer, the translator of *Paradise Lost*, who had been deeply impressed by the early cantos of *The Messiah*. In Zürich Klopstock received from Frederick V. of Denmark, on the recommendation of his minister Count Bernstorff, an invitation to settle in Copenhagen with a pension of 400 thalers. The invitation was accepted; and on his way to the Danish capital he met at Hamburg the lady who, in 1754, became his wife,—Margarethe (Meta) Moller, an enthusiastic admirer of his poetry. She died in 1758; and after her death Klopstock edited her writings, which give evidence of a tender, sensitive, and deeply religious spirit. In 1771 Klopstock left Copenhagen, and followed his friend Count Bernstorff to

Hamburg, where, in 1773, he issued the last five cantos of *The Messiah*. After spending about a year at the court of the margrave of Baden in Carlsruhe, he returned to Hamburg with the title of hofrath and a pension, which he retained along with the pension of the king of Denmark. During the rest of his life he remained in Hamburg, where, in 1792, he married Johanna Elizabeth von Winthem, a widow who had been for many years one of his most intimate friends. He died on the 14th of March, 1803, and was buried beside his first wife in the village of Ottensen, near Hamburg. Besides *The Messiah* he wrote many odes; and in several dramas he celebrated the deeds of the ancient German hero, Arminius, while in others he dealt with the earliest narratives of the Old Testament. He was also the author of *Fragmente über Sprache und Dichtkunst*, *Grammatische Gespräche*, and a book entitled *Gelehrtenrepublik*. In those works he made important contributions to philology and to the history of German poetry. Klopstock's dramatic writings are without value; many of his odes, especially those on subjects taken from northern mythology, are so vague as to be hardly intelligible; and *The Messiah* lacks plastic force, unity of conception, and precision of style. His best odes, however, and many passages of *The Messiah* are still admitted to be marked by lyrical genius of a high order; and all German critics recognize that he exercised a salutary influence on the literature of his age by helping to deliver it from slavish adherence to foreign models.

An edition of his works in 12 octavo volumes was published in Leipsic, 1798–1817; and among later editions may be mentioned one in 12 volumes, 1823–26, another in 9 vols., 1839, and a third in 11 vols., 1844–45. Klopstock's writings are included in Hempel's *Nationalbibliothek*, and there is a new edition, with notes, by Bock (Stuttgart, 1876). See K. F. Cramer, *Klopstock, er und über ihn*; and *Klopstock's Jugendgeschichte* in the *Kleine Schriften* of D. F. Strauss.

KLOSTERNEUBURG, a town in the official district of Hernals, Austria, is situated on the right bank of the Danube, 5½ miles northwest of Vienna. It is divided by a small stream into an upper and a lower town, in the former of which are the ruins of a mediæval fortress. The town has a local court, a hospital, an asylum for the insane, and a convent of Mekhitarists; among the schools is an academy of wine and fruit cultivation. As an important pioneer station, it has various military buildings and stores. On a hill rising directly from the banks of the Danube stand the magnificent buildings (erected 1730–1834) of the Augustine canonry, founded in 1106 by Margrave Leopold the Holy. This foundation is the oldest and richest of the kind in Austria; it owns much of the land upon which the northwestern suburbs of Vienna stand. Among the points of interest within it are the old chapel of 1318, with Leopold's tomb and the altar of Verdun, the treasury and relic-chamber, the library with 30,000 volumes and many MSS., the picture gallery, the collection of coins, the theological hall, and the wine-cellar, containing an immense tun like that at Heidelberg. The inhabitants of Klosterneuberg are mainly occupied in making wine, of excellent quality. There is a large cement factory outside the town. The population in 1869 was 5330, but has increased. In Roman times the castle of Citium stood in the region of Klosterneuberg. The town was founded by Charlemagne.

KNARESBOROUGH, a market-town and parliamentary borough in the West Riding of Yorkshire, is finely situated on a rocky elevation on the left bank of the Nidd, 17 miles west by north of York and 207 north of London. It is a station on the Northeastern Railway, which crosses the valley near the town by a lofty viaduct. The town is built chiefly of stone, and contains several good streets and a spacious market-place. The parish church of St. John is an old cruciform structure chiefly Perpendicular in style, restored in 1872; the free grammar school was founded in 1616. Knaresborough Castle, now in ruins, but originally of great strength, was founded in 1170 by Serlo de Burgh. After the battle of Marston Moor it was taken by Fairfax, and in 1648 it was ordered to be dismantled. To the south of the castle is St. Robert's chapel, an excavation in the rock constructed into an ecclesiastical edifice in the reign of Richard I. A little further down the river is St. Robert's cave, which is supposed to have been the residence of the hermit, and in 1744 was the scene of the murder of Daniel Clarke by Eugene Aram. Opposite the castle is a petrifying spring called the "Dropping Well." Before the rise of Harrogate Knaresborough was a favorite watering-place, but it is now dependent chiefly on its manufacture of towels, sheetings, and similar linen fabrics, and of wool rugs. There are also flour-mills and a considerable trade in corn. From the first year of the reign of Mary until 1867 Knaresborough returned two members to parliament, but since then it has returned only one. The area of the parliamentary borough and local board district, which includes part of Scriven with Tentergate, is 481 acres, and the population, which in 1871 was 5205, was exactly 5000 in 1881.

KNELLER, SIR GODFREY (1648–1723), a portrait painter whose celebrity belongs chiefly to England, was born in Lübeck in the duchy of Holstein, of an ancient family, on August 8, 1648. He was at first intended for the army, and was sent to Leyden to learn mathematics and fortification. Showing, however, a marked preference for the fine arts, he studied in the school of Rembrandt, and under Ferdinand Bol in Amsterdam. In 1672 he removed to Italy, directing his chief attention to Titian and the Caracci; Carlo Maratti gave him some guidance and encouragement. In Rome, and more especially in Venice, Kneller earned considerable reputation, by historical paintings as well as portraits. He next went to Hamburg, painting with still increasing success. In 1674 he came over to England at the invitation of the duke of Monmouth, was introduced to Charles II., and painted that sovereign, much to his satisfaction, several times. Charles also sent him to Paris, to take the portrait of Louis XIV. When Lely died in 1680, Kneller, who produced in England little or nothing in the historical department, remained without a rival in the ranks of portrait painting; there was no native-born competition worth speaking of. Charles appointed him court painter; and he continued to hold the same post into the days of George I. Under William III. (1692) he was made a knight, under George I. (1715) a baronet, and by order of the emperor Leopold I. a knight of the Roman empire. Not only his court favor but his general fame likewise was large: he was lauded by Dryden, Addison, Steele, Prior, Tickell, and Pope. Kneller's gains also were very considerable, aided by habits of frugality which approached stinginess: he left property yielding an annual income of £2000. His industry was maintained till the last. His studio had at first been in Covent Garden, but in his closing years he lived in Kneller Hall, Twickenham. He died of fever, the date being generally given as 7th November, 1723, though some accounts say 1726. He was buried in Twickenham church, and has a monument in Westminster Abbey. An elder brother, John Zachary Kneller, an ornamental painter, had accompanied Godfrey to England, and had died in 1702. The style of Kneller as a portrait painter represented the decline of the art as practised by Vandyck; Lely marks the first grade of descent, and Kneller the second. His works have much freedom, and are well drawn and colored; but they are essentially slight in manner, and to a great extent monotonous, this arising partly from the habit which he had of lengthening the oval of all his heads. The coloring may be called brilliant rather than true. He indulged much in the commonplaces of allegory; and, though he had a quality of dignified elegance not unallied with simplicity, genuine simple nature is seldom to be traced in his works. His fame has greatly declined now, and could not but do so after the advent of Reynolds. Among Kneller's principal paintings are the Forty-three Celebrities of the Kit-Cat Club, and the Ten Beauties of the Court of William III., now at Hampton Court; those were painted by order of the queen; they match, but match unequally, the Beauties of the Court of Charles II., painted by Lely. He executed altogether the likenesses of ten sovereigns. It is said that Kneller's own favorite performance was the portrait of the Converted Chinese in Windsor Castle. His works are confined almost entirely to England, not more than two or three specimens having gone abroad after he had settled there.

KNIGHT, CHARLES (1791-1873), publisher and author, was the son of a bookseller and printer at Windsor, where he was born 15th March, 1791. After acquiring some knowledge of Latin and French at a common day school, he was sent at the age of twelve to the classical school of Dr. Nicholas, of Ealing. There, according to his own account, he imbibed such a tincture of learning as made him desirous to be a scholar; and it was very much in opposition to his wishes that in 1805 he was withdrawn from school to be bound apprentice to his father. In editing *The Windsor and Eton Express*, commenced by his father in 1812, some gratification was afforded to his literary ambition, and this received additional stimulus when he became the publisher of *The Etonian*, edited by Praed, with Macaulay, Moultrie, and Derwent and Nelson Coleridge as principal contributors. After editing *The Guardian* from 1820 to 1822, Knight was induced by the Etonians already mentioned, now undergraduates at Cambridge, to set up in business at Pall-Mall East, and to become for them editor of *Knight's Quarterly Magazine*. As far as the magazine was concerned the venture was unsuccessful, for it was brought to a close with its sixth number; but it initiated for Knight a literary career as publisher and author which extended over forty years, and the unselfish enterprise of which conferred lasting intellectual benefit on the general mass of his fellow-countrymen. In 1827 Knight became the superintendent of the publications of the Society for the Diffusion of Useful Knowledge, for whom he projected and edited *The British Almanac and Companion*, commencing in 1828. In 1829 he began the publication of *The Library of Entertaining Knowledge*, he himself writing several volumes of the series. 1832 and 1833 saw respectively the commencement of *The Penny Magazine* and *The Penny Cyclopædia*, two literary ventures which so far as circulation was concerned were highly satisfactory in their results, but the latter of which, on account of the heavy excise duty, was completed at a great pecuniary sacrifice. Besides a considerable number of illustrated editions of other standard works, Knight completed in 1842 *The Pictorial Shakespeare*, which, although now superseded in regard to critical scholarship, is still valued for the research and taste displayed in its illustrations. *The Pictorial Shakespeare* was followed by various other editions of the same author. The energy of Knight also found scope in the compilation of a variety of illustrated series, such as *Old England* and *The Land We Live In*. In 1853 he became editor of *The English Cyclopædia*, and conjointly with the multifarious duties of such an office he was also engaged in writing his *Popular History of England*, published in eight volumes, 1854–61. In 1864 he withdrew from the business of publisher, but he continued his active literary career nearly to the close of his long life, publishing *The Shadows of the Old Booksellers* (1865), an autobiography under the title *Passages of a Working Life During Half a Century* (3 vols., 1864–65), an historical novel *Begg'd at Court* (1868), and subsequently various papers in *The British Almanac and Companion*. He died at Addlestone, Surrey, March 9, 1873.

KNIGHTHOOD.

KNIGHTHOOD and CHIVALRY are two words which are nearly but not quite synonymous; that is, they may often, although they cannot always, be used precisely in the same way and exactly in the same sense. What we mean by the order of knighthood is to all intents and purposes what we mean by the order of chivalry. But in some of the more special applications of the several terms diversities in their respective significations manifest themselves. We could not, for example, say of anybody that he had received the honor of chivalry, or that he had lived in the age of knighthood. Again, we should speak of lands as held in chivalry, not in knighthood, and of the rank or degree of knighthood, not of chivalry. But taken together the two words knighthood and chivalry designate a single subject of inquiry, which presents itself under three different although connected and in a measure intermingled aspects. It may be regarded in the first place as a mode or variety of feudal tenure, in the second place as a personal attribute or dignity, and in the third place as a scheme of manners or social arrangements. It is under these three general aspects that the subject is to be dealt with here. For the more important religious as distinguished from the military orders of knighthood or chivalry the reader is referred to the headings ST. JOHN (KNIGHTS OF), TEUTONIC KNIGHTS, and TEMPLARS.

Derivation of *knight*.

The Saxon *cniht*.

Our words *knight* and *knighthood* are merely the modern forms of the Anglo-Saxon or Old English *cniht* and *cnihthád*. Of these the primary signification of the first was a boy or youth, and of the second that period of life which intervenes between childhood and manhood. But some time before the middle of the 12th century they had acquired the meaning they still retain of the French *chevalier* and *chevalerie*. In a secondary sense *cniht* meant a servant or attendant answering to the German *Knecht*, and in the Anglo-Saxon Gospels a disciple is described as a *leorning cniht*. In a tertiary sense the word appears to have been occasionally employed as equivalent to the Latin *miles*—usually translated by *thegn*—which in the earlier Middle Ages was used as the designation of the domestic as well as of the martial officers or retainers of sovereigns and princes or great personages.[1] Sharon Turner suggests that *cniht* from meaning an attendant simply may have come to mean more especially a military attendant, and that in this sense it may have gradually superseded the word thegn.[2] But the word thegn itself, that is, when it was used as a description of an attendant of the king, appears to have meant more especially a military attendant. As Dr. Stubbs says, "the thegn seems to be primarily the warrior gesith"—the gesithas forming the chosen band of companions (*comites*) of the German chiefs (*principes*) noticed by Tacitus—"he is probably the gesith who had a particular military duty in his master's service;" and he adds that from the reign of Athelstan "the gesith is lost sight of except very occasionally, the more important class having become thegns, and the lesser sort sinking into the rank of mere servants of the king."[3] It is pretty clear, therefore, that the word *cniht* could never have superseded the word thegn in the sense of

[1] Du Cange, *Gloss.*, s. v. "Miles."
[2] *History of England*, vol. iii. chap. 12.
[3] Stubbs, *Constitutional History*, vol. i. p. 156.

a military attendant, at all events of the king. But besides the king, the ealdormen, bishops, and king's thegns themselves had their thegns, and to these it is more than probable that the name of *cniht* was applied. Under the singular system of joint responsibility and suretyship which was characteristic of the Anglo-Saxon government, the practice of commendation had attained to extraordinary dimensions. He who was unattached to some superior—the lordless man—was indeed regarded as a kind of outlaw; and, if he refused or neglected to choose a lord for himself, his kindred were bound to present him to the county court and select a lord for him. Hence a relation which was for the most part merely personal, but which only required the addition of landholding—an addition, it can scarcely be doubted, sometimes made—to render it in all respects feudal, was widely and firmly established in England long before the Norman Conquest. The mutual rights and obligations of lord and man, in a far more advanced condition than they appear as between hlaford and gesith at an earlier period, were perfectly familiar to the Anglo-Saxons, and it was only in part due to the influence of the Normans that they were subsequently transformed into the mutual rights and obligations of lord and tenant. Around the Anglo-Saxon magnates were collected a crowd of retainers and dependants of all ranks and conditions; and there is evidence enough to show that among them were some called *cnihtas* who were not always the humblest or least considerable of their number.[1] The testimony of Domesday also establishes the existence in the reign of Edward the Confessor of what Dr. Stubbs describes as a "large class" of landholders who had commended themselves to some lord, and he regards it as doubtful whether their tenure had not already assumed a really feudal character. But in any event it is manifest that their condition was in many respects similar to that of a vast number of unquestionably feudal and military tenants who made their appearance after the Norman Conquest. If consequently the former were called *cnihtas* under the Anglo-Saxon régime, it seems sufficiently probable that the appellation should have been continued to the latter—practically their successors—under the Anglo-Norman régime. And if the designation of knights was first applied to the military tenants of the earls, bishops, and barons—who although they held their lands of mesne lords owed their services to the king—the extension of that designation to the whole body of military tenants need not have been a very violent or prolonged process. Assuming, however, that *knight* was originally used to describe the military tenant of a noble person, as *cniht* had sometimes been used to describe the thegn of a noble person, it would, to begin with, have defined rather his social status than the nature of his services. But those whom the English called *knights* the Normans called *chevaliers*, by which term the nature of their services was defined, while their social status was left out of consideration. And at first *chevalier* in its general and honorary signification seems to have been rendered not by *knight* but by *rider*, as may be inferred from the Saxon Chronicle, wherein it is recorded under the year 1085 that William the Conqueror "dubbade his sunu Henric to ridere."[2] But, as Mr. Freeman says, "no such title is heard of in the earlier days of England. The thegn, the ealdorman, the king himself, fought on foot; the horse might bear him to the field, but when the fighting itself came he stood on his native earth to receive the onslaught of her enemies."[3] In this perhaps we may behold one of the most ancient of British insular prejudices, for on the Continent the importance of cavalry in warfare was already abundantly understood. It was by means of their horsemen that the Austrasian Franks established their superiority over their neighbors, and in time created the Western empire anew, while from the word *caballarius*, which occurs in the *Capitularies* in the reign of Charlemagne, came the words for knight in all the Romance languages.[4] In Germany the chevalier was called *Ritter*, but neither *rider* nor *chevalier* prevailed against *knight* among ourselves. And it was long after *knighthood* had acquired its present meaning with us that *chivalry* was incorporated into our language. It may be remarked too in passing that in official Latin, not only in England but all over Europe, *miles* held its own against both *eques* and *caballarius*.

Chevalier.

Origin of mediæval knighthood.

Concerning the origin of knighthood or chivalry as it existed in the Middle Ages,—implying as it did a formal assumption of and initiation into the profession of arms,—nothing beyond more or less probable conjecture is possible. The mediæval knights had nothing to do in the way of derivation with the "equites" of Rome, the knights of King Arthur's Round Table, or the Paladins of Charlemagne. But there are grounds for believing that some of the rudiments of chivalry are to be detected in early Teutonic customs, and that they may have made some advance among the Franks of Gaul. We know from Tacitus that the German tribes in his day were wont to celebrate the admission of their young men into the ranks of their warriors with much circumstance and ceremony. The people of the district to which the candidate belonged were called together; his qualifications for the privileges about to be conferred upon him were inquired into; and, if he were deemed fitted and worthy to receive them, his chief, his father, or one of his near kinsmen, presented him with a shield and a lance. Another custom apparently common to the Goths and the Franks was the ceremony of adoption by arms. By means of a solemn investiture with warlike weapons, the two parties to the formality or rite thenceforth acquired the artificial characters of father and son, not, as in the Roman practice of adoption, for any purpose of succession or inheritance, but in a purely honorary and complimentary manner. Selden and Du Cange concur in tracing the ceremony of "dubbing to knighthood" directly to the ceremony of the "adoptio per arma." Among the Lombards the sons of their kings were forbidden to sit at the tables of their fathers until they had been invested with arms, and this, it is further said, by some foreign prince or potentate.[5] But among the Franks we find, from the authorities cited by Du Cange, Charlemagne girding his son Louis the Pious, and Louis the Pious girding his son Charles the Bald with the sword, when they arrived at manhood.[6] These cases can hardly be referred, as the Lombard usages may, to the "adoptio per arma." Yet it is indisputable that in the investiture of Louis and Charles with the sword some ceremony was observed which was deemed worthy of record, not for its novelty, but as a thing of recognized importance. It does not follow that a similar ceremony extended to personages less exalted than the sons of kings and emperors. But if it did, we must naturally suppose that it applied in the first instance to the mounted warriors who formed the most formidable portion of the warlike array of the Franks. It was among the Franks indeed, and possibly through their experiences in war with the Saracens, that cavalry first acquired the pre-eminent place which it long maintained in every European country. In early society, where the army is not a paid force but the armed nation, the cavalry must necessarily consist of the noble and wealthy, and cavalry and chivalry, as Mr. Freeman observes,[7] will be the same. Since then we discover in the *Capitularies* of Charlemagne actual mention of "caballarii" as a class of warriors, it may reasonably be concluded that formal investiture with arms applied to the "caballarii," if it was a usage extending beyond the sovereign and his heir apparent. "But," as Hallam says, "he who fought on horseback and had been invested with peculiar arms in a solemn manner wanted nothing more to render him a knight;" and so he concludes, in view of the verbal identity of "chevalier" and "caballarius," that "we may refer chivalry in a general sense to the age of Charlemagne."[1] Yet, if the "caballarii" of the *Capitularies* are really the precursors of the later knights, it remains a difficulty that the Latin name for a knight is "miles," although "caballarius" became in various forms the vernacular designation.

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[1] Stubbs, vol. i. pp. 156, 366; Turner, vol. iii. pp. 125-129.

[2] Ingram's edition, p. 290.

[3] *Comparative Politics*, p. 74.

[4] Baluze, *Capitularia Regum Francorum*, vol. ii. pp. 794, 1069.

[5] Mills, *History of Chivalry*, vol. i. p. 36.

[6] *Gloss.*, *s. v.* "Arma."

[7] Freeman, *Comparative Politics*, p. 78.

Knighthood in England.

Before it was known that the chronicle ascribed to Ingulf of Croyland is really a fiction of the 13th or 14th century, the knighting of Heward or Hereward by Brand, abbot of Burgh (now Peterborough), was accepted from Selden to Hallam as an historical fact, and knighthood was supposed not only to have been known among the Anglo-Saxons, but to have had a distinctively religious character which was contemned by the Norman invaders. The genuine evidence at our command altogether fails to support this view. When William of Malmesbury describes the knighting of Athelstan by his grandfather Alfred the Great, that is, his investiture "with a purple garment set with gems and a Saxon sword with a golden sheath," there is no hint of any religious observance. In spite of the silence of our records, Dr. Stubbs thinks that kings so well acquainted with foreign usages as Ethelred, Canute, and Edward the Confessor could hardly have failed to introduce into England the institution of chivalry then springing up in every country of Europe; and he is supported in this opinion by the circumstance that it is nowhere mentioned as a Norman innovation. Yet the fact that Harold received knighthood from William of Normandy[2] makes it clear either that Harold was not yet a knight, which in the case of so tried a warrior would imply that "dubbing to knighthood" was not yet known in England even under Edward the Confessor, or, as Mr. Freeman thinks, that in the middle of the 11th century the custom had grown in Normandy into "something of a more special meaning" than it bore in England. William of Normandy was knighted by his overlord Henry I. of France, and of the Conqueror's sons he himself, as we have already seen, knighted Henry Beauclerc,[3] while William Rufus was knighted by Archbishop Lanfranc.[4] It was under William Rufus, according to Mr. Freeman, that the chivalrous and financial sides of feudalism sprang together into sudden prominence in England—the first as represented by the Red King, and the second as represented by his minister Ranulf Flambard.[5]

Knight's fee.

In one sense tenure in chivalry was practically coextensive with European feudalism, while in another sense it was strictly speaking peculiar to England after the Norman Conquest, and Ireland after the English Conquest. We have no earlier information of the details of the feudal organization of Normandy than we have of the feudal organization of England, and therefore it is impossible to say how far the second was copied from the first, or the first assimilated to the second. But at all periods there was apparently sufficient difference between the Norman "fief de haubero" and the English knight's fee to prevent the one from being pronounced in the proper meaning of the term the counterpart of the other. Into Ireland, however, the English system of tenures was imported without change of conditions.[6] But the process of feudalization commenced in England under William I. was only completed under Henry II., and at the time of the subjugation of Ireland there was already established a distinction between the feudal arrangements which had been made before and after the death of Henry I., as the "old" and the "new" feoffments. That Henry II.'s method of dealing with the conquered lands of Ireland was an exact imitation of William I.'s method of dealing with the conquered lands in England cannot therefore be assumed. But both kings had at their disposal a large extent of territory which they granted to their vassals on terms necessarily very similar. In the reign of Henry II. the knight's fee was what may be called the "unit" of the system of tenures which had grown up in England since the Norman Conquest. In the *Modus Tenendi Parliamenti*,[7] for instance, a treatise which pretended to date from the 11th and which really dates from the 14th century, it is laid down that an earldom consisted of twenty knights' fees, and that a barony consisted of thirteen and a third knights' fees, a statement which seems to have been accepted without misgiving until it was refuted by Selden.[8] It is, however, beyond question that some, although not all, of the feudal services and obligations of the tenants of earldoms and baronies were determined by the number of the knights' fees which they comprised. It was certainly not a fixed number, for it varied in every or nearly every recorded example.[9] But it was in each instance a specified number, by which the earl's or baron's military contribution to the king's army was settled and the amerciaments payable in the event of its being absent or incomplete were computed.[10] Hallam is inclined to attribute the invention of what he terms the "reasonable and convenient" principle of the knights' fee to the administrative genius of William the Conqueror.[11] But Domesday proves that at the time when the survey was made nothing approaching to a regular distribution of the country into knights' fees had been attempted. On two occasions indeed the expression "servitium unius militis," which was afterwards the technical designation of a knights' fee in legal phraseology, is employed. But even the word "miles" had not as yet acquired the special meaning which was subsequently assigned to it. Among the "milites" of Domesday are persons of very various conditions, from ordinary soldiers and the inferior tenants of manors to Hamo the sheriff and the earl of Eu.[12] But when the returns contained in the Black Book of the Exchequer were made in the reign of Henry II., both the principle and system of knights' fees were fully and definitively established. Hence this change must have been effected in the interval between the compilation of these two records. It cannot be supposed that the numerous grants of land made by William I. to his adherents were exempt from military obligation of one kind or another. But no original grant of his or of either of his immediate successors to any lay vassal is in existence to inform us what the exact nature of those military obligations was; and, arguing from the grants to various ecclesiastical vassals, Dr. Stubbs regards it as unlikely that such gifts were made on any expressed condition or accepted with a distinct pledge to provide a certain contingent of knights for the king's service.[1] Before the Norman Conquest, he contends, all landholders having been bound to the duty of national defence, and a certain quantity of land having customarily furnished a fully armed man, the old rate of military obligation was in all probability continued in the case of the new grantees after the Conquest. Nothing in Domesday implies that the conditions of military service differed under the old and the new monarchy, and hence Dr. Stubbs concludes that "the form in which knights' fees appear when called on by Henry II. for scutage was most probably the result of a series of compositions by which the great vassals relieved their lands from a general burden by carving out particular estates the holders of which performed the services due from the whole; it was a matter of convenience, and not of tyrannical pressure." And, although Selden, and Madox after him, adhere to the common and ancient tradition that William the Conqueror made his grants conditional on the service of some particular number of knights in every case, they substantially agree in regarding the knights' fee in its special meaning as the consequence of subinfeudation. From the reign of Henry II. to the reign of Edward I., indeed, what may be called grants in gross from the king and grants in detail from the mesne lords were the ordinary methods of erecting knights' fees and providing for the discharge of the personal and pecuniary obligations with which they were burdened.

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[1] Hallam, *Middle Ages*, vol. iii. p. 392.

[2] Freeman, *History of the Norman Conquest*, vol. v. p. 484.

[3] The Saxon Chronicle so records. But Ordericus Vitalis says that he received his arms from Lanfranc, and Dr. Stubbs seems to think that both statements may be true (*Const. Hist.*, vol. i. p. 367).

[4] William of Malmesbury is the authority for the knighting of William Rufus by Archbishop Lanfranc. "Accessit etiam favori ejus maximum rerum momentum archiepiscopus Lanfrancus eo quod eum nutrierat et militem fecerat, quo auctore et annitente die Sanctorum Cosmæ et Damiani coronatus."—*Gesta Regum Anglorum*, lib. iv. sec. 305. Dr. Stubbs notices, in this connection, that abbots were forbidden to make knights in the Council of London, in 1102. He adds that "Thomas Becket knighted the count of Guisnes, and William, bishop of Ely, knighted Ralph Beauchamp as late as 1191" (*Const. Hist.*, vol. i. p. 367).

[5] *Norman Conquest*, vol. v. p. 485.

[6] Madox, *Baronia Anglica*, p. 29.

[7] Stubbs, *Select Charters*, p. 502.

[8] *Titles of Honor*, pp. 611, 612.

[9] Madox, *Baronia Anglica*, p. 91 *sq.*; and Selden, *ut supra.*

[10] Madox, *lib. cit.*, p. 115 *sq.*

[11] Hallam, *Middle Ages*, vol. i. p. 171.

[12] Ellis, *General Introduction to Domesday*, vol. i. p. 58 *sq.*, where examples are noticed. "There is no ground," says Mr. Freeman, "for thinking that William directly or systematically introduced any new kind of tenure into the holding of English lands. There is nothing to suggest any such belief either in the chronicles of his reign, in the survey which is his greatest monument, in the genuine, or even in the spurious, remains of his legislation. The code of laws which bears William's name, but which is assuredly none of his enacting, is in all but a very few points a mere confirmation of the old English law. And the few points of innovation have nothing to do with feudal tenures. But when we come to the reign next but one, we are met by a document which shows us that within thirteen years after the Conqueror's death not only the military tenures but the worst abuses of the military tenures were in full force in England. The great charter of Henry I., the groundwork of the greater charter of John, and thereby the groundwork of all later English legislation, is filled with promises to abolish the very same class of abuses which were at last swept away by the famous statute of Charles II." (Freeman, *Norm. Conq.*, vol. v. p. 372 *sq.*; Palgrave, *Normandy and England*, vol. iii. p. 609 *sq.*; Digby, *History of the Law of Real Property*, p. 31).

Although the feudal services and incidents of a knight's fee appear to have been ascertained with perfect clearness, the exact nature of a knight's fee itself—what it was or in what it consisted—has been the subject of a great deal of controversy. As the demands both personal and pecuniary which were made on the holder of each knight's fee were uniform, it is reasonable to conclude that all such fees were in some way equivalent to one another. But whether their equivalence was inferred from the quantity of land they contained or from the amount of revenue derived from them has been much debated, and cannot be said to be even now finally settled. Selden, indeed, roundly affirms that "the legal value of knights' fees was never in truth estimable either by any certain number of acres or quantity of revenue (though some have erroneously determined them by both), but only by the services or number of knights reserved."[2] But if this were the case, it is difficult to understand how parts of a knight's fee, such as a half or a third, could have been held, as they unquestionably were held, under reduced burdens calculated in proportion to the full burdens of a whole knight's fee. According to the analogies of the Anglo-Norman policy in other departments of its manifestation, it might have been expected with some degree of confidence that the knight's fee would have been a combination of the property qualification of the thegn and the feudal attributes of the "fief de haubert," that is, of the latter superinduced upon the former. Before the Norman Conquest the property qualification of a thegn was five hides of land, for which a fully equipped warrior was to be furnished for the national defence in the king's host or "fyrd;" and there is no evidence to rebut the presumption that after the Norman Conquest a similar rate of military obligation was continued. It is not, however, without hesitation that Dr. Stubbs arrives at what seems to be rather a provisional than a final determination on the subject. In one passage he observes that "the name of thegn covers the whole class which after the Conquest appears under the name of knights, with the same qualification in land and nearly the same obligations."[3] In another passage, on the contrary, he says that "it cannot even be granted that a definite area of land was necessary to constitute a knight's fee; for although at a later period and in local computations we may find four or five hides adopted as a basis of calculation, where the particular knight's fee is given exactly, it affords no ground for such a conclusion."[4] On the whole he thinks it must be held that its extent was determined not by acreage but by rent or valuation, and that "the common quantity was really expressed in the twenty librates, the twenty pounds' worth of annual value, which until the reign of Edward I. was the qualification for knighthood." That this was the established appraisement of the knight's fee very soon after the Norman Conquest Dr. Stubbs infers from the circumstance that Archbishop Lanfranc maintained ten knights to answer for the military service due from the convent of Christ Church in consideration of land worth two hundred pounds a year which on that account was assigned to him.[5] But although, as Coke says, the annual value of a knight's fee was twenty pounds at the enactment of both Magna Charta and the statute "De Militibus," he cites various writs for distraint of knighthood which, if indeed some of them were not merely writs of array, would show that it varied irregularly from ten to forty pounds in amount between the reigns of Edward I. and Henry VI.[6] It was computed at forty pounds in the reign of Elizabeth, and again when Charles I. resorted to "knight-money" as a means of raising a revenue. The aggregate number of knights' fees throughout England in feudal times is very variously stated by tradition. The assertion of Ordericus Vitalis in the reign of Stephen that the Conqueror settled his military fiefs so as to provide 60,000 knights for his service was accepted, not only popularly and in an uncritical age, but by writers of weight from Selden to Hallam. But 60,000 knights' fees at £20 a year gives about twelve times the whole national income from land as it appears in Domesday; or, if the knight's fee is reckoned at five hides, the aggregate amounts to thirty millions of acres, leaving something more than two millions for royal demesnes, all other tenures, forests, waste, and the rest.[7] The Red Book of the Exchequer, which dates from the first third of the 13th century, mentions a tradition, which the compiler himself rejects as unsupported by evidence, that William I. created not 60,000 but 32,000 knights' fees.[8] According to the Black Book of the Exchequer the number of knights furnished at the date of its compilation by the tenants in chief of twenty counties taken at random was 3991, and of the ten counties south of the Thames and Avon 2047.[9] As it is probable that these ten counties contained about a fourth of the population, and as the proportion of knights' fees is not very materially departed from in the twenty unselected counties, we should not be far wrong in assuming perhaps that the entire number of knights' fees in the kingdom was between eight and nine thousand.[10]

Knight service.

All tenure in chivalry was founded on homage and fealty, to which were added the various services and liabilities under which the different fiefs or tenements were held. Homage consisted in the mutual acknowledgment by the lord and tenant that the latter was the vassal or man of the former, accompanied as evidence thereof by certain solemn acts of obeisance on the one hand and of acceptance and patronage on the other. Hence homage could be done only by the tenant in person to the lord in person. Connected with and following on homage was fealty, which was an undertaking or oath on the part of the tenant that he would be true and faithful to his lord in consideration of the lands which he held of him, and that he would duly and fully observe the several conditions of his tenure, which declaration might be received on behalf of the lord by anybody whom he might appoint for the purpose. Every tenant in chivalry owed service to his lord in peace as well as in war, and was bound to attend him in his court not less than in the field. The civil obligations of tenants by knight-service were to assist their lords in the administration of justice and to support them on occasions of ceremony and display. The chief vassals of the king, the earls and barons, were the homagers and peers of the great court-baron of the kingdom, and in turn their under-tenants were the homagers and peers of their palatine and baronial courts. The military obligations of tenants by knight-service were discharged either in the king's armies or in the castles of the king and his principal feudatories. In the first case the holder of a knight's fee was bound to serve in the royal host fully equipped and on horseback at his own expense for forty days in every year when called upon,—a tenant-in-chief serving under the direct command of the sovereign or his officers, and an under tenant in the martial retinue of his immediate lord. But in the second case the duties of the tenant were not defined by any general rule or custom, and the terms of his service of "castle guard" depended on the special stipulations of his grant or feoffment.[1] Besides all this, however, tenants by knight-service were subjected to various other burdens which in course of time became the most important incidents of their tenure. On the death of a tenant, his heir, if he was of full age, was compelled on taking up his inheritance to pay a fine to his lord. This was called a relief if he was an under tenant, or "primer seisin" if he was a tenant-in-chief, and amounted in the first instance to one quarter's profits, and in the second to one whole year's profits of his estate.[2] The tenant was also liable to render what were called aids to his lord for three purposes, namely, to ransom him from captivity, to make his eldest son a knight, and to provide a portion for his eldest daughter on her marriage. Of these three aids ransom was only a very rare and exceptional demand, while those "pur faire fitz chivaler" and "pur file marier" were of course of frequent and ordinary occurrence. Wardship and marriage, however, were the main incidents of tenure by knight-service after the military obligations which formed its essential characteristic, and they were always the most unpopular and oppressive of them. When on the death of the tenant the heir was under the age of twenty-one or the heiress under the age of fourteen, the lord became the "guardian in chivalry" of his or her person and lands until he reached the age of twenty-one or she reached the age of sixteen, when on the payment of half a year's income of their estate in lieu of all reliefs and "primer seisins" the wards were entitled to sue out their livery or "ousterlemain." In the meantime the lord had all the profits of the lands, and was not bound to render any account of them, while he was at liberty to assign or sell his guardianship with its attendant rights and immunities unimpaired. Moreover, he was entitled to dispose of his male as well as his female wards in marriage to any person of equal or similar rank to their own, and if they rejected the match recommended by him, or married without his consent, they incurred the forfeiture to him of a sum of money equivalent to what was termed the value of their marriage, that is, the price which was to have been given or might have been reasonably expected to be given for it. Nor could the tenant by knight-service part with his lands without the payment of a fine on alienation to his lord, to whom they altogether passed on his neglect to fulfil his feudal obligations or on the extinction of his heirs. Again, whether he was an under tenant or a tenant in chief, his lands escheated to the king if he was convicted of treason, while if he was convicted of any other felony they escheated to his immediate lord, the king—if he were not the immediate lord—entering into possession of them for a year and a day. It had also become customary from a comparatively early period to compel the tenants of knights' fees to take upon themselves the honorary distinction of knighthood, and it is remarkable that this appears to have been most systematically insisted on after the actual render of military service had been universally commuted to a money equivalent, and when even that money equivalent itself under its original name of escuage or scutage was passing or had passed away.[3] Neglect or refusal to be knighted by any tenant in chivalry who was thereunto commanded by the king's writ subjected the offender, if he was capable of bearing arms, and between the ages of twenty-one and sixty, to a fine. And thus in the progress of events knight-service tended to become more and more divorced from its primary uses and intentions, and to survive merely as a series of oppressive exactions and idle ceremonies. During the centuries which followed the enactment of the statute of "Quia Emptores," the king gradually added the character of immediate lord over nearly all the lands held in chivalry within the realm to the character of lord paramount which had been his from the beginning. When feudalism was as firmly established and as fully developed as it ever was in England, a single officer in each county, called the king's eschcator, who was appointed annually by the lord treasurer, was considered sufficient to watch over the royal "droits of seignory" and to prevent the evasion of them. But when nothing save the name and the hardships of feudalism remained, the Court of Wards and Liveries was erected, and the scandals and abuses to which its jurisdiction gave rise under the Tudors and the first two Stuarts speedily assumed the proportions of an almost intolerable grievance. Towards the end of the reign of James I. the general discontent resulted in an attempt to abolish tenures in chivalry altogether, compensation being proposed to the king and the mesne lords in the form of a fixed rent in the place of their feudal dues, "which motion, though it proceeded not to effect," says Coke, "yet we thought it well to remember, hoping that so good a motion . . . will some time or other . . . take effect and be established."[4] This hope was in part realized by the Long Parliament, which by resolution of both Houses in 1645 put an end to the Court of Wards and Liveries, and converted all tenures of chivalry into free and common soccage. But it was not until eleven years later that by an Act of the Commonwealth, in 1656, legislative sanction was conferred on these ordinances. Their substance, however, had been embodied in one of the articles of the treaty of Newport between Charles I. and the Parliamentarians, and the king was then to have been indemnified by means of a revenue charged on the lands relieved, amounting to a hundred thousand pounds a year. At the Restoration a tax on lands held in chivalry was proposed in place of knight-service, but an alternative scheme for an excise on beer and some other liquors received the preference. It was not, however, until the abolition of purveyance as well as knight-service had been included in the measure, since known as the 12th Charles II. cap. 24, by way of concession to the claims of the yeomanry and peasantry, that it was permitted to pass, and then only amid vigorous protests from many quarters.

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[1] Stubbs, *Con. Hist.*, vol. i. p. 261 *sq.*

[2] *Titles of Honor*, p. 613.

[3] Stubbs, *Con. Hist.*, vol. i. p. 156.

[4] *Ibid.*, p. 264 *sq.*

[5] *Ibid.*, p. 262.

[6] Coke, *Second Institute*, p. 596, ed. 1669.

[7] Pearson, *Early and Middle Ages*, vol. ii. p. 496.

[8] Madox, *Baronia Anglica*, p. 30.

[9] Pearson, *lib. cit.*, vol. ii. 209 *sq.*

[10] Pearson, *lib. cit.*, vol. i. p. 375. Stubbs, *Const. Hist.*, vol. ii. p. 264.

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[1] *Magna Carta*, sect. 29; Stubbs, *Select Charters*, p. 300; Selden, *Titles of Honor*, p. 611.

[2] *Magna Carta*, sect. 2.

[3] "In the nineteenth of Henry III., all the sheriffs of England were commanded by close writs under the great seal to make proclamation that all who held of the king in chief one knight's fee or more and were not as yet knighted should get themselves knighted before the ensuing Christmas, as they loved the tenements and fees they held of the king. Two years before the king had seized the lands and chattels of Roger de Sumery, including the honor of Dudley, because he did not come to the king to be girded with the belt of knighthood" (Madox, *Baronia Anglica*, p. 180). "There can be no doubt," Dr. Stubbs says, "that this practice was one of the influences which blended the minor tenants-in-chief with the general body of the free holders; possibly it led also to the development of the military spirit which in the following century [he is speaking of the reign of Edward I.] sustained the extravagant designs of Edward III., and was glorified under the name of chivalry." (*Const. Hist.*, vol. ii. p. 282.) The statute "De Militibus" was passed in the reign of Edward II., just at the period when scutage was being abandoned as a special mode of taxation (Stubbs, *Const. Hist.*, vol. ii. p. 522).

[4] *Institutes* 4, vol. 3, p. 203.

Regarded as a method of military organization, the feudal system of tenures was always far better adapted to the purposes of defensive than of offensive warfare. Against invasion it furnished a permanent provision both in men-at-arms and strongholds; nor was it unsuited for the campaigns of neighboring counts and barons which lasted for only a few weeks, and extended over only a few leagues. But when kings and kingdoms were in conflict, and distant and prolonged expeditions became necessary, it was speedily discovered that the unassisted resources of feudalism were altogether inadequate. The barons and knights who fought on horseback were in their own country attended by the yeomen and townsmen, who fought on foot. But in foreign wars the feudal cavalry alone were available, and the infantry were nearly all and always mercenary troops. Again, although the period for which the holders of fiefs were bound to military service had originally been uncertain and unlimited, it gradually became an established rule, to which the exceptions were everywhere trifling and rare, that it should be restricted in various countries to from forty to sixty days in each year.[1] Hence warlike operations on anything like an extended scale would have been impossible if the terms of the feudal engagement had been strictly observed. In these circumstances it became customary to retain the feudal tenants under arms as stipendiaries after their ordinary and legitimate obligations had been fulfilled. But this arrangement was exceedingly inconvenient in practice to sovereigns and their feudatories alike. It implied to the former the expenditure of large sums of money, then very difficult to raise, on what was frequently an inferior commodity, and to the latter the neglect of their estates and of all their peaceful duties and diversions. It became therefore the manifest interest of both parties that personal services should be commuted into pecuniary payments. In the early times of feudalism the refusal or omission to discharge the military obligations attached to a fief entailed immediate forfeiture. But the usage of fining the delinquents in such cases, at first arbitrarily and afterwards in a fixed amount, grew up all over Europe, while in England from the reign of Henry II. to the reign of Edward II. escuage or scutage was regularly levied, originally as an amerciament and subsequently as an ordinary war-tax on tenants by knight-service.[2] In this way funds for war were placed at the free disposal of sovereigns, and, although the feudatories and their retainers still formed the most considerable portion of their armies, the conditions under which they served were altogether changed. Their military service was now the result of special agreement, by which they undertook in consideration of certain payments to themselves and their followers, with whom they had entered into similar arrangements, to attend in a particular war or campaign with a retinue of stipulated composition and strength. In the reign of Edward I., whose warlike enterprises after he was king were confined within the four seas, this alteration does not seem to have proceeded very far, and Scotland and Wales were subjugated by what was in the main if not exclusively a feudal militia raised as of old by writ to the earls and barons and the sheriffs.[3] But the armies of Edward III., Henry V., and Henry VI. during the century of intermittent warfare between England and France were recruited and sustained entirely on the principle of contract. On the Continent the systematic employment of mercenaries was both an early and a common practice. But the transition from the feudal régime to the régime of standing armies was everywhere sudden and abrupt as compared with the same process among ourselves.

The crusades.

Besides consideration for the mutual convenience of sovereigns and their feudatories, there were other causes which materially contributed towards bringing about the changes in the military system of Europe which were finally accomplished in the 13th and 14th centuries. During the crusades vast armies were set on foot in which feudal rights and obligations had no place, and it was seen that the volunteers who flocked to the standards of the various commanders were not less but even more efficient in the field than the vassals they had hitherto been accustomed to lead. It was thus established that pay, the love of enterprise, and the prospect of plunder,—if we leave zeal for the sacred cause which they had espoused for the moment out of sight,—were quite as useful for the purpose of enlisting troops and keeping them together as the tenure of land and the solemnities of homage and fealty. Moreover, the crusaders who survived the difficulties and dangers of an expedition to Palestine were seasoned and experienced although frequently impoverished and landless soldiers, ready to hire themselves to the highest bidder, and well worth the wages they received. Again, it was owing to the crusades that the church took the profession of arms under her peculiar protection, and thenceforward the ceremonies of initiation into it assumed a religious as well as a martial character. Nor was this by any means a merely gratuitous patronage of bloodshed on her part. In the ages of faith and chivalry, magic and sorcery were the terrors alike of the pious and the brave, and the blessings of the priest on the warrior, his weapons and his armor, were always regarded as the surest safeguards against the influence of hostile spells and enchantments. To distinguished soldiers of the cross the honors and benefits of knighthood could hardly be refused on the ground that they did not possess a sufficient property qualification,—of which perhaps they had in fact denuded themselves in order to their own and their retinue's equipment for the Holy War. And thus the conception of knighthood as a something wholly distinct from and independent of feudalism both as a social condition and a personal dignity arose and rapidly gained ground. It was then that the analogy was first detected which was afterwards more fully developed between the order of knighthood and the order of priesthood, and that an actual union of monachism and chivalry was effected by the establishment of the religious orders of which the Knights Templars and the Knights Hospitallers were the most eminent examples. As comprehensive in their polity as the Benedictines or Franciscans, they gathered their members from, and soon scattered their possessions over, every country in Europe. And in their indifference to the distinctions of race and nationality they merely accommodated themselves to the spirit which had become characteristic of chivalry itself, already recognized, like the church, as a universal institution which comprised and knit together the whole warrior caste of Christendom into one great fraternity, irrespective alike of feudal subordination and territorial boundaries. Somewhat later the adoption of hereditary surnames and armorial bearings marked the existence of a large and noble class who, either from the

Knighthood independent of feudalism.

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[1] Du Cange, *Gloss.*, *s. v.* "Hostis;" Brussel, *Usage Général des Fiefs*, p. 162 *sq.*

[2] Henry II. adopted the knight's fee instead of the hide as the basis of rating (in levying taxes) for the knights and barons, and under him escuage or scutage became "an honorable commutation for personal service." Littleton defines knight-service as tenure by "homage, fealty, and escuage;" and, although scutage may have been the name for the personal service represented by the tax, it had of course long been replaced by the tax itself when he wrote in the reign of Henry VI. See Coke-Littleton, bk. ii. chap. 4, sect. 103; Madox, *Baronia Anglica*, pp. 216-226; Pearson, *Early and Middle Ages*, vol. i. p. 591; Stubbs, *Constitutional History*, vol. i. pp. 581-590

[3] Stubbs, *Const. Hist.*, vol. ii. p. 278; also compare Grose, *Military Antiquities*, vol. i. p. 65 *sq.*

subdivision of fiefs or from the effects of the custom of primogeniture, were very insufficiently provided for. To them only two callings were generally open, that of the churchman and that of the soldier; and the latter as a rule offered greater attractions than the former in an era of much license and little learning. Hence the favorite expedient for men of birth, although not of fortune, was to attach themselves to some prince or magnate in whose military service they were sure of an adequate maintenance, and might hope for even a rich reward in the shape of booty or of ransom.[1] It is probably to this period and these circumstances that we must look for at all events the rudimentary beginnings of the military as well as the religious orders of chivalry. Of the existence of any regularly constituted companionships of the first kind there is no trustworthy evidence until between two and three centuries after fraternities of the second kind had been organized. Soon after the greater crusading societies had been formed, similar orders, such as those of St. James of Compostella, Calatrava, and Alcantara, were established to fight the Moors in Spain instead of the Saracens in the Holy Land. But the members of these orders were not less monks than knights; their statutes embodied the rules of the cloister, and they were bound by the ecclesiastical vows of celibacy, poverty, and obedience. From a very early stage in the development of chivalry, however, we meet with the singular institution of brotherhood in arms; and from it the ultimate origin if not of the religious fraternities at any rate of the military companionships is usually derived.[2] By this institution a relation was created between two or more knights by voluntary agreement which was regarded as of far more intimacy and stringency than any which the mere accident of consanguinity implied. Brothers in arms were supposed to be partners in all things save the affections of their "lady-loves." They shared in every danger and every success, and each was expected to vindicate the honor of another as promptly and zealously as his own. Their engagements usually lasted through life, but sometimes only for a specified period or during the continuance of specified circumstances, and they were always ratified by oath, occasionally reduced to writing in the shape of a solemn bond, and often sanctified by their reception of the eucharist together. Romance and tradition speak of strange rites—the mingling and even the drinking of blood—as having in remote and rude ages marked the inception of these martial and fraternal associations.[3] But in later and less barbarous times they were generally evidenced and celebrated by a formal and reciprocal exchange of weapons and armor. In warfare it was customary for knights who were thus allied to appear similarly accoutred and bearing the same badges or cognizances, to the end that their enemies might not know with which of them they were in conflict, and that their friends might be unable to accord more applause to one than to another for his prowess in the field. It seems likely enough, therefore, that at or soon after the period when the crusades had initiated the transformation of feudalism into chivalry as a military system, bodies banded together by engagements of fidelity, although free from monastic obligations, wearing a uniform or livery, and naming themselves after some special symbol or some patron saint of their adoption, were neither unknown nor even uncommon. And such bodies raised by or placed under the command of a sovereign or grand master, regulated by statutes and enriched by ecclesiastical endowments, would have been precisely what in after times such orders as the Garter in England, the Golden Fleece in Burgundy, the Annunciation in Savoy, and the St. Michael and Holy Ghost in France, actually were.[4] The knight too who had "won his spurs" was very differently esteemed from the knight who succeeded to them as an incident of his feudal tenure. In rank and the external ensigns of rank under the sumptuary regulations of the age they were equal. But it was the first and not the second who was welcomed in court and camp, who was invited to the "round tables" which the Arthurian romances brought into fashion among the potentates of mediæval Europe, and more particularly Edward III. and Philip VI. And thus it became the ambition of every aspirant to knighthood to gain it by his exploits rather than to claim it merely as his right by virtue of his position and estate. But there was one qualification for knighthood which was theoretically exacted even in England, and which was rigorously exacted abroad. Nobody could be legitimately created a knight who was not a gentleman of "name and arms," that is, who was not descended on both sides at the least from grandparents who were entitled to armorial bearings. And this condition is embodied in the statutes of every order of knighthood, religious or military, which can trace its origin to a period when chivalry was a social institution.[5]

Grades of knighthood.

During the 14th and 15th centuries, as well as somewhat earlier and later, the general arrangements of a European army were always and everywhere pretty much the same.[6] Under the sovereign the constable and the marshal or marshals held the chief commands, their authority being partly joint and partly several. Attendant on them were the heralds, who were the officers of their military court, wherein offences committed in the camp and field were tried and adjudged, and among whose duties it was to carry orders and messages, to deliver challenges and call truces, and to identify and number the wounded and the slain. The main divisions of the army were distributed under the royal and other principal standards, smaller divisions under the banners of some of the greater nobility or of knights banneret, and smaller divisions still under the pennons of knights or, as in distinction from knights banneret they came to be called, knights bachelors. All knights, whether bachelors or bannerets, were escorted by their squires. But the banner of the banneret always implied a more or less extensive command, while every knight was entitled to bear a pennon and every squire a pencel. All three flags were of such a size as to be conveniently attached to and carried on a lance, and were emblazoned with the arms or some portion of the bearings of their owners. But while the banner was square the pennon, which resembled it in other respects, was either pointed or forked at its extremity, and the pencel, which was considerably less than the others, always terminated in a single tail or streamer.[1] As we have already indicated, it became the custom from the time of the crusades to seek out and as far as possible to establish analogies between the institutions of chivalry and the church. In the military grades of the squire, the knight, and the banneret, therefore, were of course seen the representatives of the clerical grades of the deacon, the priest, and the bishop.[2] But despite that the ceremonies of ordination were unquestionably imitated in the ceremonies of knighting, there is no reason for supposing that the resemblance, such as it was, which obtained between the chivalrous and the ecclesiastical series of degrees was otherwise than accidental. Moreover, it failed in at least two material respects, namely, that squirehood although the usual was not the necessary preliminary to knighthood, and that in all the attributes of knighthood as knighthood a knight bachelor was as fully and completely a knight as a knight banneret. If indeed we look at the scale of chivalric subordination from another point of view, it seems to be more properly divisible into four than into three stages, of which two may be called provisional and two final. The bachelor and the banneret were both equally knights, only the one was of greater distinction and authority than the other. In like manner the squire and the page were both in training for knighthood, but the first had advanced further in the process than the second. It is true that the squire was a combatant while the page was not, and that many squires voluntarily served as squires all their lives owing to the insufficiency of their fortunes to support the costs and charges of knighthood. But in the ordinary course of a chivalrous education the successive conditions of page and squire were passed through in boyhood and youth, and the condition of knighthood was reached in early manhood. Every feudal court and castle was in fact a school of chivalry in which the sons of the sovereign and his vassals, or of the feudatory and his vassals, together commonly with those of some of their allies or friends, were reared in its principles and habituated to its customs and observances. And, although princes and great personages were rarely actually pages or squires, the moral and physical discipline through which they passed was not in any important particular different from that to which less exalted candidates for knighthood were subjected.[3] The page, or as he was more anciently and more correctly called, the "valet," or "damoiseau," commenced his service and instruction when he was between seven and eight years old, and the initial phase continued for seven or eight years longer. He acted as the constant personal attendant of both his master and mistress. He waited on them in their hall and accompanied them in the chase, served the lady in her bower and followed the lord to the camp.[4] From the chaplain and his mistress and her damsels he learnt the rudiments of religion, of rectitude, and of love;[5] from his masters and his squires the elements of military exercise, to cast a spear or dart, to sustain a shield, and to march with the measured tread of a soldier; and from his master and his huntsmen and falconers the "mysteries of the woods and rivers," or in other words the rules and practices of hunting and hawking. When he was between fifteen and sixteen he became a squire. But no sudden or great alteration was made in his mode of life. He continued to wait at dinner with the pages, although in a manner more dignified according to the notions of the age. He not only served but carved and helped the dishes, proffered the first or principal cup of wine to his master and his guests, and carried to them the basin, ewer, or napkin when they washed their hands before and after meat. He assisted in clearing the hall for dancing or minstrelsy, and laid the tables for chess or draughts, and he also shared in the pastimes for which he had made preparation. He brought his master the "vin de coucher" at night, and made his early refection ready for him in the morning. But his military exercises and athletic sports occupied an always increasing portion of the day. He accustomed himself to ride the "great horse," to tilt at the quintain, to wield the sword and battle-axe, to swim and climb, to run and leap, and to bear the weight and overcome the embarrassments of armor. He inured himself to the vicissitudes of heat and cold, and voluntarily suffered the pains or inconveniences of hunger and thirst, fatigue and sleeplessness. It was then, too, that he chose his "lady-love," whom he was expected to regard with an adoration at once earnest, respectful, and the more meritorious if concealed. And when it was considered that he had made sufficient advancement in his military accomplishments, he took his sword to the priest, who laid it on the altar, blessed it, and returned it to him.[6] Afterwards he either remained with his early master, relegating most of his domestic duties to his younger companions, or he entered the service of some valiant and adventurous lord or knight of his own selection. He now became a "squire of the body," and truly an "armiger" or "scutifer," for he bore the shield and armor of his leader to the field, and, what was a task of no small difficulty and hazard, cased and secured him in his panoply of war before assisting him to mount his courser or charger. It was his function also to display and guard in battle the banner of the baron or banneret or the pennon of the knight he served, to raise him from the ground if he were unhorsed, to supply him with another of his own horses if his was disabled or killed, to receive and keep any prisoners he might take, to fight by his side if he was unequally matched, to rescue him if captured, to bear him to a place of safety if wounded, and to bury him honorably when dead. And after he had worthily and bravely borne himself for six or seven years as a squire, the time came when it was fitting that he should be made a knight.

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[1] Sainte Palaye, *Mémoires sur l'Ancienne Chevalerie*, vol. i. pp. 363, 364, ed. 1781.

[2] Du Cange, *Dissertation sur Joinville*, xxi.; Sainte Palaye, *Mémoires*, vol. i. p. 272; Beltz, *Memorials of the Order of the Garter*, p. xxvii.

[3] Du Cange, *Dissertation*, xxi., and *Lancelot du Lac*, among other romances.

[4] Anstis, *Register of the Order of the Garter*, vol. i. p. 63.

[5] Being made to "ride the barriers" was the penalty for anybody who attempted to take part in a tournament without the qualification of name and arms. Hence the importance of the descents in geometrical progression commonly referred to as "sixteen quarters," beginning with "three descents" in England, "four lines" in France, "four quarters" in the empire, and "four branches" in Scotland. The books where this subject may be pursued are far too numerous to mention. Guillim (*Display of Heraldry*, p. 66) and Nisbet (*System of Heraldry*, vol. ii. p. 147) speak of it as concerning England and Scotland. See also Ashmole's *Order of the Garter*, p. 284. But in England knighthood has always been conferred to a great extent independently of these considerations. At almost every period there have been men of obscure and illegitimate birth who have been knighted. Ashmole cites Sandars's *Flandria Illustrata* to the effect that "the degree of knighthood is of so great splendor and fame that it bestows gentility not only upon a man meanly born but also upon his descendants, and very much increaseth the honor of those who are well descended." And he adds that "it is a maxim laid down by a learned civilian (Tiraquel, *De Nobilitate*) that knighthood ennobles, insomuch that whosoever is a knight it necessarily follows that he is also a gentleman (*Militia nobilitat ut quisquis est Miles is quoque continuo sit nobilis*), for, when a king gives the dignity to an ignoble person whose merit he would thereby recompense, he is understood to have conferred whatsoever is requisite for the completing of that which he bestows." By the common law, if a villain were made a knight, he was thereby enfranchised and accounted a gentleman, and if a person under age and in wardship were knighted, both his minority and wardship terminated. —*Order of the Garter*, p. 43; Nicolas, *British Orders of Knighthood*, vol. i. p. v.

[6] Grose, *Military Antiq.*, vol. i. p. 207 *sq.*; Stubbs, *Const. Hist.*, vol. ii. p. 276 *sq.*, and vol. iii. p. 278 *sq.*

Modes of conferring knighthood.

Two modes of conferring knighthood appear to have prevailed from a very early period in all countries where chivalry was known. In both of them the essential portion seems to have been the accolade. But while in the one the accolade constituted the whole or nearly the whole of the ceremony, in the other it was surrounded with many additional observances. As soon as we have any historical evidence of their separate and distinct existence, we discover them as severally appropriated, the first to time of war and the second to time of peace.[7] In one of the oldest records of chivalry quoted by Selden, under the heading of "Comment on doit faire et creer ung Chivalier," it is stated that "quant ung Escuier que a longement voyage et este en plusiers faicts d'armes et que a de quoy entretenir son estate et qu'il est de grant maison et rich et qu'il se trouve en un battaile on recounter il doit adviser le chiefe de l'armé ou vaillant chivalier. Alors doit venir devant luy et demander 'chivalier au nom de Dieu et de Sainct George donnez moy le ordre' et le dit chivalier ou chiefe de guerre doit tirer l'espee nue vers le dict demaundeur et doit dire en frappant trois fois sur iceuly: 'Je te fais chivalier au nom de Dieu et de mon seigneur Sainct George, pour la foy et justice loyalment garder et l'eglise, femes, vesves, et orphelins defender.' "[1] But the words of creation were various as well as the words of the exhortation. Sometimes the first were "avancez chevalier au nom de Dieu," or "au nom de Dieu, Saint Michel, et Saint George je te fais chevalier;" and the second "soyez preux, hardi, et loyal," "be a good knight in the name of God;" or "soyes bon chevalier," or "be a good knight," merely. In this form a number of knights were made before and after almost every battle between the 11th and the 16th centuries, and its advantages on the score of both convenience and economy gradually led to its general adoption both in time of peace and time of war. On extraordinary occasions indeed the more elaborate ritual continued to be observed. But recourse was had to it so rarely that among us about the beginning of the 15th century it came to be exclusively appropriated to a special kind of knighthood. When Segar, garter king of arms, wrote in the reign of Queen Elizabeth, this had been accomplished with such completeness that he does not even mention that there were two ways of creating knights bachelors. "He that is to be made a knight," he says, "is striken by the prince with a sword drawn upon his back or shoulder, the prince saying, 'Soys Chevalier,' and in times past was added 'Saint George.' And when the knight rises the prince sayeth 'Avencez.' This is the manner of dubbing knights at this present, and that term 'dubbing' was the old term in this point, not 'creating.' This sort of knights are by the heralds called knights bachelors."[2] In our days when a knight is personally made he kneels before the sovereign, who lays a sword drawn, ordinarily the sword of state, on either of his shoulders, and says, "Rise," calling him by his Christian name with the addition of "Sir" before it.[3]

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[1] Grose's *Military Antiquities*, vol. ii. p. 256.

[2] The same analogy may be drawn between bachelors, masters, and doctors; barristers, serjeants, and judges; or pursuivants, heralds, and kings of arms.

[3] Sainte Palaye, *Mémoires*, vol. i. p. 86; Froissart, bk. iii. chap. 9.

[4] Sainte Palaye, *Mémoires*, part i.; and Mills, *History of Chivalry*, vol. i. chap. 2.

[5] "Le petit Jehan de Saintré" is the great example on this point, especially the homily addressed to him by La Dame des Belles-Cousines. Therein she instructs him how he ought to love *par amours*. But Sir Walter Scott says that "so pure was the nature of the flame which she recommended that she maintained it to be inconsistent even with the seventh sin of chambering and wantonness, to which it might seem too nearly allied. The least dishonest thought or action was, according to her doctrine, sufficient to forfeit the chivalrous lover the favor of his lady. It seems, however, that the greater part of her charges concerning incontinence is levelled against such as haunted the receptacles of open vice, and that she reserved an exception (of which in the course of the history she made liberal use) in favor of the intercourse which in all love, honor, and secrecy might take place when the favored and faithful knight had obtained by long service the boon of amorous mercy from the lady whom he loved *par amours*" (article CHIVALRY in 7th and 8th editions of the *Encyclopædia Britannica*)

[6] Sainte Palaye, *Mémoires*, vol. i. p. 11 *sq.*:—"C'est peut-être à cette cérémonie et non à celles de la chevalerie qu'on doit rapporter ce qui se lit dans nos historiens de la première et de la seconde race au sujet des premières armes que les Rois et les Princes remettoient avec solemnité au jeunes Princes leurs enfans."

[7] There are several obscure points as to the relation of the longer and shorter ceremonies, as well as the origin and original relation of their several parts. There is nothing to show whence came "dubbing" or the "accolade." It seems certain that the word "dub" means to strike, and the usage is as old as the knighting of Henry by William the Conqueror (*supra*, pp. 113, 114). So, too, in the empire a dubbed knight is "ritter geschlagen." The "accolade" may etymologically refer to the embrace,

Very different were the solemnities which attended the creation of a knight when the complete procedure was observed. "The ceremonies and circumstances at the giving this dignity," says Selden, "in the elder time were of two kinds specially, which we may call courtly and sacred. The courtly were the feasts held at the creation, giving of robes, arms, spurs, and the like, whence in the stories of other nations so in those of ours 'armis militaribus donare' or 'cingulo militari,' and such more phrases are the same with 'militem facere' or to make a knight. The sacred were the holy devotions and what else was used in the church at or before the receiving of the dignity, whence also 'consecrare militem' was to make a knight. Those of the first kind are various in the memories that preserve them, and yet they were rarely or never without the girding with a sword until in the later ages wherein only the stroke on the neck or shoulder according to the use at this day hath most commonly supplied it."[4] Of these "ceremonies and circumstances" Selden gives several examples, especially those of the knighting of Geoffrey of Anjou by Henry I., of Alexander III. of Scotland by Henry III. of England, and of Edward Prince of Wales (afterwards Edward II.) by his father Edward I. But the leading authority on the subject is an ancient tract written in French, which will be found at length either in the original or translated by Segar, Dugdale, Byshe, and Nicolas, among other English writers.[5] Daniel explains his reasons for transcribing it, "tant à cause du detail que de la naiveté du stile et encore plus de la bisarrerie des ceremonies que se faisoient pourtant alors fort serieusement," while he adds that these ceremonies were essentially identical in England, France, Germany, Spain, and Italy.

The process of inauguration was commenced in the evening by the placing of the candidate under the care of two "esquires of honor grave and well seen in courtship and nurture and also in the feats of chivalry," who were to be "governors in all things relating to him." Under their direction, to begin with, a barber shaved him and cut his hair. He was then conducted by them to his appointed chamber, where a bath was prepared hung within and without with linen and covered with rich cloths, into which after they had undressed him he entered. While he was in the bath two "ancient and grave knights" attended him "to inform, instruct, and counsel him touching the order and feats of chivalry,' and when they had fulfilled their mission they poured some of the water of the bath over his shoulders, signing the left shoulder with the cross, and retired.[6] He was then taken from the bath and put into a plain bed without hangings, in which he remained until his body was dry, when the two esquires put on him a white shirt and over that "a robe of russet with long sleeves having a hood thereto like unto that of an hermit." Then the "two ancient and grave knights" returned and led him to the chapel, the esquires going before them "sporting and dancing" with "the minstrels making melody." And when they had been served with wines and spices they went away, leaving only the candidate, the esquires, "the priest, the chandler, and the watch" who kept the vigil of arms until sunrise, the candidate passing the night "bestowing himself in orisons and prayers." At daybreak he confessed to the priest, heard matins, and communicated in the mass, offering a taper and a piece of money stuck in it as near the lighted end as possible, the first "to the honor of God" and the second "to the honor of the person that makes him a knight." Afterwards he was taken back to his chamber, and remained in bed until the knights, esquires, and minstrels went to him, and aroused him. The knights then dressed him in distinctive garments, and they then mounted their horses and rode to the hall where the candidate was to receive knighthood; his future squire was to ride before him bareheaded bearing his sword by the point in its scabbard with his spurs hanging from its hilt. And when everything was prepared the prince or subject who was to knight him came into the hall, and, the candidate's sword and spurs having been presented to him, he delivered the right spur to the "most noble and gentle" knight present, and directed him to fasten it on the candidate's right heel, which he kneeling on one knee and putting the candidate's right foot on his

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accompanied by a blow with the hand, characteristic of the longer form of knighting. The derivation of "adouber," corresponding to "dub," from "adoptare," which is given by Du Cange, and would connect the ceremony with "adoptio per arma," is certainly inaccurate. The investiture with arms, which formed a part of the longer form of knighting, and which we have seen to rest on very ancient usage, may originally have had a distinct meaning. We have observed that Laufranc invested Henry I. with arms, while William "dubbed him to rider." If there was a difference in the meaning of the two ceremonies, the difficulty as to the knighting of Earl Harold (*supra*, p. 112) is at least partly removed.

[1] *Titles of Honor*, p. 455; *ib.*, 865.

[2] Segar, *Honor Civil and Military*, p. 74.

[3] Nicolas, *British Orders of Knighthood*, p. vii.

[4] Selden, *Titles of Honor*, p. 639.

[5] Daniel, *Histoire de la Milice Françoise*, vol. i. pp. 99–104; Byshe's Upton, *De Studio Militari*, pp. 21–44; Dugdale, *Warwickshire*, vol. ii. pp. 708–710; Segar, *Honor Civil and Military*, p. 69 *sq.*; and Nicolas, *Orders of Knighthood*, vol. ii. (*Order of the Bath*), p. 19 *sq.* It is given as "the order and manner of creating Knights of the Bath in time of peace according to the custom of England," and consequently dates from a period when the full ceremony of creating knights bachelors generally had gone out of fashion. But as Ashmole, speaking of Knights of the Bath, says, "if the ceremonies and circumstances of their creation be well considered, it will appear that this king [Henry IV.] did not institute but rather restore the ancient manner of making knights, and consequently that the Knights of the Bath are in truth no other than knights bachelors, that is to say, such as are created with those ceremonies wherewith knights bachelors were formerly created." (Ashmole, *Order of the Garter*, p. 15.) It is singular that Dugdale in his translation of this ancient formulary has accidentally omitted the actual dubbing or accolade. See also Selden, *Titles of Honor*, p. 578; and the *Archæological Journal*, vol. v. p. 258 *sq.*

[6] In another formulary in the Cotton MSS. (Tib. E. viii. f. 72), which is printed in full in the *Archæological Journal*, vol. v. p. 267 *sq.*, the shoulders of the candidate are to be signed with the sign of the cross, and in still another formulary among the Astley MSS. the cross was to be signed on the candidate's left shoulder only by the senior of the ancient and grave knights "in nomine patris," etc. In both, however, the cross is to be kissed by the officiating knight after he had signed it with the water.

knee accordingly did, signing the candidate's knee with the cross, and in like manner by another "noble and gentle" knight the left spur was fastened to his left heel. And then he who was to create the knight took the sword and girded him with it, and then embracing him he lifted his right hand and smote him on the neck or shoulder, saying, "Be thou a good knight," and kissed him. When this was done they all went to the chapel with much music, and the new knight laying his right hand on the altar promised to support and defend the church, and ungirding his sword offered it on the altar. And as he came out from the chapel the master cook awaited him at the door and claimed his spurs as his fee, and said, "If you do anything contrary to the order of chivalry (which God forbid), I shall hack the spurs from your heels."

As may be gathered from Selden, Favyn, La Colombiers, Menestrier, and Sainte Palaye, there were several differences of detail in the ceremony at different times and in different places. But in the main it was everywhere the same both in its military and its ecclesiastical elements. In the *Pontificale Romanum*, the old *Ordo Romanus*, and the manual or Common Prayer Book in use in England before the Reformation forms for the blessing or consecration of new knights are included, and of these the first and the last are quoted by Selden.[1] But the full solemnities for conferring knighthood seem to have been so largely and so early superseded by the practice of dubbing or giving the accolade alone that in England it became at last restricted to such knights as were made at coronations and some other occasions of state. And to them the particular name of knights of the bath was assigned, while knights made in the ordinary way were called in distinction from them knights of the sword, as they were also called knights bachelors in distinction from knights banneret.[2] It is usually supposed that the first creation of Knights of the Bath under that designation was at the coronation of Henry IV.; and before the Order of the Bath as a companionship or capitular body was instituted the last creation of them was at the coronation of Charles II. But all knights were also knights of the spur or "equites aurati," because their spurs were golden or gilt,—the spurs of squires being of silver or white metal,—and these became their peculiar badge in popular estimation and proverbial speech. In the form of their solemn inauguration too, as we have noticed, the spurs together with the sword were always employed as the leading and most characteristic ensigns of knighthood.[3]

With regard to knights banneret various opinions have been entertained as to both the nature of their dignity and the qualifications they were required to possess for receiving it at different periods and in different countries. On the Continent the distinction which is commonly but incorrectly made by us between the nobility and the gentry has never arisen, and it was unknown here while chivalry existed and heraldry was understood. Here, as elsewhere in the old time, a nobleman and a gentleman meant the same thing, namely, a man who under certain conditions of descent was entitled to armorial bearings. Hence Du Cange divides the mediæval nobility of France and Spain into two classes:—first, barons or ricos hombres; secondly, chevaliers or caballeros; and thirdly, écuyers or infanzons; and to the first, who with their several special titles constituted the greater nobility of either country he limits the designation of banneret and the right of leading their followers to war under a banner, otherwise a "drapeau quarré" or square flag.[4] Selden mentions as an instance of "the nearness and sometimes community of the title of banneret and baron," the "bannerherr" or "dominus vexillifer" of the empire. And he also shows especially from the parliament rolls that the term banneret has been occasionally employed in England as equivalent to baron, where, for example, in the reign of Richard II. among "divers other earls and barons there mentioned by name, 'plusiers autres barons et bannerets esteants au dit parlament assemblez'" are referred to.[5] In Scotland even, as late as the reign of James VI., lords of parliament were always created bannerets as well as barons at their investiture, "part of the ceremony consisting in the display of a banner, and such 'barones majores' were thereby entitled to the privilege of having one borne by a retainer before them to the field of a quadrilateral form."[6] In Scotland, too, lords of parliament and bannerets were also called bannerents, banrents, or baronets, and in England banneret was often corrupted to baronet. "Even in a patent passed to Sir Ralph Fane, knight under Edward VI., he is called 'baronettus' for 'bannerettus.'"[7] In this manner it is not improbable that the title of baronet may have been suggested to the advisers of James I., when the Order of Baronets was originally created by him, for it was a question whether the recipients of the new dignity should be designated by that or some other name.[8] But there is no doubt that as previously used it was merely a corrupt synonym for banneret, and not the name of any separate dignity. On the Continent, however, there are several recorded examples of bannerets who had an hereditary claim to that honor and its attendant privileges on the ground of the nature of their feudal tenure.[9] And generally, at any rate to commence with, it seems probable that bannerets were in every country merely the more important class of feudatories, the "ricos hombres" in contrast to the knights bachelors, who in France in the time of St. Louis were known as "pauvres hommes." In England all the barons or greater nobility were entitled to bear banners, and therefore Du Cange's observations would apply to them as well as to the barons or greater nobility of France and Spain. But it is clear that from a comparatively early period bannerets whose claims were founded on personal distinction rather than on feudal tenure gradually came to the front, and much the same process of substitution appears to have gone on in their case as that which we have marked in the case of simple knights. According to the *Sallade* and the *Division du Monde*, as cited by Selden, bannerets were clearly in the beginning feudal tenants of a certain magnitude and importance and nothing more, and different forms for their creation are given in time of peace and in time of war.[10] But in the French *Gesta Romanorum* the warlike form alone is given, and it is quoted by both Selden and Du Cange. From the latter a more modern version of it is given by Daniel as the only one generally in force. "Quand un bachelier," says the ceremonial in question, "a grandement servi et suivi la guerre et que il a terre assez et qu'il puisse avoir gentilshommes ses hommes et pour accompagner sa bannière il peut licitement lever bannière et non autrement; car nul homme ne doit lever bannière en bataille s'il n'a du moins cinquante hommes d'armes, tous ses hommes, et les archiers et les arbelestriers qui y appartiennent, et s'il les a, il doit à la première baitaille ou il se trouvera apporter un pennon de ses armes et doit venir au connetable ou aux maréchaux ou à celui qui sera lieutenant de l'ost pour le prince et requirir qu'il porte bannière, et s'il lui octroyent doit sommer les herauts pour temoignage et doivent couper la queue du pennon."[1] The earliest contemporary mention of knights banneret is in France, Daniel says, in the reign of Philip Augustus, and in England, Selden says, in the reign of Edward I. But in neither case is reference made to them in such a manner as to suggest that the dignity was then regarded as new or even uncommon, and it seems pretty certain that its existence on one side could not have long preceded its existence on the other side of the Channel. Sir Alan Plokenet, Sir Ralph Daubeney, and Sir Philip Daubeney are entered as bannerets on the roll of the garrison of Caermarthen castle in 1282, and the roll of Carlaverock records the names and arms of eighty-five bannerets who accompanied Edward I. in his expedition into Scotland in 1300. Selden quotes some and refers to many of the wardrobe accounts of Edward II. in which contracts with and payments to bannerets are mentioned, observing that "under these bannerets divers knights bachelors and esquires usually served, and according to the number of them the bannerets received wages."[2] What the exact contingent was which they were expected to supply to the royal host is doubtful. In the authorities collected by Selden, Du Cange, and Daniel it varies from ten and twenty-five to fifty men-at-arms with their attendants. Grose seems to prefer the medium estimate of a hundred mounted combatants in all, that number forming a square of ten on each face and being the lowest equivalent of the more modern squadron.[3] But, however this may be, in the reign of Edward III. and afterwards bannerets appear as the commanders of a military force raised by themselves and marshalled under their banners—although paid through them by the sovereign—who were moreover always persons of property and soldiers of distinction. At the same time their status and their relations both to the crown and their followers were the consequences of voluntary contract, not of feudal tenure. It is from the reigns of Edward III. and Richard II. also that the two best descriptions we possess of the actual creation of a banneret have been transmitted to us. During Edward the Black Prince's expedition of 1367 into Spain, Sir John Chandos, one of the founder Knights of the Garter, was made a banneret on the morning of the day on which the battle of Navarrete was fought. When the troops were drawn up in order before the action commenced, "Sir John Chandos," says Froissart, "advanced in front of the battalions with his banner uncased in his hand. He presented it to the prince, saying, 'My lord, here is my banner; I present it to you that I may display it in whatever manner shall be most agreeable to you; for, thanks to God, I have now sufficient lands to enable me to do so and maintain the rank which it ought to hold.' The Prince, Don Pedro being present, took the banner in his hands, which was blazoned with a sharp stake gules on a field argent; after having cut off the tail to make it square, he displayed it, and returning it to him by the handle said, 'Sir John, I return you your banner: God give you strength and honor to preserve it.' Upon this Sir John left the prince, went back to his men with the banner in his hand, and said to them, 'Gentlemen, behold my banner and yours; you will therefore guard it as it becomes you.' His companions taking the banner replied with much cheerfulness that 'if it pleased God and St. George they would defend it well and act worthily of it to the utmost of their abilities.'"[4] At a later period some distinction appears to have been made between bannerets who were created under the royal standard, the king himself being present with his army in open war, and bannerets who were created only by the king's lieutenants, as Sir John Chandos and Sir Thomas Trivet were created. But no such distinction seems to have existed in the reigns of Edward III. and Richard II.; and, although it was doubtless of more ancient origin, the earliest contemporary evidence of its existence is of the reign of James I., when bannerets, whether of one or two classes, had practically disappeared. Sir Thomas Smith, writing towards the end of the 16th century, says, after noticing the conditions to be observed in the creation of bannerets, "but this order is almost grown out of use in England;"[5] and during the controversy which arose between the new order of baronets and the crown early in the 17th century respecting their precedence[6] it was alleged without contradiction in an argument on behalf of the baronets before the privy council that "there are not bannerets now in being, peradventure never shall be."[7] Sir Ralph Fane, Sir Francis Bryan, and Sir Ralph Sadler were created bannerets by the Lord Protector Somerset after the battle of Pinkie in 1547, and the better opinion is that this was the last occasion on which the dignity was conferred. It has been stated indeed that Charles I. created Sir John Smith a banneret after the battle of Edgehill in 1642 for having rescued the royal standard from the enemy. But of this there is no sufficient proof. It was also supposed that George III. had created several naval officers bannerets towards the end of the last century, because he knighted them on board ship under the royal standard displayed.[8] This, however, is unquestionably an error. Knights bannerets were not distinguished from knights bachelors merely because they were created under the standard or banner of the sovereign, but further because their own pennons were converted into or exchanged for banners.

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[1] *Titles of Honor*, pp. 369 and 648. See also p. 367 for the ceremonies observed at the knighting of William, count of Holland, when he was elected king of the Romans in 1247, and Selden's remarks and authorities with respect to the disuse of the ancient form of investiture with arms in the empire.

[2] Selden, *Titles of Honor*, p. 678; Ashmole, *Order of the Garter*, p. 15; Favyn, *Théâtre de Honneur*, vol. ii. p. 1035.

[3] "If we sum up the principal ensigns of knighthood, ancient and modern, we shall find they have been or are a horse, gold ring, shield and lance, a belt and sword, gilt spurs, and a gold chain or collar."—Ashmole, *Order of the Garter*, pp. 12, 13.

[4] On the banner see Grose, *Military Antiquities*, vol. ii. p. 257; and Nicolas, *British Orders of Knighthood*, vol. i. p. xxxvii.

[5] *Titles of Honor*, pp. 356 and 608. See also Hallam, *Middle Ages*, vol. iii. p. 126 *sq.*, and Stubbs, *Const. Hist.*, vol. iii. p. 440 *sq.*

[6] Riddell's *Law and Practice in Scottish Peerages*, p. 578. Also Nisbet's *System of Heraldry*, vol. ii. p. 49; and Selden's *Titles of Honor*, p. 702.

[7] Selden, *Titles of Honor*, pp. 608 and 657.

[8] See "Project concerninge the conferinge of the title of vidom," wherein it is said that "the title of vidom (vicedominus) was an ancient title used in this kingdom of England both before and since the Norman Conquest" (*State Papers*, James I. Domestic Series, vol. lxiii. p. 150 B, probable date April, 1611).

[9] Selden, *Titles of Honor*, p. 452 *sq.*

[10] Selden, *Titles of Honor*, p. 449 *sq.*

Existing orders of knighthood.

On the Continent the degree of knight bachelor disappeared with the military system which had given rise to it. It is now therefore peculiar to the United Kingdom, where, although very frequently conferred by letters patent, it is yet the only dignity which is still even occasionally created—as every dignity was formerly created—by means of a ceremony in which the sovereign and the subject personally take part. Everywhere else dubbing or the accolade seems to have become obsolete, and no other species of knighthood, if knighthood it can be called, is known except that which is dependent on admission to some particular order. It is a common error to suppose that baronets are hereditary knights. Baronets are not knights unless they are knighted like anybody else; and, so far from being knights because they are baronets, one of the privileges granted to them shortly after the institution of their dignity was that they, not being knights, and their successors and their eldest sons and heirs apparent, should, when they attained their majority, be entitled if they desired to receive knighthood.[9] It is a maxim of the law indeed that, as Coke says, "the knight is by creation and not by descent," and, although we hear of such designations as the "knight of Kerry" or the "knight of Glin," they are no more than traditional nicknames, and do not by any means imply that the persons to whom they are applied are knights in a legitimate sense. Notwithstanding, however, that simple knighthood has gone out of use abroad, there are innumerable grand crosses, commanders, and companions of a formidable assortment of orders in almost every part of the world,[1] from that of the Golden Fleece of Spain and Austria to those of St. Charles of Monaco and of King Kamehameha of the Sandwich Islands. But, with the exception of the orders of the Golden Fleece founded by Philip II., duke of Burgundy, in 1429, and of the Annunciation founded by Charles III., duke of Savoy, in 1518—now that the orders of St. Michael founded by Louis XI. and of the Holy Ghost founded by Henry III. of France, in 1469 and 1578, are either extinct or in abeyance—none of the foreign military as distinguished from the religious orders of knighthood have any actual historical connection with chivalry. The orders of the Genet of France and the Oak of Navarre of course are to be classed as mere fictions with the order of the Round Table of Britain. But the pretensions of almost every other foreign order to extreme antiquity, as for example of the Elephant and Dannebrog of Denmark, the White Eagle of Poland, or the Seraphim of Sweden, if they are less obviously extravagant, are not more susceptible of verification. It has nearly always been the practice even in modern days to represent the establishment as the revival or reorganization of an order. We ourselves have seven orders of knighthood, the Garter, the Thistle, St. Patrick, the Bath, the Star of India, St. Michael and St. George, and the Indian Empire; and while the first is undoubtedly the oldest as well as the most illustrious anywhere existing, a fictitious antiquity has been claimed and is even still frequently conceded to the second and fourth, although the third, fifth, sixth, and seventh appear to be as contentedly as they are unquestionably recent.

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[1] Du Cange, *Dissertation IX.;* Selden, *Titles of Honor*, p. 452; Daniel, *Milice Françoise*, vol. i. p. 86.

[2] Selden, *Titles of Honor*, p. 656.

[3] *Military Antiquities*, vol. ii. p. 206.

[4] Froissart, bk. i. chap. 241. The other case is that of Sir Thomas Trivet in 1380 (Froissart, bk. ii. chap. 53).

[5] *Commonwealth of England*, p. 48, ed. 1640.

[6] By the decree of 1612 on the precedence of baronets they are placed after the younger sons of viscounts and barons, who came next to "bannerets made by the sovereign in person under the royal standard displayed in an army royal in open war," and immediately before "bannerets not made by the sovereign in person," and are still so ranked in all the "Tables of Precedence (see Selden, *Titles of Honor*, p. 749, 750).

[7] *State Papers*, Domestic Series, James the First, vol. lxvii. p. 119.

[8] "Thursday, June 24th: His Majesty was pleased to confer the honor of knights banneret on the following flag officers and commanders under the royal standard, who kneeling kissed hands on the occasion: Admirals Pye and Sprye, Captains Knight, Bickerton, and Vernon" (*Gentleman's Magazine*, vol. xliii. p. 299, 1773). Sir Harris Nicolas remarks on these and the other cases (*British Orders of Knighthood*, p. xliii.), and Sir William Fitzherbert published anonymously a pamphlet on the subject, *A Short Inquiry into the Nature of the Titles Conferred at Portsmouth*, etc., which is very scarce, but is to be found under the name of "Fitzherbert" in the catalogue of the British Museum Library.

[9] "Sir Henry Ferrers, Baronet, was indicted by the name of Sir Henry Ferrers, Knight, for the murther of one Stone whom one Nightingale feloniously murthered, and that the said Sir Henry was present aiding and abetting, etc. Upon this indictment Sir Henry Ferrers being arraigned said he never was knighted, which being confessed, the indictment was held not to be sufficient,

Order of the Garter.

It is, however, certain that the "most noble" Order of the Garter at least was instituted in the middle of the 14th century, when, to use Hallam's words, the court of England "was the sun as it were of that system which embraced the valor and nobility of the Christian world," when "chivalry was in its zenith, and in all the virtues which adorned the knightly character none were so conspicuous as Edward III. and the Black Prince." But in what particular year this event occurred is and has been the subject of much difference of opinion. All the original records of the order until after 1416 have perished, and consequently the question depends for its settlement not on direct testimony but on inference from circumstances. The dates which have been selected vary from 1344 to 1351, and it is a matter of some historical interest and importance to determine so far as it is practicable which of them is probably accurate, since Dr. Stubbs cites the fact of "Edward III. celebrating his great feast on the institution of the Order of the Garter in the midst of the Black Death" as a "typical illustration" of the heartlessness and want of sympathy between classes which he holds to have been characteristic of the age.[2] The Black Death made its appearance on the coast early in August, 1348, reached the capital in the following November, and spreading over the country raged until the end of September, 1349. Hence Dr. Stubbs apparently agrees with Ashmole (who based his opinion on the preamble to the two earliest but evidently not contemporary copies of the statutes) in referring the institution of the order and the accompanying feast to St. George's Day in the April of the second of these two years.[3] Mr. Longman thinks that the order was "finally established" in 1347;[4] Mr. Beltz contends that it was founded in 1344, as Froissart, who wrote in the reign of Edward III. and Richard II., affirms, while Sir Harris Nicolas maintains that, although it is not impossible that Edward III. may have determined to found an order of knighthood in 1344, when he invited knights of all countries to jousts at Windsor and revived the feast of the Round Table, of which Froissart speaks, yet "the details of the Order of the Garter were not settled (even if the institution itself was contemplated), the companions appointed, nor the name or ensigns established until the latter part of 1347 or early in 1348."[5] And, without going fully into the evidence, which may be examined at length in Nicolas and Beltz, it is indisputable that in the wardrobe account from September, 1347, to January, 1349, the 21st and 23d Edward III., the issue of certain habits with garters and the motto embroidered on them is marked for St. George's Day, that similar vestments for the king and others on occasions not connected with the order are recorded as having been delivered in 1347 at the Christmas games at Guildford and the tournaments at Bury, Windsor, Lichfield, and Eltham, that the letters patent relating to the preparation of the royal chapel at Windsor are dated in August, 1348, and that in the treasury accounts of the Prince of Wales there is an entry in November, 1348, of the gift by him of "twenty-four garters to the knights of the Society of the Garter."[6] But that the order, although from this manifestly already fully constituted in the autumn of 1348, was not in existence before the summer of 1346 Sir Harris Nicolas holds, on the ground that nobody who was not a knight could under its statutes have been admitted to it, and that neither the Prince of Wales nor several others of the original companions were knighted until the middle of that year. Mr. Beltz, following a suggestion of Anstis, had endeavored to overcome this difficulty by assuming that the Black Prince had been knighted in his infancy, and that he was made a banneret at the age of fifteen. But, although it was not unusual for the sons of sovereigns and great feudatories to be knighted when they were children, and even at their baptism, it is beyond question, as Sir Harris Nicolas points out, that in England only commoners could be formally created bannerets. All knights of or above the rank of a baron were at once entitled to bear their banners in the field. And that the Prince of Wales was knighted on the landing of Edward III.'s expedition against France at La Hogue, in July, 1346, there can be no doubt. It seems pretty clear, however, that the Order of the Garter was instituted and the great feast celebrated, not in the midst of the Black Death, but at any rate some months before its ravages commenced. Regarding the occasion there has been almost as much controversy as regarding the date of its foundation. The "vulgar and more general story," as Ashmole calls it, is that of the countess of Salisbury's garter. But commentators are not at one as to which countess of Salisbury was the heroine of the adventure, whether she was Katherine Montacute or Joan the Fair Maid of Kent, while Heylyn rejects the

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wherefore he was indicted *de novo* by the name of Sir Henry Ferrers, Baronet." Brydall, *Jus Imaginis apud Anglos, or the Law of England relating to the Nobility and Gentry*, p. 50, London, 1675. After the dispute between the baronets and the younger sons of viscounts and barons for precedence in 1612, it was declared by James I., among other concessions to them, that "his Majesty is pleased to knight the present baronets that are no knights," and that for the future all baronets and their eldest sons and heirs apparent should be knighted if they pleased to apply for knighthood when they came or were of age.—*Patent Rolls*, 10 Jac. I., part x. No. 18; Selden, *Titles of Honor*, p. 687.

[1] Louis XIV. introduced the practice of dividing the members of military orders into several degrees when he established the order of St. Louis in 1693.

[2] *Const. Hist.*, vol. ii. p. 624.

[3] Ashmole, *Order of the Garter*, p. 187; Anstis, *Order of the Garter*, vol. i. p. 92. Selden, in the first edition of *Titles of Honor*, gives 1347, and the last edition 1344. Barnes in his *Life of Edward III.*, and Beltz in his *Memorials*, p. xxx., collect the various older authorities.

[4] *Life of Edward III.*, vol. i. p. 298.

[5] *Orders of Knighthood*, vol. i. p. lxxi. and pp. 9–16.

[6] Beltz, *Memorials*, p. 385.

legend as "a vain idle romance derogatory both to the founder and the order, first published by Polydor Vergil, a stranger to the affairs of England, and by him taken upon no better ground than *fama vulgi*, the tradition of the common people, too trifling a foundation for so great a building," and Anstis says that "it is now no more credited than the absurd, ridiculous relation of Micheli Marquez that this order, termed from the Greek language Periscelidis Ordo, was erected to the memory of one Periscelide, a true fairy queen, or the whimsical dream of Mr. Joshua Barnes in his far-fetched derivation of it from the Cabiri among the Samothracians."[1] Ashmole, however, while denying that any such accident became the principal cause of creating the order, will not altogether repudiate the allegation that "the king may have picked up a garter at some solemn ball or festivity,"—the queen's garter, some have said,—while she and not he made use of the memorable words "Honi soit qui mal y pense."[2] Another legend is that contained in the preface to the Register or Black Book of the order, compiled in the reign of Henry VIII., by what authority supported is unknown, that Richard I., while his forces were employed against Cyprus and Acre, had been inspired through the instrumentality of St. George with renewed courage and the means of animating his fatigued soldiers by the device of tying about the legs of a chosen number of knights a leathern thong or garter, to the end that being thereby reminded of the honor of their enterprise they might be encouraged to redoubled efforts for victory. This was supposed to have been in the mind of Edward III. when he fixed on the garter as the emblem of the order, and it was stated so to have been by Taylor, master of the rolls, in his address to Francis I. of France on his investiture in 1527.[3] According to Ashmole the true account of the matter is that, "King Edward having given forth his own garter as the signal for a battle which sped fortunately (which with Du Chesne we conceive to be that of Cressy, fought almost three years after the setting up of the Round Table at Windsor, rather than with the author of the 'Nouveau Théâtre du Monde' that of Poictiers, which happened above seven years after the foundation of the order and whereat King Edward was not present), the victory, we say, being happily gained, he thence took occasion to institute this order, and gave the garter (assumed by him for the symbol of unity and society) pre-eminence among the ensigns of it, whence that select number whom he incorporated into a fraternity are frequently styled 'equites aureæ periscelidis' and vulgarly knights of the garter."[4] Ashmole and Beltz also see in the order a reference to the king's French claims, and remark that the color of the garter is the tincture of the field of the French arms. But, as Sir Harris Nicolas points out,—although Ashmole is not open to the correction,—this hypothesis rests for its plausibility on the assumption that the order was established before the invasion of France in 1346. And he further observes that "a great variety of devices and mottoes were used by Edward III.; they were chosen from the most trivial causes and were of an amorous rather than of a military character. Nothing," he adds, "is more likely than that in a crowded assembly a lady should accidentally have dropped her garter; that the circumstance should have caused a smile in the bystanders; and that on its being taken up by Edward he should have reproved the levity of his courtiers by so happy and chivalrous an exclamation, placing the garter at the same time on his own knee, as 'Dishonored be he who thinks ill of it.' Such a circumstance occurring at a time of general festivity, when devices, mottoes, and conceits of all kinds were adopted as ornaments or badges of the habits worn at jousts and tournaments, would naturally have been commemorated as other royal expressions seem to have been by its conversion into a device and motto for the dresses at an approaching hastilude."[5] Moreover, Sir Harris Nicolas contends that the order had no loftier immediate origin than a joust or tournament. It consisted of the king and the Black Prince, and twenty-four knights divided into two bands of twelve like the tilters in a hastilude—at the head of the one being the first, and of the other the second; and to the companions belonging to each, when the order had superseded the Round Table and had become a permanent institution, were assigned stalls either on the sovereign's or the prince's side of St. George's Chapel. That Sir Harris Nicolas is accurate in this conjecture seems probable from the selection which was made of the "founder knights." As Mr. Beltz observes, the fame of Sir Reginald Cobham, Sir Walter Manny, and the earls of Northampton, Hereford, and Suffolk, was already established by their warlike exploits, and they would certainly have been among the original companions had the order been then regarded as the reward of military merit only. But, although these eminent warriors were subsequently elected as vacancies occurred, their admission was postponed to that of several very young and in actual warfare comparatively unknown knights, whose claims to the honor may be most rationally explained on the assumption that they had excelled in the particular feats of arms which preceded the institution of the order. The order was dedicated to St. George of Cappadocia and St. Edward the Confessor, and its feast or solemn annual convention was kept at Windsor on St. George's Day, the 23d of April, with little interruption from the reign of Edward III. to the reign of Queen Elizabeth. But a few years after the Restoration the celebration was altogether discontinued. The original companionship had consisted of the sovereign and twenty-five knights, and no change was made in this respect until 1786, when the sons of George III. and his successors were made eligible notwithstanding, that the chapter might be complete. In 1805 another alteration was effected by the provision that the lineal descendants of George II. should be eligible in the same manner, except the Prince of Wales for the time being, who was declared to be "a constituent part of the original institution;" and again in 1831 it was further ordained that the privilege accorded to the lineal descendants of George II. should extend to the lineal descendants of George I. The power of making and modifying the statutes of the order as exemplified in these innovations had from the beginning belonged to the whole fraternity, and it was only in the reign of Charles II. that it was surrendered to the sovereign. But the knights still continued, at any rate formally, to elect their companions, and the gorgeous and elaborate ceremonies of installation were still regarded as requisite to the full reception of knights-elect. Since the beginning of the reign of George III., however, both chapters and installations became more and more occasional, and it is now the established custom for the sovereign altogether to dispense with them. Although, as Sir Harris Nicolas observes, nothing is now known of the form of admitting ladies into the order, the description applied to them in the records during the 14th and 15th centuries leaves no doubt that they were regularly received into it. The queen consort, the wives and daughters of knights, and some other women of exalted position, were designated "Dames de la Fraternité de St. George," and entries of the delivery of robes and garters to them are found at intervals in the Wardrobe Accounts from the 50th Edward III. (1376) to the 10th of Henry VII. (1495), the first being Isabel, countess of Bedford, the daughter of the one king, and the last being Margaret and Elizabeth, the daughters of the other king. The effigies of Margaret Byron, wife of Sir Robert Harcourt, K. G., at Stanton Harcourt, and of Alice Chaucer, wife of

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[1] Heylyn, *Cosmographie and History of the Whole World*, book i. p. 286; Anstis, *Order of the Garter*, vol. i. p. 62.

[2] *Order of the Garter*, p. 182.

[3] Beltz, *Memorials*, p. xlvi.

[4] *Order of the Garter*, p. 183.

[5] *Orders of Knighthood*, vol. i. p. lxxxiii.

William de la Pole, duke of Suffolk, K. G., at Ewelme, which dates from the reigns of Henry VI. and Edward IV., have garters on their left arms. At a chapter in 1637 an attempt was made to revive the practice of issuing the ensigns of the order to ladies. Sir James Palmer, acting as a deputy for Sir Thomas Rowe, the chancellor of the order, moved the sovereign that the wives of the knights companions might have the privilege of wearing "a garter of the order about their arms and an upper robe at festival times, according to ancient usage." The matter was referred by Charles I. to the queen, and another chapter was appointed for the purpose of taking it into final consideration. But owing to the civil war nothing further was done in the matter. At present the officers of the order are five—the prelate, chancellor, register, king of arms, and usher—the first, third, and fifth having been attached to it from the commencement, while the fourth was added by Henry V. and the second by Edward IV. The prelate has always been the bishop of Winchester; the chancellor was formerly the bishop of Salisbury, but is now the bishop of Oxford; the registership and the deanery of Windsor have been united since the reign of Charles I.; the king of arms, whose duties were in the beginning discharged by Windsor herald is garter principal king of arms; and the usher is the gentleman usher of the Black Rod.

Other British orders.

The other orders of knighthood subsisting in the British empire must be spoken of more briefly. The "most ancient" Order of the Thistle was founded by James II. in 1687, and dedicated to St. Andrew. It consisted of the sovereign and eight knights companions, and fell into abeyance at the Revolution of 1688. In 1703 it was revived by Queen Anne, when it was ordained to consist of the sovereign and twelve knights companions, the number being increased to sixteen by statute in 1827. The "most illustrious" Order of St. Patrick was instituted by George III. in 1788, to consist of the sovereign, the lord lieutenant of Ireland as grand master, and fifteen knights companions, enlarged to twenty-two in 1833. The "most honorable" Order of the Bath was established by George I. in 1725, to consist of the sovereign, a grand master, and thirty-six knights companions. This was a pretended revival of an order supposed to have been created by Henry IV. at his coronation in 1399. But, as we have before shown, no such order existed. Knights of the Bath, although they were allowed precedence before knights bachelors, were merely knights bachelors who were knighted with more elaborate ceremonies than others and on certain great occasions. After the so-called revival the grand mastership merged in the crown on the death of John, duke of Montagu, the first tenant of the office in 1749, and in 1815 and again in 1847 the constitution of the order was remodelled. Exclusive of the sovereign, royal princes, and distinguished foreigners, it is limited to fifty military and twenty-five civil knights grand crosses, one hundred and twenty-three military and eighty civil knights commanders, and six hundred and ninety military and two hundred and fifty civil companions. The "most distinguished" Order of St. Michael and St. George was founded by the prince regent, afterwards George IV., in 1818, in commemoration of the British protectorate of the Ionian Islands, "for natives of the Ionian Islands and of the island of Malta and its dependencies, and for such other subjects of his majesty as may hold high and confidential situations in the Mediterranean." By statute of 1832 the lord high commissioner of the Ionian Islands was to be the grand master, and the order was directed to consist of fifteen knights grand crosses, twenty knights commanders, and twenty-five cavaliers or companions. After the repudiation of the British protectorate of the Ionian Islands, the order was placed on a new basis, and by letters patent of 1868 and 1877 it was extended and provided for such of "the natural born subjects of the crown of the United Kingdom as may have held or shall hold high and confidential offices within her Majesty's colonial possessions, and in reward for services rendered to the crown in relation to the foreign affairs of the empire." It is now limited to fifty knights grand crosses, of whom the first or principal is grand master, exclusive of extra and honorary members, of one hundred and fifty knights companions, and two hundred and sixty companions. It ranks between the "most exalted" Order of the Star of India and the Order of the Indian Empire, of both of which the viceroy of India for the time being is *ex officio* grand master. Of these the first was instituted in 1861 and enlarged in 1876, and the second was established in 1878 in commemoration of the Queen's assumption of the imperial style and title of the empress of India. Of the Star of India there may be thirty knights grand commanders, seventy-two knights commanders, and one hundred and fifty-four companions, while of the Indian Empire there may be an unlimited number of companions, among whom the councillors of her majesty for her Indian Empire are included by virtue of their office and for life.

Persons empowered to confer knighthood.

It has been the general opinion, as expressed by Sainte Palaye and Mills, that formerly all knights were qualified to confer knighthood.[1] But it may be questioned whether the privilege was thus indiscriminately enjoyed even in the earlier days of chivalry. It is true that as much might be inferred from the testimony of the romance writers; historical evidence, however, tends to limit the proposition, and the sounder conclusion appears to be, as Sir Harris Nicolas says, that the right was always restricted in operation to sovereign princes, to those acting under their authority or sanction, and to a few other personages of exalted rank and station.[2] In several of the writs for distraint of knighthood from Henry III. to Edward III. a distinction is drawn between those who are to be knighted by the king himself or by the sheriffs of counties respectively, and we have seen that bishops and abbots could make knights in the 11th and 12th centuries.[3] At all periods the commanders of the royal armies had the power of conferring knighthood; as late as the reign of Elizabeth it was exercised among others by Sir Henry Sidney in 1583, and Robert, earl of Essex, in 1595, while under James I. an ordinance of 1622, confirmed by a proclamation of 1623, for the registration of knights in the college of arms, is rendered applicable to all who should receive knighthood from either the king or any of his lieutenants.[4] Many sovereigns, too, both of England and of France, have been knighted after their accession to the throne by their own subjects, as for instance, Edward III. by Henry, earl of Lancaster, Edward VI. by the Lord Protector Somerset, Louis IX. by Philip, duke of Burgundy, and Francis I. by the Chevalier Bayard. But when in 1543 Henry VIII. appointed Sir John Wallop to be captain of Guisnes, it was considered necessary that he should be authorised in express terms to confer knighthood, which was also done by Edward VI. in his own case when he received knighthood from the duke of Somerset.[5] In like manner Henry, earl of Arundel, under special commission from the queen, created the Knights of the Bath and other knights at the coronation of Elizabeth in 1559, and in the patent from James II. nominating Christopher, duke of Albemarle, governor of Jamaica in 1686 he is empowered to confer knighthood on any persons "not exceeding six in number within the said island whom he may think deserving of the same in the king's service."[6] But at present the only subject to whom the right of confer-

[1] *Mémoires*, vol. i. p. 67, vol. i. p. 22; *History of Chivalry*; Gibbon, *Decline and Fall*, vol. vii. p. 200.

[2] *Orders of Knighthood*, vol. i. p. xi.

[3] Selden, *Titles of Honor*, p. 638.

[4] Harleian MS., 6063; Hargrave MS., 325.

[5] *Patent Rolls*, 35th Hen. VIII., part xvi., No. 24; Burnet, *Hist. of Reformation*, vol. i. p. 15.

[6] Rymer, *Fœdera*, vol. xv. p. 497; *Patent Rolls*, 4th Jac. II., part v., No. 20.

ring knighthood belongs is the lord-lieutenant of Ireland, and to him it belongs merely by long usage and established custom. It was called in question in 1821 by the Lords of the Admiralty on the occasion of Earl Talbot knighting Sir John Phillimore, a captain in the navy, and the point having been submitted to the law officers of the crown in England and Ireland, was the subject of contradictory opinions from them. In 1823, however, it was referred by order in council to the English judges, who unanimously reported in favor of the lord-lieutenant of Ireland's claims.[1] But, by whomsoever conferred, knighthood at one time endowed the recipient with the same status and attributes in every country wherein chivalry was recognized. In the Middle Ages it was a common practice for sovereigns and princes to dub each other knights, much as they were afterwards, and are now, in the habit of exchanging the stars and ribands of their orders. Henry II. was knighted by his great-uncle David I. of Scotland, Alexander III. of Scotland by Henry III., Edward I. when he was prince by Alphonso X. of Castile, and Ferdinand of Portugal by Edmund of Langley, earl of Cambridge.[2] And, long after the military importance of knighthood had practically disappeared, what may be called its cosmopolitan character was maintained. Writing in the 17th century, Mr. Justice Doddridge lays it down as a principle of law, in which he is supported by all the older authorities, that "the highest and the lowest dignities are universal, for if the king of a foreign nation comes into England by leave of the king of this realm (as it ought to be), in this case he shall sue and be sued by the name of a king, so shall he sue and be sued by the name of a knight wheresoever he received that degree of dignity, but otherwise it is as of a duke, marquess, earl, or other title of honor given by any foreign king."[3] The well-known story told by Camden about Queen Elizabeth and Sir Thomas Arundel, afterwards Lord Arundel of Wardour, and her disinclination that "her sheep should bear a stranger's mark," and "dance after the whistle of every foreigner," had reference to a countship of the empire, and not to knighthood or an order of chivalry. Even to the end of the last century indeed any knight duly dubbed abroad was fully accepted as a knight in England. Hence when in 1792, at the request of the king of Sweden, George III. invested Sir Sidney Smith with the grand cross and collar of the Swedish Order of the Sword, it was expressly announced that he "was not knighted on this occasion, that ceremony having been performed by his late Swedish majesty."[4] By certain regulations, however, made in 1823, and repeated and enlarged in 1855, not only is it provided that the sovereign's permission by royal warrant shall be necessary for the reception by a British subject of any foreign order of knighthood, but further that such permission shall not authorize "the assumption of any style, appellation, rank, precedence, or privilege appertaining to a knight bachelor of the United Kingdom." Moreover, no permission of the kind will be granted "unless the foreign order shall have been conferred in consequence of active and distinguished service before the enemy either at sea or in the field," or unless the person receiving it shall have been "actually and entirely" employed beyond the British dominions "in the service of the foreign sovereign by whom the order is conferred."[5]

Degradation.

Since knighthood was accorded either by actual investiture or its equivalent, a counter process of degradation was regarded as necessary for the purpose of depriving anybody who had once received it of the rank and condition it implied. And in this respect there can be no doubt that the order of chivalry was designedly assimilated to the order of priesthood.[6] Hence, as Selden points out, "as by the canon laws the ceremony of degradation from any degree of any order is by the solemn taking away those things from the clerk wherewith he was so invested at his taking the order from which he is to be degraded, so the ceremonies of degradation of a knight were in ancient times such as that the sword with which he was girt at his knighting and the spurs that were put on him were to be publicly taken off from him, and some other solemnities were sometimes in it."[7] The cases in which a knight has been formally degraded in England are exceedingly few, so few indeed that two only are mentioned by Segar, writing in 1602, and Dallaway says that only three were on record in the College of Arms when he wrote in 1793. But in illustration of the statement of Coke that "when a knight is degraded one of his punishments is 'quod clypeus suus gentilicius reversus erit,' and how his arms be reversed that he beareth none," Sir Harris Nicolas states that in an illuminated copy of Matthew Paris's *Historia Major*, among the royal manuscripts in the British Museum, there is a representation of Sir William de Marisco, who was convicted of treason in the reign of Henry III., with his sword and the staff of his banner broken and his shield hewn asunder.[8] With this exception, however, the earliest known example of degradation from knighthood is that of Sir Andrew Harclay, who was created earl of Carlisle by Edward II., and was attainted of high treason in the year following his creation. He was tried and condemned at Carlisle in 1323 by special commission under Edmund of Woodstock, earl of Kent, the king's half-brother. A part of his sentence, as preserved in the record, was in the following words: "que vous soietz degrade, que vous perdetz noun de count pur vous et pur vous heirs a touts jours que vous soietz deceynt del espée que vous esporeuns d'orrees soient coupez de talouns," which having been done, according to Hollingshed, Sir Anthony Lucy, the sheriff of Cumberland, said to him, "Andrew, thou art no knight, but thou art a knave," when judgment for treason was pronounced on him, and he was immediately beheaded.[9] The next case was that of Sir Ralph Grey, which occurred in the reign of Edward IV. He was tried and convicted of treason, before John Tiptoft, earl of Worcester, constable of England in 1468, but the sentence, as preserved by Stowe, seems to indicate that the ceremonies of degradation were to be remitted.[10] The last case was that of Sir Francis Michell in 1621, whose spurs were hacked from his heels, his sword belt cut, and his sword broken over his head by the heralds in Westminster Hall.[11] The ceremony of degrading a knight who is a companion of an order which as a capitular body has a chapel assigned to it applies to his achievements therein displayed more markedly than to him in person. On the degradation of a Knight of the Garter, indeed, a deputation of the companions are (Ashmole says) to go to him, attended by Garter king of arms, who "in a solemn manner first takes from him his George and riband and then his garter."[12] But the principal observances are that his banner, helm, and armorial plate are torn down from above and from off his stall by the officers of arms, and are by them spurned or kicked out of the building.[13] From the Order of the Garter William Lord Paget, who was subsequently reinstated, was degraded in 1552, "chiefly," according to the diary of Edward VI., "because he was no gentleman of blood neither of father's side or mother's side."[14] The degradation in due form of

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[1] Nicolas, *Orders of Knighthood*, vol. i. p. xiv.

[2] Spelman, "De Milite Dissertatio," *Posthumous Works*, p. 181.

[3] *Law of Nobility*, p. 129.

[4] *London Gazette*, May 19, 1792.

[5] *London Gazette*, December 6, 1823, and May 15, 1855.

[6] On the Continent very elaborate ceremonies, partly heraldic and partly religious, were observed in the degradation of a knight, which are described by Saint Palaye, *Mémoires*, vol. i. p. 60 *sq.*, and after him by Mills, *History of Chivalry*, vol. i. p. 60 *sq.*

[7] *Titles of Honor*, p. 653.

[8] Nicolas, *British Orders of Knighthood*, p. xxviii.

[9] Selden, *Titles of Honor*, p. 654.

[10] Nicolas, *Orders of Knighthood*, p. xxvii.; Selden, *Titles of Honor*, p. 655.

[11] Dallaway's *Heraldry*, p. 303.

[12] *Order of the Garter*, p. 621.

[13] Warrants for taking down the achievements and for the degradation of John Dudley, duke of Northumberland, and Edward Stafford, duke of Buckingham, are given by Ashmole, Appendices clxxxiii. and clxxxiv.

[14] Beltz, *Memorials*, p. xcvi.

James, duke of Monmouth, and of James, duke of Ormond, for treason occurred severally in 1685 and 1716. Thomas Lord Cochrane and Sir Eyre Coote were similarly degraded from the Order of the Bath in 1814 and 1816. But in all these cases the knights retained their knighthood, although they were expelled from the orders to which they had belonged.

Decline of chivalry.

Its merits and defects.

Roughly speaking, the age of chivalry properly so called may be said to have extended from the beginning of the crusades to the end of the Wars of the Roses. Within the limits of that period, which comprised about four hundred years, all that was peculiarly characteristic of it arose, attained to maturity, and fell into decay. It is true that some of its spirit and many of its external forms lingered on throughout the greater part of the 16th century. But the chivalry of Francis I. and Charles V. bore much the same relation to the chivalry of Edward III. and the Black Prince that the romance of Don Quixote bears to the romance of Amadis de Gaul. As a practical military system chivalry was entirely at an end. The revolution in the mode of warfare which had commenced under Edward III. was completed under Henry VIII., and it was on their infantry and artillery rather than on their cavalry that commanders had come principally to rely. Knights still disported themselves in the lists as bravely and gallantly as of old, but neither their arms nor their armor availed them aught against the cannon and muskets they were compelled to encounter in the field. And even in the way of pageantry and martial exercise chivalry was not destined to be of long continuance. In England tilts and tourneys, in which her father had so much excelled, were patronized to the last by Queen Elizabeth, and were even occasionally held until after the death of Henry, Prince of Wales. But on the Continent the Comte de Montgomerie's lance proved as fatal to them as it did to the French king Henry at Paris. By that time, however, chivalry had ceased to exist as a social institution as well as a military régime. Its standard of conduct, the code of honor, indeed remained as it in some measure still remains, the test of propriety and the guide of manners in the higher ranks of society all over Europe. But the order of knighthood as an order formally and particularly dedicated to the service of "God and the Ladies,"—"I blush," says Gibbon, "to unite such discordant names,"—and bound by solemn and express engagements to vindicate justice, to avenge wrong, and to defend the weak, the unprotected, and the oppressed, had disappeared. It was under this shape, however, that chivalry manifested itself during the earlier and more vigorous stages of its development, and played its part among the chief and certainly among the most remarkable of those influences which moulded the form and directed the course of Western civilization in mediæval times. The common offspring of feudalism and the church, it derived its resources and its sanctions from each of its parents in turn, and stood forth as at once the spiritual representative of the one and the temporal representative of the other. Whatever may have been its inherent vices and defects, it is at any rate indisputable that it embodied some of the noblest sentiments and engendered many of the worthiest actions of contemporary mankind. It animated poetry and art; it created romance and heraldry; it determined individual ethics, modified the policy of states, and generally inspired the energies while it controlled the destinies of all those nations, especially England and France, which were then as they now are the most enlightened as well as the most powerful in the world. Under ecclesiastical teaching war came to be regarded from a judicial standpoint as, to use the words of Bacon, "the highest trial of right when princes and states that acknowledge no superior on earth shall put themselves upon the justice of God for the deciding of their controversies by such success as it please Him to give on either side."[1] Battles were commenced with religious celebrations, and armies esteemed themselves happy if they marched beneath a consecrated standard. Even in the field and while engaged in mortal conflict Christian knights acknowledged the duties and courtesies of their order. And if they were taken prisoner, they could count on consideration from their captors, and on their freedom when they paid their stipulated ransom. Moreover, when they took prisoners they could safely release them on parole to raise their ransom, and that they would return to captivity if their ransom could not be raised.[2] It is indeed from the customs of chivalry that the best and most humane portions of the laws of war in so far as actual combatants are concerned have their origin. But war, although it was the principal, was not the exclusive or the continuous occupation of mediæval knighthood. When not in the camp, the home of the knight was in the court or the castle, and it was there that his prowess in the past campaign or present tournament was rewarded, often it might be rather generously than discreetly by the ladies in whose cause he was partly enrolled. Hence, although at no period were women held in greater outward respect by men, it is probable that at no period did more license in the association of the sexes prevail; and it is a strange comment on the manners of the times that the single word "gallantry" should have grown to signify both bravery and illicit love.[3] But if chastity was not among the cardinal virtues of chivalry, the catalogue of them included valor, loyalty, courtesy, and munificence; and, had they been practised with the zeal with which they were inculcated, they would have gone far towards redeeming the dissoluteness of private manners with which they were connected. Valor was of course the primary qualification of a knight, and the imputation of cowardice the most damaging that could be cast upon him. But loyalty, which implied the strictest fidelity to all his engagements to his sovereign or lord, his "lady-love," and his friends and foes alike, was only second to it in importance. Next came courtesy, which meant not only ceremonious politeness but also spontaneous modesty of carriage, self-denial, and careful respect for the feelings of others. And last came munificence, a disdain for money, readiness to relieve want and reward services, hospitality, and liberality in all things. In a celebrated passage Burke describes chivalry as "the unbought grace of life, the cheap defence of nations, the nurse of manly sentiment and heroic enterprise." "Never never more," he says, "shall we behold that generous loyalty to rank and sex, that proud submission, that dignified obedience, that subordination of the heart which kept alive even in servitude itself the spirit of an exalted freedom;" and, he adds, "that sensibility of principle, that chastity of honor which felt a stain like a wound, which inspired courage whilst it mitigated ferocity, which ennobled whatever it touched, and under which vice itself lost half its evil by losing all its grossness."[4] A very different estimate of chivalry is expressed by Mr. Freeman. "The chivalrous spirit," he contends, "is above all things a class spirit. The good knight is bound to endless fantastic courtesies towards men and still more towards women of a certain rank; he may treat all below that rank with any degree of scorn and cruelty. The spirit of chivalry implies the arbitrary choice of one or two virtues to be practised in such an exaggerated degree as to become vices, while the ordinary laws of right and wrong are forgotten. The false code of honor supplants the laws of the commonwealth, the law of God, and the eternal principles of right. Chivalry, again, in its military aspect not only encourages the love of war for its own sake without regard to the cause for which war is waged, it encourages also an extravagant regard for a fantastic show of personal daring which cannot in any way advance the objects of the siege or campaign which is going on. Chivalry in short is in morals very much what feudalism is in law: each substitutes purely personal obligations, obligations devised in the interests of an exclusive class, for the more homely duties of an honest man and a good citizen.'"[1] Between these two views,—which, indeed, may be taken to represent the extremes of praise and of depreciation,—it may be assumed that at all events an approximation to the truth concerning the ethical effects of chivalry or knighthood is somewhere to be found. (F. DR.)

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[1] "Observations on a Libel," *Works*, vol. v. p. 384.

[2] Sainte Palaye, *Mémoires*, vol. i. pp. 309 and 364; Mills, *History of Chivalry*, vol. i. p. 186; Grose, *Military Antiquities*, vol. ii. p. 343 *sq.*

[3] Hallam, *Middle Ages*, vol. iii. p. 398.

[4] Burke, *French Revolution*, p. 113, ed. 1790.

KNITTING is the art of forming looped fabrics or textures with the use of needles or wires and a single continuous thread. Crochet is an analogous art, differing from knitting in the fact that the separate loops are thrown off and finished successively, whereas in knitting the whole series of loops which go to form one length or round of the fabric are retained on one or more needles while a new series is being formed from them on a separate needle. The origin and history of the art of knitting are referred to under the heading HOSIERY, vol. xii. p. 312. The wires, needles, or pins used are of different lengths and gauges, according to the work for which they are intended, and are made either of steel, ivory, bone, or wood. Some are headed, to prevent loops from slipping over their ends, but on these can be woven only flat pieces of work; others are pointed at both ends, and with the use of three or more of these circular webs can be made. The materials used in knitting are specially twisted for the purpose, and consist of twines, threads, cotton, silk, wools, and worsteds, the latter being the most important and largely used substance. Ordinary stockings and socks, which are the staple hand-knit articles, are worked in "lambswool," "fingering," and "wheeling" worsteds respectively, these differing in size and fineness of quality; and for other articles of underclothing and fancy knitting the worsteds most commonly used are "fleecy," "Berlin," and "Lady Betty" wool. Shetland wool is a thin hairy undyed and very tenacious and strong worsted, spun in the Shetland Islands from the wool of the native sheep, and very extensively used in the knitting of fine shawls, veils, scarfs, and small articles by the islanders, among whom the industry is of much local consequence. "Crewels" are closely twisted colored worsteds of the same size as Shetland wool, and capable consequently of being knit into the same fabric. Much spun silk is also knit into patterns and articles similar in form and appearance to Shetland wool goods. In Ayrshire the hand-knitting of Scotch caps is extensively prosecuted as a domestic industry, the knit work being collected and "waulked" or felted and otherwise finished in factories. The methods by which, with plain knitting, "purling," "slipping" loops, "taking up" and "casting off," etc., materials can be shaped and worked into varied and variegated forms are endless, and patterns and directions for working are to be found in all magazines and papers devoted to ladies' work, as well as in numerous special cheap publications.

Standard works, from which many of the patterns and directions in smaller manuals are copied, are Mrs. Gaugain's *Knitting and Crochet Work*, and Esther Copley's *Comprehensive Knitting Book*, London, 1849.

KNOLLES, RICHARD (c. 1545–1610), author of the *History of the Turks*, was a native of Northamptonshire, and was born about 1545. In 1560 he entered Lincoln's College, Oxford, of which four years later he was elected fellow. After graduating M.A. he left Oxford to become master of the free school at Sandwich in Kent, where he died in 1610.

In 1603 Knolles published *A General History of the Turks*, a second edition of which appeared in 1610. The work was continued up to date in several editions subsequently published, the best known being that by Sir Paul Rycaut, 1687–1700, who gives a continuation to 1699. The history of Knolles was highly praised by Dr. Johnson, and, though now entirely superseded, it has for the time in which it was written considerable merits at least as regards style and arrangement. Knolles also published a translation of Bodin's *Respublica* in 1606, but the *Grammaticæ Latinæ, Græcæ, et Hebraicæ Compendium*, and the *Rudiments of Hebrew Grammar*, attributed to him by Anthony Wood and in most works of reference, were, as is shown in the *Athenæum* of August 6, 1881, the works of the Rev. Hanserd Knollys, a Baptist minister.

KNOT. In the scientific sense, a knot is an endless physical line which cannot be deformed into a circle. A physical line is flexible and inextensible, and cannot be cut,—so that no lap of it can be drawn through another.

The founder of the theory of knots is undoubtedly Listing. In his "Vorstudien zur Topologie" (*Göttinger Studien*, 1847), a work in many respects of startling originality, a few pages only are devoted to the subject. He treats knots from the elementary notion of twisting one physical line (or thread) round another, and shows that from the projection of a knot on a surface we can thus obtain a notion of the relative situation of its coils. He distinguishes "reduced" from "reducible" forms, the number of crossings in the reduced knot being the smallest possible. The simplest form of reduced knot is of two species, as in figs. 1 and 2. Listing points out that these are formed, the first by right-handed, the second by left-handed twisting. In fact, if three half twists be given to a long strip of paper, and the ends be then pasted together, the two edges become one line, which is the knot in question. We may free it by slitting the paper along its middle line; and then we have the juggler's trick of putting a knot on an endless unknotted band. One of the above forms cannot be deformed into the other. The one is, in Listing's language, the "perversion" of the other, *i. e.*, its image in a plane mirror. He gives a method of symbolizing reduced knots, but shows that in this method the same knot may, in certain cases, be represented by different symbols. It is clear that the brief notice he has published contains a mere sketch of his investigations.

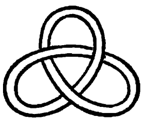
FIG. 1.

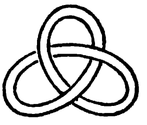
FIG. 2.

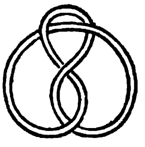
FIG. 3.

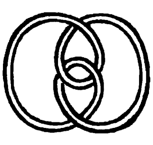
FIG. 4.

The most extensive dissertation on the properties of knots is that of Tait (*Trans. Roy. Soc. Edin.*, 1876–7). It was for the most part written in ignorance of the work of Listing, and was suggested by an inquiry concerning vortex atoms (see ATOM). Tait starts with the almost self-evident proposition that, if any plane closed curve have double points only, in passing continuously along the curve from one of these to the same again an even number of double points has been passed through. Hence the crossings may be taken alternately over and under. On this he bases a scheme for the representation of knots of every kind, and employs it to find all the distinct forms of knots which have in their simplest projections, 3, 4, 5, 6, and 7 crossings only. Their numbers are shown to be 1, 1, 2, 4, and 8. The unique knot of three crossings has been already given as drawn by Listing. The unique knot of four crossings merits a few words, because its properties lead to a very singular conclusion. It can be deformed into any of the four forms—figs. 3 and 4 and their perversions. Knots which can be deformed into their own perversion Tait calls "amphicheiral," and he has shown that there is at least one knot of this kind for every even number of crossings. He shows also that "links" (in which two endless physical lines are linked together) possess a similar property; and he then points out that there is a third mode of making a complex figure of endless physical lines, without either knotting or linking. This may be called "lacing" or "locking." Its nature is obvious from fig. 5, in which it will be seen that no one of the three lines is knotted, no two are linked, and yet the three are inseparably fastened together.

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[1] Freeman, *Norman Conquest*, vol. v. p. 482.

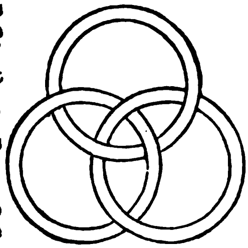
Fig. 5.

The rest of Tait's paper deals chiefly with numerical characteristics of knots, such as their "knottiness," "beknottedness," and "knotfulness." He also shows that any knot, however complex, can be fully represented by three closed plane curves, none of which has double points, and no two of which intersect. It may be stated here that the notion of beknottedness is founded on a remark of Gauss, who in 1833 considered the problem of a number of interlinkings of two closed circuits, and expressed it by the electrodynamic measure of the work required to carry a unit magnetic pole round one of the interlinked curves, while a unit electric current is kept circulating in the other. This original suggestion has been developed at considerable length by Boeddicker (*Erweiterung der Gauss'schen Theorie der Verschlingungen*, Stuttgart, 1876). This author treats also of the connection of knots with Riemann's surfaces.

It is to be noticed that, although every knot in which the crossings are alternately over and under is irreducible, the converse is not generally true. This is obvious at once from fig. 6, which is merely the three-crossing knot with a doubled string—what Listing calls "paradromic."

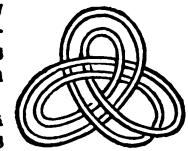
Fig. 6.

Klein, in the *Mathematische Annalen*, ix. 478, has proved the remarkable proposition that knots cannot exist in space of four dimensions.

SAILORS' KNOTS.—The knots used by sailors are of many kinds. The following are the most useful:

Overhand Knot (fig. 7).—Take the end *a* of the rope round the end *b*.

Reef Knot (figs. 8. 9).—Form an overhand knot as above. Then take the end *a* over the end *b* and through the bight.

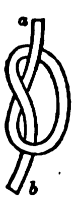

Fig. 7.

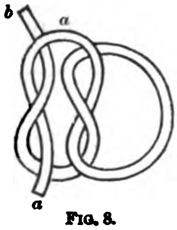

Fig. 8.

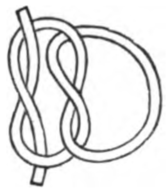
Fig. 9.

If the end *a* were taken under the end *b* a *granny* would be formed. This knot is so named from being used in tying the reef-points of a sail.

Bowline (figs. 10-12).—Lay the end *a* of a rope over the standing part *b*. Form with *b* a bight *c* over *a*. Take *a* round behind *b* and down through the bight *c*. This is a most useful knot employed to form a loop which will not slip.

Half Hitch (fig. 13).—Pass the end *a* of the rope round the standing part *b* and through the bight.

Close Hitch (figs. 14, 15).—Pass the end *a* round a spar and cross it over *b*. Pass it round the spar again and put the end *a* through the second bight.

Blackwall Hitch (fig. 16).—Form a bight at the end of a rope, and put the hook of a tackle through the bight so that the end of the rope may be jammed between the standing part and the back of the hook.

Timber Hitch (fig. 17).—Take the end *a* of a rope round a spar, then round the standing part *b*, then several times round its own part *c*.

Fisherman's Bend (fig. 18). Take two turns round a spar, then a half hitch round the standing part and between the spar and the turns, lastly a half hitch round the standing part.

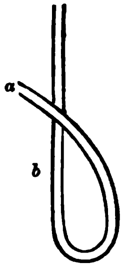

Fig. 10.

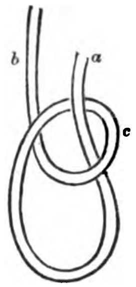

Fig. 11.

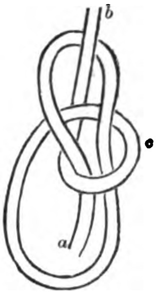

Fig. 12.

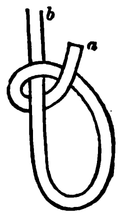

Fig. 13.

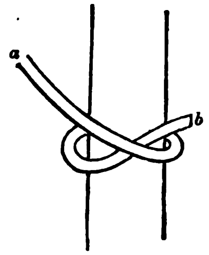

Fig. 14.

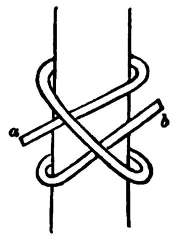

Fig. 15.

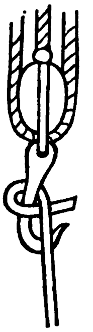
Fig. 16.

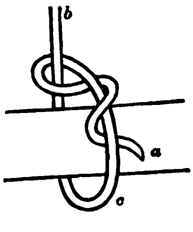

Fig. 17.

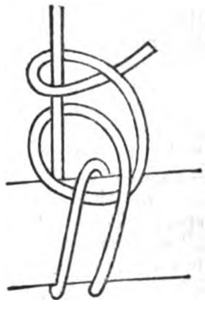
Fig. 18.

Carrick Bend (fig. 19).—Lay the end of one rope over its own standing part so as to form a bight. Put the end of the other rope through this bight, under the standing part, over the end beyond the bight, under the standing part beyond the bight, and down through the bight over its own standing part.

Sheet Bend (fig. 20).—Pass the end of one rope through the bight of another, round both parts of the other, and under its own standing part.

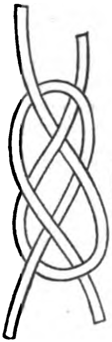
Fig. 19.

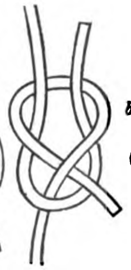
Fig. 20.

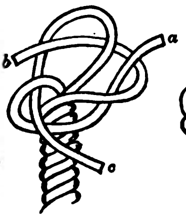

Fig. 21.

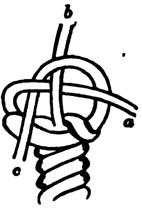

Fig. 22.

Single Wall Knot (fig. 21).—Unlay the end of a rope, and with the strand *a* form a bight. Take the next strand *b* round the end of *a*. Take the last strand *c* round the end of *b* and through the bight made by *a*. Haul the ends taut.

Single Wall Crowned (fig. 22).—Form a single wall, and lay one of the ends, *a*, over the knot. Lay *b* over *a*, and *c* over *b* and through the bight of *a*. Haul the ends taut.

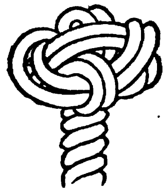
Fig. 23.

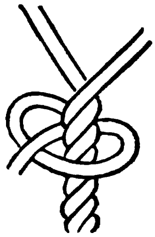
Fig. 24.

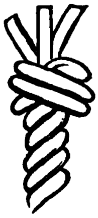
Fig. 25.

Double Wall and Double Crown (fig. 23).—Form a single wall crowned; then let the ends follow their own parts round until all the parts appear double. Put the ends down through the knot.

Matthew Walker (figs. 24, 25).—Unlay the end of a rope. Take the first strand round the rope and through its own bight; the second strand round the rope, through the bight of the first, and through its own bight; the third through all three bights. Haul the ends taut.

See Nares, *Seamanship*, 4th ed., 1868; Dana, *Seaman's Manual*, 9th ed., 1863; A. H. Alston, *Seamanship*, Portsmouth, 1871; Kipping, *Masting and Rigging*, 9th ed., 1864; *Yachts and Yachting*, by "Vanderdecken," (William Cooper), 1873; *Book of Knots*, by "Tom Bowling" (J. Bonwick), 1866.

KNOT, a Limicoline bird very abundant at certain seasons on the shores of Britain and many countries of the northern hemisphere. Camden in the edition of his *Britannia* published in 1607 (p. 408) inserted a passage not found in the earlier issues of that work, connecting the name with that of King Canute, and this account of its origin has been usually received. But no other evidence in its favor is forthcoming, and Camden's statement is merely the expression of an opinion,[1] so that there is perhaps ground for believing him to have been mistaken, and that the clue afforded by Sir Thomas Browne, who (*circa* 1672) wrote the name "Gnatts or Knots," may be the true one.[2] Still the statement was so determinedly repeated by successive authors that Linnæus followed them in calling the species *Tringa canutus*, and so it remains with nearly all modern ornithologists.[3] Rather larger than a snipe, but with a short, plover-like bill and legs, the Knot visits the coasts of some parts of Europe, Asia, and North America at times in vast flocks; and, though in temperate climates a good many remain throughout the winter, these are nothing in proportion to those that arrive towards the end of spring, in England generally about the 15th of May, and after staying a few days pass northward to their summer quarters, while early in autumn the young of the year throng to the same places in still greater numbers, being followed a little later by their parents. In winter the plumage is ashy-gray above (save the rump, which is white) and white beneath. In summer the feathers of the back are black, broadly margined with light orange-red, mixed with white, those of the rump white, more or less tinged with red, and the lower parts are of a nearly uniform deep bay or chestnut. The birds which winter in temperate climates seldom attain the brilliancy of color exhibited by those which arrive from the south; the luxuriance generated by the heat of a tropical sun seems needed to develop the full richness of hue. The young when they come from their birthplace are clothed in ashy-gray above, each feather banded with dull black and ochreous, while the breast is more or less deeply tinged with warm buff. Much curiosity has long existed among zoologists as to the egg of the Knot, of which not a single identified or authenticated specimen is known to exist in collections. Yet more than sixty years ago the species was found breeding abundantly on the North Georgian (now commonly called the Parry) Islands by Parry's memorable expedition, as well as soon after on Melville Peninsula by Captain Lyons, and again during the recent voyage of Sir George Nares on the northern coast of Grinnell Land and the shores of Smith Sound, where Major Feilden obtained examples of the newly-hatched young (*Ibis*, 1877, p. 407), and observed that the parents fed largely on the buds of *Saxifraga oppositifolia*. These are the only localities in which this species is known to breed, for on none of the arctic lands lying to the north of Europe or Asia has it been unquestionably observed.[4] In winter its wanderings are very extensive, as it is recorded from Surinam, Brazil, Walvisch Bay in South Africa, China, Queensland, and New Zealand. Formerly this species was extensively netted in England, and the birds fattened for the table, where they were esteemed a great delicacy, as witness the entries in the Northumberland and Le Strange Household Books; and the British Museum contains an old treatise on the subject—"The maner of kepyng of knotts, after Sir William Askew and my Lady, given to my Lord Darcy, 25 Hen. VIII." (*MSS. Sloane*, 1592, 8 *cat.* 663). (A. N.)

KNOWLES, James Sheridan (1784–1862), dramatic author, was born at Cork, 21st May, 1784. His father was the lexicographer James Knowles, cousin-german of Richard Brinsley Sheridan. Not long after the removal of the family to London in 1793, young Knowles began his dramatic career by composing a play which was performed by himself and his juvenile companions. At the age of fourteen he published a ballad entitled *The Welsh Harper*, which was set to music and obtained great popularity; and about the same time his precocious talents secured him the friendship of Hazlitt, through whom he also formed an intimacy with Lamb and Coleridge. Of his early career little else is known except that for some time he served in the Wilts and afterwards in the Tower Hamlets militia, and that he left the latter corps to become pupil of Dr. Willan the physician, through whom he was appointed vaccinator to the Jennerian Society. Although, however, he was generously offered by Dr. Willan a share in his practice, he resolved to forsake medicine for the stage, making his debut at the Crow Theatre, Dublin. At Wexford he in October, 1809, married Maria Charteris, an actress from the Edinburgh Theatre. About this time he wrote *Leo*, which was played at Waterford with great success by Edmund Kean; but, although another piece, *Brian Boroihme*, which he wrote for the Belfast Theatre, also drew crowded houses, his labors as an actor and author secured him so little pecuniary return that he found it advisable to become assistant to his father at the Belfast Academical Institution. In 1817 he removed from Belfast to Glasgow, where, besides conducting a flourishing school, he continued his dramatic authorship. His first important dramatic success was *Caius Gracchus*, produced at Belfast in 1815; and by *Virginius*, written for Edmund Kean, and first performed in 1820, he obtained a very high place among the dramatic authors of the century. Besides *William Tell*, in which Macready performed one of his most successful parts, the other principal plays of Knowles are *The Hunchback*, *Love*, and *The Wife*. In some of his own pieces he acted with a just appreciation of the character and with considerable vigor and fire, but he failed in the power of personation. He achieved some success, however, as a lecturer on elocution. In his later years he forsook the stage for the pulpit, and as a Baptist preacher attracted large audiences at Exeter Hall and elsewhere, while he also entered the field of polemical theology, publishing two works,—the *Rock of Rome*, and the *Idol Demolished by its own Priests*,—in both of which he combated the special doctrines of the Romish Church. Knowles was for some years in the receipt of an annual pension of £200, bestowed by Sir Robert Peel. He died at Torquay, November 30, 1862.

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[1] His words are simply "*Knotts*, i. *Canuti aues*, vt opinor e Dania enim aduolare creduntur." In the margin the name is spelt "Cnotts," and he possibly thought it had to do with a well-known story of that king. Knots undoubtedly frequent the sea-shore, where Canute is said on one occasion to have taken up his station, but they generally retreat, and that nimbly, before the advancing surf, which he is said in the story not to have done.

[2] In this connection we may compare the French *maringouin*, ordinarily a gnat or mosquito, but also, among the French Creoles of America, a small shore-bird, either a *Tringa* or an *Ægialitis*, according to Descourtilz (*Voyage*, ii. p. 249). See also Littré's *Dictionnaire*, *sub voce*.

[3] There are few of the *Limicolæ*, to which group the Knot belongs, that present greater changes of plumage according to age or season, and hence before these phases were understood the species became incumbered with many synonyms, as *Tringa cinerea*, *ferruginea*, *grisea*, *islandica*, *nævia*, and so forth. The confusion thus caused was mainly cleared away by Montagu and Temminck.

[4] The *Tringa canutus* of Payer's expedition seems more likely to have been *T. maritima*, which species is not named among the birds of Franz Josef Land, though it can hardly fail to occur there.

A full list of the works of Knowles and of the various notices of him will be found in his *Life*, by his son Richard Brinsley Knowles, of which twenty five copies were printed privately.

KNOX, John (1505–1572), the great Reformer of Scotland, was born at Haddington, the county town of East Lothian, in the year 1505.[1] His father was William Knox, commonly said to have been descended from the Knoxes of Ranfurly in Renfrewshire, but there is no evidence to prove what rests solely upon the authority of David Buchanan. The name of his mother was Sinclair, and some of his letters, written in seasons of danger, were signed "John Sinclair." Whatever might be their lineage, Knox's relations were in such circumstances as secured for him a liberal education in the grammar school of his native town; and, when about sixteen years of age, he was sent to pursue his studies at the university of Glasgow, where Dr. John Mair or Major was principal regent, or professor of philosophy and divinity. Owing to some undiscovered cause he left the university without qualifying himself to take the degree of master of arts. It has been usual to state that from Glasgow Knox proceeded to St. Andrews and there taught philosophy and theology, but no evidence can be adduced to show that he was officially connected in any way whatever with the university of that city. Not having qualified himself by taking his degree, he would be excluded from acting as a regent or professor, so that if he taught it can only have been in the way of private tuition. In truth, for some years about this time the course of life pursued by Knox is involved in obscurity. The probability is that he took orders in the Church of Rome as a secular priest about 1530, and was connected for upwards of ten years with one of the religious establishments in the neighborhood of Haddington. In the Protocol books of that town the name of John Knox occurs among the witnesses to deeds of the years 1540, 1541, and 1542, in one deed under the style of *Schir*, that being the designation of priests who had not attained the higher academical degree of *Magister;* and as late as March 27, 1543, he pens and signs a notarial instrument as an apostolic notary, describing himself as "sacri altaris minister, Sanctiandrææ dioceseos, auctoritate appostolica, notarius."

The martyrdom of Wishart in 1546 was the turning-point in the spiritual life of Knox, determining him to renounce scholastic theology and to profess his adherence to the Protestant faith. As this subjected him to suspicion and trouble, he resolved to leave Scotland and visit the schools of Germany; but Douglas of Longniddrie and Cockburn of Ormiston, to whose sons Knox had for some time been acting as private tutor, prevailed on him to relinquish his design, and, along with his pupils, to enter the castle of St. Andrews as a place of safety from the Romish clergy. It was there that Knox received a public call to the ministry, "whairat," to use his own graphic description of the scene in the great church, "the said Johnne abashed, byrst furth in moist abundand tearis, and withdrew him self to his chalmer."

In June of the same year (1547) the Catholics of Scotland and France joined their forces to avenge the death of Cardinal Beaton by capturing the Protestant garrison of St. Andrews; the French fleet appeared in the bay, and the castle surrendered. It was stipulated that the lives of the refugees should be spared, that they should be removed to France, and that such of them as declined entering into the French service should be conveyed to any other country except Scotland. Knox, sharing the fate of his companions, was conveyed on board one of the French ships to Rouen; but the terms of the capitulation were grossly violated, and the captives were treated as prisoners of war. Knox and some others were sent on board the galleys, and, after being loaded with chains, were compelled to labor at the oar. Here they were subjected to many indignities and much suffering; but, in spite of every hardship and every threat, not one of their number renounced his faith. During the ensuing winter the galley in which he was confined lay in the Loire; and in the summer of 1548 it sailed for Scotland, and cruised off the east coast. The hardships to which he was now subjected produced a very serious effect upon his health: he was seized with a violent fever, and no hope was entertained of his recovery. He, however, regained his strength, and during his captivity had sufficient energy of mind to engage in literary work. In the winter of 1548 Henry Balnaves of Halhill, who remained a prisoner in the old palace of Rouen, had sent to Knox a treatise on the doctrine of justification by faith. With this work Knox was so much pleased that, having revised it carefully, divided the contents into chapters, and added a brief summary of the book, he sent it to Scotland for publication with an epistle addressed by "the bound Servant of Jesus Christ unto his best beloved Brethren of the Congregation of the Castle of St. Andrewes, and to all Professours of Christs true Evangell" (*Works of John Knox*, vol. iii.). As the old copy of this epistle bears the title of "The Confession of Faith," this work may have been the "confession of his faith, containing the substance of what he had taught at St. Andrews," which "he found means to convey to his religious acquaintances in Scotland," and which, Dr. M'Crie thinks, "appears to have been lost." If so, leaving out of view the notices of his first sermon and of his disputation with Friar Arbuckle in St. Leonard's Yards, contained in his *Historie*, this epistle will rank as the earliest specimen of the Reformer's composition that has been preserved.

After an imprisonment of eighteen or nineteen months Knox obtained his release from the French galleys in February or March, 1549. As he probably owed his freedom to the intercession of Edward VI. or the English Government, he came to London on obtaining his liberty, and was favorably received by Archbishop Cranmer and the lords of council. Of the English section of his life, extending over five years, Knox himself disposes in few words: "The said Johne was first appointed preachar to Berwik, then to New-castell; last he was called to London, and to the sowth partes of England, whar he remaned to the death of King Edward the Sext" (*Historie*, book i.). At Berwick, where he labored for two years, he preached with his characteristic fervor and zeal, exposing the errors of Romanism with unsparing severity. The tendency of his zeal was not, however, calculated to recommend him to the bishop of the diocese, Dr. Cuthbert Tunstall or Tonstall, who was strongly attached to the old faith. Having been accused of asserting that the sacrifice of the mass is idolatrous, the preacher was cited to appear before the bishop, and to give an account of his preaching. Accordingly, on the 4th of April, 1550, Knox entered into a full defence of his opinions, and with the utmost boldness proceeded to argue that the mass is a superstitious and idolatrous substitute for the sacrament of the Lord's Supper. The bishop did not venture to pronounce any ecclesiastical censure; and the fame of the obnoxious preacher was extended by this feeble attempt to restrain the boldness of his attacks on the doctrines of Rome. The confession or vindication of his doctrine made by Knox on this occasion will be found in vol. iii. of his collected *Works*—"A Vindication of the Doctrine that the Sacrifice of the Mass is Idolatry," 1550.

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[1] Founding upon the designation "Giffordiensis" applied to him by Beza in his *Icones* of 1580, and the statement of Spottiswood in his *History* (1627) that Knox "was born in Gifford in the Lothians," later writers, beginning with David Buchanan, have given Gifford, a village a few miles to the south of Haddington, as the birthplace of Knox. On the other hand two contemporary Romanist writers—Archibald Hamilton (1577) and James Laing (1581)—assign to Haddington itself the honor in question: "Presbyter Joannes Knoxeus natus in Hadintona oppido in Laudonia;" "Joannes Knox natus prope Hadintonam, quæ est urbs in Laudonia." In 1785 the Rev. Dr. Barclay of Haddington directed attention to Giffordgate, one of the suburbs of Haddington, as the locality which popular tradition has uniformly maintained to have been the spot where the Reformer was born, and which, with the grounds adjoining, is called "Knox's Walls" in a charter of 1607. Recent investigations prove that no village of the name of Gifford was in existence until the latter half of the 17th century, whereas in the Geneva Register of 1558, when Knox was admitted a burgess of Geneva, his name is thus entered: "Jehan, fils de Guillaume Cnoxe, natif de Hedington en Escosse." David Laing, who in 1846 followed M'Crie in preferring Gifford, in 1864 gives his verdict in favor of the Giffordgate, stating that a visit to the locality led him to the conclusion that the question now admits of no dispute.

Upon Knox's reforming work while a preacher at Berwick some interesting light has recently been thrown by the late Dr. Lorimer's *John Knox and the Church of England*, 1875. When looking through the "Morrice" collection of manuscripts in Dr. Williams' library, London, Dr. Lorimer came upon four papers never before published. One of these is a letter from "Johne Knokks to the Congregatioun of Bervik," and another is "The practice of the Lord's Supper used in Berwick by John Knox, 1550." With this "practice," which is nothing more than a fragment, Dr. Lorimer associates "A Summary, according to the Holy Scriptures, of the Sacrament of the Lord's Supper" to be found in the third volume of the *Works*, and to which Dr. Laing has assigned the date 1550. Founding upon these documents, Dr. Lorimer maintains that the very beginning of Puritan practice in the Church of England in the administration of the Lord's Supper is to be found in the order followed by Knox at Berwick, inasmuch as he not only substituted common bread for "wafer-breads," thus anticipating by several years the substitution as authorized by Edward's second Prayer-Book, published in 1552, but gave the first example of the substitution of sitting instead of kneeling in the act of communion, which has ever since continued to be a characteristic Puritan practice. At the close of 1550, or early in 1551, Knox was transferred to Newcastle-upon-Tyne, where he remained, with occasional absences in London, till the spring of 1553. In the closing month of 1551 he was appointed one of six chaplains to Edward VI., and in virtue of this appointment he was consulted in the preparation of the formularies of the Church of England. A book of forty-five articles of religion, forming the basis of the thirty-nine articles of the Anglican Church, drawn up by Cranmer, was submitted to the royal chaplains for their opinion. An original copy of these articles is preserved in H. M. State Paper Office with the autographs of the chaplains, the sixth being "Jo. Knox." Shortly after this the duke of Northumberland originated a proposal to make Knox a bishop. The letters bearing upon the proposal, not known to Dr. M'Crie, were discovered by the late Mr. Tytler, and published by him in his *England under the Reigns of Edward and Mary*, vol. ii. The duke's wish was that the king would "appoint Mr. Knocks to the office of Rochester Bishoprick." When, however, the Scotch chaplain was informed of what was in contemplation, and was instructed to wait upon Northumberland, the latter did not find the man he thought to benefit eager to grasp at promotion, and the matter ultimately came to nothing by default of Knox himself. The last year of work in England was spent mainly in London and the southern counties. As royal chaplain Knox preached in turn before the court, and found favor with his royal hearer; but he was twice summoned before the privy council, first to answer complaints made by his would-be ducal patron, and then to vindicate his declinature of the vacant living of All Hallows in London.

Edward VI. having died in July, 1553, and, the Marian persecutions having shortly afterwards broken out, Knox was persuaded to withdraw from England, and sailed for Dieppe, landing at that town in January, 1554. The enforced leisure of exile gave the refugee an opportunity of completing and publishing several treatises during two sojourns in the same year at Dieppe. "An Exposition upon the Sixth Psalm of David," addressed to Mrs. Bowes, "A Godly Letter of Warning or Admonition to the Faithful in London, Newcastle, and Berwick," "Two Comfortable Epistles to his afflicted Brethren in England," and "A Faithful Admonition to the Professors of God's Truth in England," all belong to the year 1554. After visiting the churches of France and Switzerland, Knox accepted an invitation to become one of the pastors of the English congregation at Frankfort-on-the-Main, and repaired thither in November of the same year. Soon after his settlement dissensions arose in the congregation in regard to the use of the surplice, the omission of the litany, the audible responses, and kneeling at the communion (see the letters and extracts from the "Brief Discourse of the Troubles at Frankfort" given by Dr. Laing in vol. iv. of Knox's *Works*). A party in the congregation, clamorous for a strict adherence to the English Book of Prayer, lodged information with the magistrates that Knox, in his "Faithful Admonition," had used treasonable language in speaking of the emperor, the queen of England, and her husband Philip II. Not wishing to increase the troubles, the maligned preacher relinquished his charge on the 26th March, 1555, and retired to Geneva. The closing months of that year and the opening ones of the year following form an important period in the public labors and the private life of the Reformer; for he then visited his native country, preached in Edinburgh, in West Lothian, and in Ayrshire, and dispensed the communion privately in several places. Before his visit came to a close he addressed a letter to the queen regent, in the hope that she might be persuaded to extend her protection to the Reformed preachers, or at least listen favorably to their doctrine. This letter, "augmented and explained by the author," and reprinted in 1558, "An Exposition upon Matthew iv., concerning the temptation of Christ in the wilderness," and "A letter of wholesome counsel, addressed to his Brethren in Scotland," belong to the year 1556. In visiting Scotland at that time, however, Knox was influenced by other considerations than those bearing simply on the public weal. For as far back as his Berwick ministry he had become acquainted with the family of Richard Bowes, and formed an attachment for the fifth daughter, Marjory. Dr. M'Crie represents the marriage as having taken place in 1553 before Knox left England; and in support of his view it falls to be said that after that date Knox addresses Mrs Bowes as "Dearly Beloved Mother," and that he speaks of Marjory as his "wife," his "dearest spouse." But, considering the strong opposition to the union on the part of Richard Bowes and other relatives, as also the very uncertain and precarious position of the Reformer at the time, there is good reason to think, with Dr. Laing, that then the parties had only formally pledged themselves to one another "before witnesses," and that the actual marriage took place when Knox visited Scotland in 1555.

At the urgent solicitation of the English congregation at Geneva, consisting largely of those who had withdrawn from Frankfort, Knox left Scotland in the summer of 1556; and in the "Livre des Anglois à

Genève," on the 13th September of that year, the names of "John Knox, Marjory, his wife, Elizabeth, her mother, James (*blank*), his servant, and Patrick, his puple," are entered as members of the English congregation. In Geneva the Scotch Reformer labored with voice and pen till 1559. The literary works of that period, in addition to ten *Familiar Epistles*, include *Letters to his Brethren and the Lords professing the truth in Scotland*, three in number, 1557; *An Apology for the Protestants who are holden in prison at Paris*, 1557; *The Appellation from the Sentence pronounced by the bishops and clergy*, 1558; *A letter addressed to the Commonality of Scotland*, 1558; *An Epistle to the inhabitants in Newcastle and Berwick*, 1558; and *A brief exhortation to England for the speedy embracing of the Gospel*, 1559. Judged by the excitement it created, the most outstanding writing of this period is *The First Blast of the Trumpet against the Monstrous Regiment of Women*; and it cannot be denied that this publication was unseasonable, and might be expected to expose the author to the resentment of two queens during whose reign it was his lot to live. Indeed the sounder of the *First Blast* would seem to have realized that it was "blown out of season," for, whereas his purpose was "thrice to blow the trumpet in the same matter, if God so permit," and on the last occasion to reveal his name, the intention was never carried into effect. The resentment to which his blast against feminine government gave rise in queenly breasts did not soon subside; one immediate effect was that, when Knox resolved to return to Scotland, and applied to the English Government for permission to pass through the sister kingdom, the application was refused. Impatient of delay, he sailed from Dieppe direct for Leith, and, landing at that port in safety, reached Edinburgh on 2d May, 1559.

From this time to the close of his life the biography of the Reformer becomes inseparably connected with the history of Scotland. Within a few days of his arrival in Scotland, through the representations of the Romanist clergy to the queen-regent, Knox was proclaimed an outlaw and a rebel; but, undeterred by considerations of personal danger, he lost no time in joining the leaders of the Protestant party then assembled in Dundee. From Dundee he went with them to Perth, where his preaching was the antecedent though not the cause of a tumult which resulted in the altar, images, and other ornaments of the church being torn down and the houses of the gray and black friars being laid in ruins. St. Andrews is the next place of importance at which Knox joined the Protestants, at this time called the congregation, the lay leaders of the party, mostly noblemen, being known as the lords of the congregation. Here Knox announced his intention to preach in the cathedral church; and, undismayed by the threats of the archbishop, unmoved by the remonstrances of his friends, he carried his purpose into effect, preaching on four successive days, and with such signal effect that the provost, bailies, and inhabitants agreed to set up the Reformed worship in the town, stripped the church of images and pictures, and pulled down the monasteries. By the end of June Knox was again in Edinburgh, preaching in St. Giles's and the abbey Church; and on the 7th July he was elected minister of Edinburgh.

When the army of the queen-regent took possession of the capital, and the lords of the congregation agreed to leave it, they took their minister with them from a regard alike to the danger to which he would be exposed if left behind and the service it was in his power to render the Protestant cause. The result abundantly verified the wisdom of the step, for, set free from city labors, Knox travelled over a great part of Scotland, and visited the towns of Kelso, Jedburgh, Dumfries, Ayr, Stirling, Perth, Brechin, Montrose, Dundee, and St. Andrews, with marked results in the diffusing of knowledge and the strengthening of the hands of fellow-Protestants. By the end of April, 1560, we find him once more in Edinburgh, having rendered important service to the Protestant leaders in their negotiations to procure aid from England, and of necessity rather than from choice, acting the part of a politico-ecclesiastic. The most elaborate theological writing of the Scottish Reformer, although written before his final return to Scotland, was published in this year, 1560, at Geneva. It is *An Answer to the Cavillations of an Adversary respecting the doctrine of Predestination*.

The event of greatest political importance in this same year 1560 was the assembling of the Scottish parliament at Edinburgh, on 1st August. A petition having been presented by the Protestants of the country, craving the abolition of the Popish doctrine, the restoration of purity of worship and discipline, and the appropriating of ecclesiastical revenues to the support of the ministry, the promotion of education, and the relief of the poor, the ministers and barons were required to lay before parliament a summary of Reformed doctrines. "Within foure dayis" this was done. The confession was read before the whole parliament, and after reasoning and voting was ratified by Act of Parliament, and the Protestant religion formally established. *The Confessioun of faith professit and belevit be the Protestants within the Realme of Scotland*, etc., in the composing of which no small share must have fallen to the minister of Edinburgh, is inserted by him at length in book iii. of his *Historie*. Between the dissolution of parliament and the first meeting of the General Assembly of the Church of Scotland on the 20th December, Knox and three other ministers were engaged in drawing up the plan of ecclesiastical government known as the *Book of Policy*, or *First Book of Discipline*. This standard document, approved by the General Assembly and subscribed by a majority of the members of privy council, is also incorporated in Knox's *Historie*.

The youthful, widowed, and fair Queen Mary, having arrived in Scotland in August, 1561, lost no time in sending for Knox to the palace of Holyrood, in order that she might hold with him the first of those four or five dialogues which historians have rendered with dramatic effect not always consistent with historical accuracy. The charge brought against the Reformer of treating his sovereign with rudeness and disrespect in the course of those interviews has been thoroughly disproved by his biographer giving the details of what passed as furnished by one of the parties in his *Historie*, and is quite discredited by such a judge as Thomas Carlyle.

In the following year Knox found a more congenial sphere for the exercise of his logical and dialectic skill in a disputation with Quintine Kennedy, abbot of Crossragwell, in the neighborhood of Maybole, Ayrshire. The abbot had set forth a number of articles respecting the mass, purgatory, praying to the saints, the use of images, and other points, which he declared his intention to open up more fully in his chapel at Kirkoswald. But when Knox, who happened to be in the vicinity, appeared on the Sabbath specified, the abbot deemed it prudent to absent himself, and Knox preached in his stead. This led to a correspondence which resulted in arrangements for a disputation taking place. The disputants met at Maybole on the 28th September, 1562, and the two following days at 8 A.M., in the house of the provost. Forty persons on each side were admitted as witnesses of the dispute, "with so many mo as the house may goodly hold, be the sight of my lord of Cassilis" (nephew of Kennedy). As usually is the case in such contentions, both sides claimed to be victorious; but to counteract the one-sided reports circulated by the abbot and his friends, Knox published, in 1563, an account of the dispute taken from the records of the notaries present, to which he added a prologue and short marginal notes.

Queen Mary, having failed to influence the Reformer by her "many salt tears" or her flattery, endeavored to get him into her power by moving the privy council to pronounce him guilty of treason on the ground that he had written a circular letter to leading Protestants in reference to the trial of two persons indicted for a riot in the Chapel Royal. Knox's trial took place at a special meeting of council in December, 1562, at which the queen was present and acted an unseemly part as prosecutrix. To the unconcealed chagrin and intense displeasure of his sovereign, Knox was by the majority of the noblemen present absolved from all blame and commended for his judicious defence.

Before he was required to appear a second time at a privy council meeting, Knox, who had been a widower for three years, was married to his second wife Margaret Stewart, daughter of "the good" Lord Ochiltree; and in Ochiltree House, an ancient baronial residence, the room is still pointed out where, in March, 1564, the marriage was celebrated. The occasion of his second appearance before the privy council was the preaching of a sermon in St. Giles's about a month after the marriage of Queen Mary and Lord Darnley in July, 1565. On the day the sermon was preached the young king made an imposing appearance, sitting on a throne prepared for his reception. Enraged by what he regarded as passages having a reference to himself in the discourse of the preacher, Darnley returned to the palace with the determination not to taste food till the offender had been punished. Knox was accordingly called before the council, "from my bed," as he tells us. Informed that he had offended the king, and that he must desist from preaching so long as their majesties remained in Edinburgh, Knox made reply that he had spoken nothing but according to his text (Isa. xxvi. 13–21), and, if the church should command him either to speak or abstain, he would obey, so far as the word of God would permit him. In regard to the sermon he deemed it necessary for his own exoneration to write out in full what he had spoken, and publish it with a preface dated at "Edingbrough, the 19th of September, 1565." This sermon is the only specimen of Knox's pulpit discourses handed down to us. Dr. M'Crie is of opinion that the prohibition was of a very temporary nature; but it does not appear that Knox resumed his usual ministrations in Edinburgh, unless at occasional intervals, till after Mary had been deprived of her authority in 1567. During this period of absence from his charge, however, the inhibited preacher was far from idle. In 1566 he drew up the most considerable portion of his *Historie of the Reformatioun*, having made a commencement in 1559 or 1560, and he wrote at the request of the Assembly various public letters. He also visited churches in the south of Scotland, and made a journey to England, in order to see his two sons, who had been there for education since the death of their mother Marjory Bowes.

On the 29th of July, 1567, the infant James VI. was crowned in the parish church of Stirling, and on that occasion Knox reappeared in public and preached the coronation sermon. He also preached at the opening of parliament in December of the same year, when the Confession of Faith formed and approved by parliament in 1560, with various Acts in favor of the Reformed religion, was solemnly ratified. When James Stuart, earl of Murray and regent of Scotland, was assassinated and died at Linlithgow, 23d January, 1569, the event caused anguish and anxiety to the Reformer, who poured out the sorrows of his heart in the sermon and the prayers of the day on which the tidings reached the capital, and who thereafter preached the funeral sermon in the presence of 3,000 persons gathered to witness the interment in the south aisle of the collegiate church of St. Giles. The strain to which body and mind alike had been subjected for many years back, and the shock caused by the removal of the nobleman in whom he placed the greatest confidence, affected the Reformer's health, and in the month of October, 1570, he had a stroke of apoplexy. Although he so far rallied as to have the use of speech restored to him and to resume preaching, he never entirely recovered from the debility which the stroke produced.

Resolved to take no prominent part in public affairs, and confining himself to preaching in the forenoon of the Lord's day, Knox might have spent what little of life on earth remained for him in the house assigned him by the provost and town council of Edinburgh, had he not become personally obnoxious to Kirkcaldy of Grange. This and the troubles which agitated the country induced Knox, "sore against his will, being compellit be the Brethren of the Kirk and Town," to quit the metropolis and retire to St. Andrews. During his stay there of fifteen months the many infirmities of age did not prevent him engaging in his two favorite employments of preaching and writing. How he preached, James Melville, then a student, afterwards minister of Anstruther, has described in an often-quoted passage of his "Diary." The latest publication of Knox in his lifetime was "imprentit at Sanctandrois be Robert Lekpreuik, Anno Do. 1572." It is a tract in the form of an answer to a letter written by James Tyrie, a Scottish Jesuit.

By the end of July the adherents of the queen's party abandoned Edinburgh, and so enabled the banished citizens to return to their homes. One of their first acts was to send for Knox, who, travelling slowly because of weakness, reached the capital (for the last time) on the 23d August, 1572. Only two more public appearances were to be made by him. The first of these was when in September tidings came to Edinburgh of the St. Bartholomew massacre. Being assisted to reach the pulpit, and summoning up the remainder of his strength, he thundered out the vengeance of heaven against "that cruel murderer and false traitor, the king of France," and desired the French ambassador to tell his master that sentence was pronounced against him in Scotland, that the Divine vengeance would never depart from him nor from his house if repentance did not ensue, but that his name would remain an execration to posterity, and none proceeding from his loins should enjoy his kingdom in peace. The other occasion on which the debilitated Reformer appeared in public was the induction of Lawson, sub-principal of King's College, Aberdeen, as his successor, which took place on the 9th November. After taking a leading and solemn part in the services, he crept down the street leaning upon his staff and the arm of his attendant, and entered his house never to leave it alive.

Interesting details of his last illness and death-bed exercises are furnished in two contemporary narratives—Richard Bannatyne's "Account of Knox's Last Illness and Death" given in his *Journal of the Transactions in Scotland*, 1570–1573, and the "Eximii viri Joannis Knoxii Scoticanæ, Ecclesiæ instauratories vera extremæ vitæ & obitus Historia" of Thomas Smeton, principal of the university of Glasgow, at the end of his *Responsio ad Hamiltonii Dialogum*, 1579. Both narratives are inserted by Dr. Laing in his addition of the *Works*, vol. vi. part ii. Attended by his wife and friends, Knox died on Monday the 24th of November, 1572, in the 67th year of his age. The funeral took place on the Wednesday following, when the body was brought from the house in the Netherbow Port by the newly-appointed regent, the earl of Morton, and other noblemen, and interred in the burying-ground connected with the church of St. Giles. "When the body was laid in the grave," says Calderwood, "the earl of Morton uttered these words:—'Here lieth a man, who in his life never feared the face of man; who hath been often threatened with dagge and dagger, but yet hath ended his days in peace and honor.'" If any stone ever marked the precise spot where Knox was buried—said by tradition to be in the Parliament Square, a few feet to the west of the pedestal of Charles II.'s statue—it must have been destroyed in 1633, when the burying-ground was wholly obliterated by buildings. As in the case of his illustrious contemporary and friend Calvin, no tombstone marks the place where he was interred.

Knox's family consisted of five children—two sons and three daughters. His two sons were born to him by his first wife, Marjory Bowes. Nathanael and Eleazer Knox were both born in Geneva, entered as students of the university of Cambridge, and became fellows of St. John's College. Both died at an early age, and by their deaths the family of the Reformer became extinct in the male line. The three daughters of Knox were Martha, Margaret, and Elizabeth. Martha was married to Alexander Fairlie of Braid, in the neighborhood of Edinburgh, a tradition that she became the first wife of James Fleming, father of Robert Fleming, author of *The Fulfilling of the Scriptures*, having been disproved by Dr. Laing (*Works*, vol. vi., part 2, lxix.); Margaret Knox married Zachary Pont, for several years minister of St. Cuthbert's, Edinburgh; and Elizabeth married John Welch, or Welsh, or Welsch, minister successively of Selkirk, Kirkcudbright, and Ayr, and, when transported, of the French Protestant Church. Dr. Laing considers it improbable that any lineal descendants of these daughters still exist.

Of Knox no original painting is known to exist. Several likenesses have been frequently reproduced. 1. A woodcut portrait of the Reformer occurs in Beza's *Icones*, published at Geneva in 1580, which has often been reproduced. 2. A French translation of the *Icones*, by Simon Gaulart, appeared in 1581 with a totally different portrait substituted in place of that of Knox, which is now believed to represent William Tyndale, the translator of the Bible. 3. In 1602 Verheiden, a Dutch theologian, published at the Hague his *Præstantium aliquot Theologorum Effigies*, and in that work a head engraved on copper by Hondius is given as that of Knox. There is every reason to suppose that this is merely an improved copy from Beza, and not taken from an original painting. 4. The Torphichen portrait of Knox is at Calder House. It has on the back of the canvas the inscription, in a handwriting less than a century old—"Rev. Mr. John Knox. The first sacrament of the Supper given in Scotland after the Reformation was dispensed by him in this hall." It is a harsh, disagreeable likeness, painted at least a century after Knox's death, with Beza's woodcut for model. 5. In 1836 the Society for the Diffusion of Useful Knowledge published an engraving of a portrait of Knox which now goes by the name of the Somerville portrait. This painting belonged to the Somerville family, and hung on the walls of their London residence till the peerage became extinct. The tradition in the family is that it was brought into their possession by James, the thirteenth baron, in the latter half of the 18th century; and the supposition of those who regard this as a veritable likeness of the Reformer is that Baron Somerville had fallen in with an excellent portrait seemingly by some distinguished artist of Knox's time (presumably Francis Porbus, who painted a likeness of George Buchanan), and had a copy of it painted for his mansion of Drum, near Edinburgh. Engravings of Beza's and Verheiden's portraits will be found in Knox's *Works*, vols. i. and vi.; of the Torphichen portrait in the *Life of Knox*, 1st edition; and of all the five likenesses in *The Portraits of John Knox*, by Thomas Carlyle, whose verdict is in favor of the Somerville portrait as "the only probable likeness anywhere known to exist."

Literature.—The Works of John Knox, collected and edited by David Laing, 6 vols., Edinburgh, 1846–64; M'Crie, *The Life of John Knox*, 1st ed., 1811, 7th ed., 1855; Lorimer, *John Knox and the Church of England*, London, 1875; T. Carlyle, *An Essay on the Portraits of John Knox*, published in collected works along with *The Early Kings of Norway*, London, 1875. The life and labors, character and influence, of Knox are dealt with more generally in the following works:—Hill Burton's *History of Scotland;* J. A. Froude's *History of England;* Carlyle's *Heroes and Hero Worship;* Moncrieff, *The Influence of Knox and the Scottish Reformation on England*, London, 1860; Froude, *The Influence of the Reformation on the Scottish Character*, Edinburgh, 1865. (C. G. M'C.)

KNOXVILLE, chief city of Knox county and of East Tennessee, United States, is situated on the right bank of the Tennessee river, which is navigable up to this point, four miles below the confluence of the Holston and French Broad rivers, and about 165 miles east of Nashville. By recent statistics it is shown to be one of the six healthiest cities in the United States; the elevation is 1000 feet, mean temperature 58° Fahr., average rainfall 54.5 inches. Among its numerous handsome buildings are the United States custom-house and post-office, the university of Tennessee, and the public schools. There is a free library in the city. The university, which includes the State college of agriculture and the mechanic arts, was founded in 1807, the latter departments being added in 1869. It has a good library, and geological, mineralogical, and zoological collections. In 1881 there were 398 students. Knoxville is a busy industrial and commercial centre. Its manufactures include iron in all its forms, railway and other carriages, paper, furniture, sashes and blinds, tobacco, flour, leather and harness, pottery, etc.; and it has a brisk trade in these articles, as well as in boots and shoes, hardware, and dry goods. Marble and coal of excellent quality are found in vast quantities near the city. Knoxville was settled in 1789, and laid out as a town in 1791, when it was named after General Henry Knox, at that time Washington's minister of war. From 1794 till 1817 it was the capital of Tennessee. During the civil war it was an important position, passing into the possession of the Union forces in 1863. The population of the city in 1880 was 9693, or, including directly connected suburbs, 15,450.

KOBELYAKI, a town of Russia, in the government of Poltava, 40 miles southwest of the government town, with a station on the railway between Kharkoff and Krementchug. The town proper is situated on the right bank of the Vorskla, but a suburb of some size, known simply as Zaryetchya or "Beyond the River," lies on the other side. Of the 13,000 inhabitants more than half are occupied exclusively with agriculture; but weaving, introduced by German colonists, is beginning to be a considerable industry in the town. Kobelyaki was founded by the Polish nobleman Nemirovitch, and is mentioned as a town in 1647. In the neighborhood lies the village of Perevolotchna, where the Swedish forces under Charles XII. laid down their arms.

KOBRIN, a town of Russia, in the government of Grodno, 12 miles east of Brest-Litovsk and 4 miles from the Tevli station of the railway between Minsk and Brest-Litovsk. It lies in the midst of a marshy country, to the east of which are extensive forests; although situated on the Mukhavetz river, which enters into the system of canals uniting the Dnieper and Bug, it enjoys but little prosperity. Its 8000 inhabitants are chiefly engaged in agriculture; there is also some trade in grain, salt, timber, and bones. Kobrin was until the 16th century the capital of a principality of the same name.

KOCK, CHARLES PAUL DE (1794–1871), novelist, was born at Passy on the 21st of May, 1794, and died at Paris on the 29th of August, 1871. He was a posthumous child, his father, who was a banker of Dutch extraction, having been one of the numerous victims of the Terror, and dying on the scaffold with Hebert and Clootz, not as an extreme republican, but as "suspect" of foreign relations. The family was one of some rank in the Netherlands, and an uncle of the novelist attained to the position of minister of the interior in his native country. Paul de Kock, however, remained all his life a citizen of France. He began life as a banker's clerk, which occupation he soon quitted for literature. But his natural taste, or the memory of his father's death, kept him far apart from the republican party, and he was perhaps the most remarkable literary continuator of the *ancien régime* as far as light novels were concerned. His life was almost entirely uneventful, its chief incident being a burglary which was committed at his country house at Romainville in his later days. For the most part he resided on the Boulevard St. Martin, and was one of the most inveterate of Parisians.

Paul de Kock began to write very early, and continued to produce novels almost until the end of his long life. But his period of greatest and most successful activity was the Restoration and the early days of Louis Philippe. The comparative "patavinity" of his style, and the fact of his standing aloof from the whole innovating movement in literature as in politics made him relatively less popular in France itself than abroad, where he was considered as the special painter of life in Paris. Major Pendennis's remark that he had read nothing of the novel kind for thirty years except Paul de Kock, "who certainly made him laugh," is likely to remain one of the most durable of his testimonials, with as a companion the legendary question of a foreign sovereign to a Frenchman who was paying his respects, "Vous venez de Paris et vous devez savoir des nouvelles. Comment se porte Paul de Kock?" The disappearance of the *grisette* and of the cheap dissipation which Murger pathetically laments in more than one of his works practically made Paul de Kock obsolete, and his want of style affected him as unfavorably as it did his dramatic analogue Scribe. But to the student of manners his vivid and by all accounts truthful portraiture of low and middle class life in the first half of the 19th century at Paris will never lose its value, and, though he can hardly be said to hold a high place in literature, he is a remarkable follower of Restif de la Bretonne, and may be said to be in a sense the last of the 18th century school of novelists.

It has been said that the works of Paul de Kock are very numerous. In the fullest list that we have seen they amount to about a hundred, some of them being decidedly voluminous. With the exception of a few not very felicitous excursions into the historical romance, they are all stories of middle-class Parisian life, of *guinguettes* and *cabarets* and equivocal adventures of one sort or another. The most famous of all is *Le Barbier de Paris*, which has been translated into almost every European language. Of equal literary merit, and, considering the style, of singular freedom from objectionable characteristics, is *André le Savoyard*, a remarkable story, full of narrative power, and one of the happiest examples of the working up of simple and commonplace details into an interesting whole. A certain sameness pervades most of Paul de Kock's work. It is almost untouched by the influences of the romantic movement, and has none of the strong sentiments of the school which derived from the author's contemporary Balzac. But there is a good deal of human nature in it, a good deal of accurate observation, and an almost total absence of the revolting and the preposterous. Paul de Kock was the Charles de Bernard of low life, and greater praise of its kind could hardly be given to any writer.

KODUNGALÚR, or Cranganore, a town in Cochin state, Southern India, 10° 13′ 50″ N. lat., 76° 14′ 50″ E. long., with a population (1876) of 9475.

Though now a place of little importance, its historical interest is considerable. Tradition assigns to it the double honor of having been the first field of St. Thomas's labors (52 A.D.) in India and the seat of Cherumán Perumál's government (341). The visit of St. Thomas is generally considered mythical; but it is certain that the Syrian Church was firmly established here before the 9th century (Burnell), and probably the Jews' settlement was still earlier. The latter, in fact, claim to hold grants dated 378 A.D. The cruelty of the Portuguese drove most of the Jews to Cochin. Up to 1314, when the Vypín harbor was formed, the only opening in the Cochin backwater, and outlet for the Periyár, was at Kodungalúr, which must then have been the best harbor on the coast. In 1502 the Syrian Christians invoked the protection of the Portuguese. In 1523 the latter built their first fort there, and in 1565 enlarged it. In 1661 the Dutch took the fort, the possession of which for the next forty years was contested between this nation, the Zamorin, and the rájá of Kodungalúr. In 1776 Tipú (Tippoo) seized the stronghold. The Dutch recaptured it two years later, and, having ceded it to Tipú in 1784, sold it to the Travancore rájá, and again in 1789 to Tipú, who destroyed and left it in the following year.

KOHÁT, a district in the lieutenant-governorship of the Punjab, India, is situated between 32° 47′ and 33° 53′ N. lat., and between 70° 34′ and 72° 17′ E. long., and is bounded on the N. by Pesháwar, on the E. by the Indus river, on the S. by Bannu district, and on the W. by the Kuram river and the Wazírí hills. It consists chiefly of a bare and intricate mountain region, deeply scored with river valleys and ravines, but inclosing a few scattered patches of cultivated lowland. The eastern or Khatak country especially comprises a perfect labyrinth of ranges, which fall, however, into two principal groups, to the north and south of the Teri Toi river. The Miranzái valley, in the extreme west, appears by comparison a rich and fertile tract. In its small but carefully tilled glens, the plane, palm, fig, and many orchard trees flourish luxuriantly; while a brushwood of wild olive, mimosa, and other thorny bushes clothes the rugged ravines upon the upper slopes. Occasional grassy glades upon their sides form favorite pasture grounds for the Wazírí tribes. The Teri Toi, rising on the eastern limit of Upper Miranzái, runs due eastward to the Indus, which it joins 12 miles north of Makhad, dividing the district into two main portions. The drainage from the northern half flows southward into the Teri Toi itself, and northward into the parallel stream of the Kohát Toi. That of the southern tract falls northwards also into the Teri Toi, and southwards towards the Kuram and the Indus. The frontier mountains, continuations of the Safed Koh system, attain in places a considerable elevation, the two principal peaks, Dupa Sir and Mazeo Garh, just beyond the British frontier, being 8260 and 7940 feet above the sea respectively. The Wazírí hills, on the south, extend like a wedge between the boundaries of Bannu and Kohát, with a general elevation of less than 4000 feet. The salt mines are situated in the low line of hills crossing the valley of the Teri Toi, and extending along both banks of that river. The deposit has a width of a quarter of a mile, with a thickness of 1000 feet; it sometimes forms hills 200 feet in height, almost entirely composed of solid rock-salt, and may probably rank as one of the largest veins of its kind in the world. The most extensive exposure occurs at Bahádur Khel, on the south bank of the Teri Toi. Petroleum springs exude from a rock at Panoba, 23 miles east of Kohát; and sulphur abounds in the northern range.

The census of 1868 extended over an area of 2838 square miles, and disclosed a total population of 145,419 (males, 79,323; females, 66,096). The Mohammedans numbered 136,565, as against 6544 Hindus, 1837 Síkhs, and 473 "others." The Hindus chiefly belong to the trading castes. Among the Mohammedans, 6313 rank as Sayyids; but the Patháns form by far the largest division. Only one town, Kohat, contains a population exceeding 5000 inhabitants. Since the annexation of the Punjab, cultivation has extended from 64,772 acres in 1848 to 163,015 acres in 1873–74. The agricultural staples include wheat and barley for the spring harvest, with rice, millet, Indian corn, and pulses for the autumn crops. Tobacco, mustard, and oil-seeds also cover small areas, and cotton of inferior quality is grown in favorable years. The area under wheat in 1873–74 was returned as 36,600 acres; barley, 17,070; millets, 23,705; Indian corn, 12,050, rice, 4710 acres. Cultivation has now nearly reached its utmost limit. The principal industry of the district is centred in the salt mines. Of these five are now open, from which 294,680 cwts. of salt were quarried in 1870–71. Gun-barrels manufactured near Kohát town have a considerable reputation along the north western frontier. Colored scarfs, woollen carpets, country cloth, and pottery are also turned out at Kohát, Hangu, and Teri. The frontier military road forms the chief channel of communication, practicable throughout for wheeled conveyances and artillery. The district has altogether 249 miles of road, all unmetalled, and in many cases mere tracks, passable at best by camels, and sometimes only by bullocks or ponies. The total imperial revenue raised in the district in 1851–52 amounted to £9824, which in 1872–73 had risen to £19,443, of which the land-tax contributed £8951, and salt £8556. Education remains in a very backward stage. Four Government or aided schools and forty-three indigenous schools had a total roll of only 745 pupils in 1872–73. From its proximity to the hills, the temperature of the district is comparatively cool, except during the summer months.

Kohát, the chief town and cantonment of the above district, situated in 33° 35′ N. lat. and 71° 29′ 43″ E. long., near the north bank of the Kohát Toi river, and 2 miles from the southern base of the Afridi hills.

The population in 1868, including the cantonment, was 11,274. The town is built on undulating ground, within an amphitheatre of hills, and is surrounded by a slight wall, 12 feet in height. Its principal manufacture is that of gun-barrels. The cantonment and civil station lie to the east and northeast of the native city. The cantonment has accommodation for about 3000 troops.

KOHL, Johann Georg (1808–1878), traveller and author, was born at Bremen, April 28, 1808. He studied law at Göttingen, Heidelberg, and Munich, and for six years was a private tutor in Courland. In 1838, after travelling through parts of Russia, he settled at Dresden. The success of four books, which he published in 1841, describing his Russian experiences, decided his choice of literature as a profession. Travels in Europe and America supplied ample material, and book after book appeared. In 1854 he undertook to prepare an historical coast survey of the United States, in the service of Government. In 1858 he returned to Bremen, where in 1863 he was made city librarian. In that post he died, October 28, 1878.

Kohl was a prolific author, and his books, both in the original and in English translations, have enjoyed considerable popularity. His style is agreeable and lively, and not without humor; his observation was acute, and not more superficial than was inevitable from the mode in which he amassed his materials. Besides the books on Russia, Kohl published works on Austria-Hungary (1842), England, Scotland, and Ireland (1844), the Alps (1849–51), Denmark and the Northern Duchies (1846–47), Southeastern Germany (1852), the Netherlands (1850), Istria, Montenegro, etc. (1851), the Danube (1854), Canada and New England (1857), the Northwest of the United States (1859), Lake Superior ("Kitchi-Gami") (1859). Among his historical, geographical, and miscellaneous writings are the following: —*Der Rhein*, 2 vols., 1851; *Aus meinen Hütten*, 3 vols., 1850; *Geschichte der Entdeckung Amerika's*, 1861; *Das Haus Seefahrt zu Bremen*, 1862; *Nordwestdeutsche Skizzen*, 1864; *History of the Discovery of Maine*, 1869; *Die Völker Europa's*, 2 vols., 1872; *Kleine Essays*, 1875.

KOLÁBA, a district of the Bombay Presidency, India, lying between 17° 52′ and 18° 50′ N. lat., and between 73° 7′ and 73° 42′ E. long. It is bounded on the N. by Bombay harbor and Thána district, on the E. by Poona and Sátára, on the S. by Ratnágiri and Janjíra state, and on the W. by the Arabian Sea. Lying between the Sahyádri range and the sea, Kolába district abounds in hills, some being spurs of considerable regularity and height, running at right angles to the main range, whilst others are isolated peaks or lofty detached ridges. The sea frontage, of about 20 miles, is throughout the greater part of its length fringed by a belt of cocoa-nut and betel-nut palms. Behind this belt lies a stretch of flat country devoted to rice cultivation. In many places along the banks of the salt-water creeks there are extensive tracts of salt marsh land, some of them reclaimed, some still subject to tidal inundation, and others set apart for the manufacture of salt. The district is traversed by a few small streams. Tidal inlets, of which the principal are the Nágothna on the north, the Roha or Chaul in the west, and the Bánkot creek in the south, run inland for 30 or 40 miles, forming highways for a brisk trade in rice, salt, firewood, and dried fish. Near the coast especially, the district is well supplied with reservoirs. The Sahyádri range has two remarkable peaks,—Ráigarh, where Sivají built his capital, and Mirádongar. There are extensive teak and blackwood forests, of which the value is increased by their proximity to Bombay. The Kolába teak has been pronounced the best grown in the Concan, and inferior only to that of Calicut. In 1875–76 the forest revenue amounted to £3634. Tigers and leopards are found all over the district, and bears on the Sahyádri range. Hyænas and jackals abound. Bison, *sámbhar*, and cheetah have been shot, but are very rare.

Kolába district, with the exception of Alíbágh subdivision, formed part of the dominions of the peshwa, annexed by the Bombay Government in 1818. Alíbágh lapsed to the paramount power in 1839.

The population in 1872 was 350,405—Hindus, 330,914; Mohammedans, 17,194; Parsís, 25; Jews, 1940; and Christians, 208. Of the Hindus the most important class are the Bráhmans, who own large gardens and palm groves along the coast. Another important class are the Bhandáras, or toddy-drawers and cocoa-nut cultivators. The Beni-Israel (see vol. xiii. p. 695) are chiefly found in the seaboard tracts. A considerable number of them enlist in the native army, and are highly esteemed as soldiers. They also monopolize the work of oil-pressing to so great an extent that they are generally known as oilmen or *telis*. The total area of Government cultivable land in 1876–77 was returned at 468,646 acres, of which upwards of 98 per cent. was taken up for cultivation. Rice forms the staple produce and is the chief export of the district. The inferior grains are *nachni* (*Eleusine coracana*), *wari* (*Panicum miliaceum*), and *harik* (*Paspalum frumentaceum*); and these form the chief food supply of the people. The estimated value of the exports (rice, salt, timber, vegetables, and fruit) is £438,249; of the imports (grain, piece goods, oil, butter, and sugar), £170,816. The local industries are salt manufacture and silk-weaving. The total imperial, local, and municipal revenue in 1876–77 was £106,893, of which £72,462 was contributed by the land tax. There are seventy-one Government or aided schools attended by 3644 pupils. The average annual rainfall is 75 inches. The chief town of the district is Alíbágh.

KOLÁR, or **Colar**, a district of Mysore state, Southern India, lying between 12° 46′ and 13° 36′ N. lat., and 78° 5′ and 78° 35′ E. long. It occupies that portion of the Mysore table-land immediately bordering the Eastern Gháts. The principal watershed lies in the northwest, around the hill of Nandidrug (4810 feet), from which rivers radiate in all directions: and the whole country is broken by numerous hill ranges. The chief rivers are the Pálár, the South Pinákiní or Pennár, the North Pinákiní, and the Pápaghni, which are industriously utilized for irrigation by means of anicuts and tanks. The rocks of the district are mostly syenite or granite, with a small admixture of mica and felspar. The soil in the valleys consists of a fertile loam; and in the higher levels sand and gravel are found. The hills are covered with scrub, jungle, and brushwood. The only tract where the trees attain any size is in the neighborhood of Nandidrug, where an area of 7 square miles has been reserved by the forest department.

The population in 1871 was 618,954, spread over an area of 2577 square miles—Hindus numbering 592,652; Mohammedans, 25,038; Jaíns, 651; and Christians, 613. Four towns contain upwards of 5000 inhabitants, namely, Kolár, 9924; Chikballapur, 9882; Siálghata, 7009; and Hosur, 5711. The staple agricultural products are rice, *ragi*, and *joar*. Pulses, oil-seeds, vegetables, and tobacco are also grown on limited areas. Cattle-breeding has recently been fostered by the British Government, and large cattle fairs are held annually. The manufactures of the district comprise sugar, silk and cotton weaving, and oil-pressing. Iron ore is smelted in considerable quantities. The principal exports are sugar, rice, *ragi*, vegetables, cotton cloth, betel leaf, opium, and *ghí*; the imports are European piece goods and salt. The total revenue of the district in 1873-74 amounted to £119,446, of which £97,470 was derived from the land and paid by 78,247 proprietors of 678 separate estates. The Government aided and inspected schools in 1874 numbered 233, attended by 5547 pupils; in addition there were also 102 unaided schools. The district bears a good reputation for healthiness, the mean annual temperature being 76°, and the average annual rainfall 29.17 inches.

The early history of the district is enshrouded in the usual Hindu legends, chiefly localized at the village of Avani, which is still a popular place of pilgrimage, as containing a *linga* set up by Ráma himself. The earliest authentic evidence shows that Kolár in primitive times formed part of the kingdom of the Pallavas, a dynasty overthrown by the Cholás, to whom is assigned the foundation of Kolár town. After the Cholás came the Ballála kings, who in their turn gave way to the powerful monarch of Vijayanagar, in the early part of the 14th century. About this period arose the Gauda family, whose chiefs appear to have submitted successively to every conqueror until they were swept away by Hyder Ali. The first Mohammedans to invade this tract were the Bijápur kings, whose general was the Marhátta Sháhjí, the father of Sivají the Great. In

1639 Shahji obtained Kolár as a fief, which he transmitted to his son Venkoji or Ekoji, the founder of the Tanjore line. Subsequently Kolár was overrun by the Mughals. In 1761 it was formally ceded by the nizám to Hyder Ali, who was a native of the state, having been born at the little village of Budikot; and after the fall of Tipú in 1799 it was incorporated in the Hindu state of Mysore. The chief historical interest of modern times centres round the hill fort of Nandidrug (Nundydroog), which was stormed by the British in 1791, after a bombardment of twenty-one days. Kolár, which with the rest of Mysore had been under British administration since 1835, was restored to its native chief in March, 1881.

KŌLCSEY, Ferencz or Francis (1790–1838), a distinguished Hungarian poet, critic, and orator, was born at Szōdemeter, in Transylvania, on the 8th of August, 1790. His parents both died during his childhood, leaving him to the care of a trusted female servant. At an early age Kölcsey was sent to the Calvinistic school at Debreczen, where he acquired a sound knowledge of the Latin and Greek classics, as also of the leading Hungarian and German poets. In his fifteenth year he made the acquaintance of Kazinczy, and zealously adopted his linguistic reforms. In 1809 Kölcsey went to Pest with the intention of following the legal profession, and became a "notary to the royal board." The public career of a lawyer, however, proving distasteful to him, he soon left the city, and secluding himself at Cseke in Szatmár county, devoted his time to æsthetical study, poetry, criticism, and the defence of the theories of Kazinczy. Kölcsey's early metrical pieces contributed to the *Transylvanian Museum* did not attract much attention, whilst his severe criticisms of Csokonai, Kis, and especially Berzsenyi, published in 1817, rendered him very unpopular. From 1821 to 1826 he published many separate poems of great beauty in the *Aurora*, *Hebe*, *Aspasia*, and other magazines of polite literature. Having by these means again risen in the estimation of the literary public, he was induced by Paul Szemere to join him in the production of a new periodical, styled *Élet és Literatura* ("Life and Literature"), which appeared from 1826 to 1829, in 4 vols., and gained for Kölcsey the highest reputation as a critical writer. About this time his powers as an orator began to be displayed in his capacity of upper notary to the county of Szatmár. From 1832 to 1835 he sat in the Hungarian diet, where his extreme liberal views and his singular eloquence soon rendered him famous as a parliamentary leader. In the meantime he had not been inactive as a literary savant. Elected on the 17th November, 1830, a member of the Hungarian Academy of Sciences, he took part in its first grand meeting; in 1832 he delivered his famous oration on Kazinczy, and in 1836 that on his former opponent Daniel Berzsenyi. When in 1838 Baron Wesselényi was unjustly thrown into prison upon a charge of treason, Kölcsey eloquently though unsuccessfully conducted his defence; and he died about a week afterwards (24th of August) from internal inflammation. His collected works, in 6 vols., were published at Pest, 1840–48, and his journal of the diet of 1832–36 appeared in 1848. A monument erected to the memory of Kölcsey was unveiled at Szatmár-Németi on the 25th of September, 1864.

See G. Steinacker, *Ungarische Lyriker*, Leipsic and Pest, 1874; F. Toldy, *Magyar Költōk élete*, 2 vols., Pest, 1871; J. Ferenczy and J. Danielik, *Magyar Irók*, 2 vols., Pest, 1856–58.

KOLDING, a town in the district of Veile, Denmark, is situated on the east coast of the province of Jutland, on the Koldingfjord, an inlet of the Little Belt. It has some little shipping, but its harbor is not deep. A little to the northwest is the splendid ruin of the royal castle Koldinghuus, formerly called Oernsborg or Arensborg. It was begun by Duke Abel in 1248; in 1808 it was burned. The large square tower was built by Christian IV. (1588–1648), and was surmounted by colossal statues, of which one is still standing. The name of Kolding occurs in the 10th century; but its earliest known town-rights date from 1321. In 1644 it was the scene of a Danish victory over the Swedish, and in 1849 of a Danish defeat by the Schleswig-Holstein troops. The population in 1870 was 5400.

KOLHÁPUR, a native state in the Bombay Presidency, India, lying between 15° 58′ and 17° 11′ N. lat., and between 73° 45′ and 74° 24′ E. long.; it is bounded on the N. by Sátára district, on the E. and S. by the states of Sángli, Miráj, and Kurunchwád, and on the W. and S.W. by Sawantwári state and Ratnágiri district. The area is 3184 square miles. Kolhápur state stretches from the heart of the Sahyádri range eastwards into the plain of the Deccan. Along the spurs of the main chain of the Sahyádri hills lie wild and picturesque hill slopes and valleys, producing little but timber, and till recently covered with rich forests. The centre of the state is crossed by several lines of low hills running at right angles from the main Sahyádri range. In the east the country becomes more open, and presents the unpicturesque uniformity of a well-cultivated and treeless plain, broken only by an occasional river. Among the western hills are the ancient Marhattá strongholds of Panhála, Vishalgarh, Baura, and Rungna. The rivers, though navigable during the rains by boats of 2 tons burden, are all fordable during the hot months. Iron ore is found in the Sahyádri range, and smelting was formerly carried on to a considerable extent; but now the Kolhápur mineral cannot compete with that imported from Europe. There are several good stone quarries. The principal agricultural products are rice, millet, sugar-cane, tobacco, cotton, safflower, and vegetables. The population of the state, including feudatories, was 802,691 in 1872. Hindus amounting to 95½ per cent., and Mohammedans to 4 per cent. Pottery, hardware, and coarse cotton and woollen cloth are the principal manufactures. The chief exports are coarse sugar, tobacco, cotton, and grain; piece goods, salt, silk, sulphur, and spices are imported.

The rájás of Kolhápur trace their descent from Rája Rám, a younger son of Sivaji the Great, the founder of the Marhattá power. The prevalence of piracy caused the British government to send expeditions against Kolhápur in 1765 and 1792; and in the early years of this century the misgovernment of the chief compelled the British to resort to military operations, and ultimately to appoint an officer to manage the state. In 1862 a treaty was concluded with Sivaji III. The revenue of the state is estimated at £304,000. The military force consists of 1618 men. Exclusive of a few missionary institutions, there are in all 104 schools, attended by 5105 pupils. The climate is on the whole temperate.

Kolhápur, the capital of the above state, is situated in 16° 42′ N. lat. and 74° 16′ E. long., 128 miles south by east of Poona. It is a picturesque, flourishing trading town, adorned with many handsome buildings. Population in 1872, 39,621.

KOLIN (Boh. *Novy Kolin*, *i. e.*, New Kolin), a town in the circle of Kaurzim, Bohemia, is situated on the Elbe, about 35 miles east of Prague, with which city as also with Brünn it is connected by the Austrian State Railway, here intersected by the northwestern line in 50° 4′ N. lat., 15° 14′ E. long. Among the many noteworthy buildings in Kolin may be specially mentioned the church of St. Bartholomew (Early Gothic style), erected during the latter half of the 14th century, the castle, and the town-hall. The educational and industrial establishments comprise collegiate institutes for both sexes, a commercial school, religious houses, several sugar refineries and oil-mills, a spirit distillery, and an artificial manure factory. Population of commune 9473, of town 9199. Kolin is chiefly famous on account of the battle of Chotzemitz or Kolin, 18th June, 1757, when the Prussians under Frederick the Great were defeated by the Austrians under Daun.

KOLOMEA, or Kolomyia, a town and district in the Austrian province of Galicia, lies on the right bank of the Pruth and on the railway from Czernowitz to Lemberg, about 105 miles south-southeast of the latter, 48° 31′ N. lat., 25° 1′ E. long. Kolomea is the seat of the administrative, military, and judicial authorities of the district, and has Roman Catholic churches, synagogues, a lower gymnasium, and manufactories of earthenware. More than a third of the inhabitants are Jews, who carry on the greater part both of the wholesale and retail trade. The Ruthenian or native population of the town and neighborhood are mostly employed in agricultural pursuits, and in the pasturing of horses, oxen, and sheep. In 1881 the population amounted to 23,109.

KOLOMNA, a district town of Russia, in the government of Ryazan, situated on the railway between Moscow and Ryazan, 67 miles southeast of Moscow, at the confluence of the Moskva river with the Kolomenka. It is an old town mentioned in annals in 1177, and until the 14th century the capital of the Ryazan principality. It suffered greatly from the invasions of the Tartars, who destroyed it four times, as well as from the wars of the 17th century; but it always recovered, and never has lost its commercial importance. During this century it became a centre of manufactures of silks, cottons, and leather; there are also several smaller manufactures. The merchants of Kolomna carry on an active trade in cattle brought from southern provinces, and in grain, cattle, tallow, skins, salt and timber purchased in the governments of Ryazan and Tula, and sent to Moscow, either by rail, or by boat down the Moskva river. Population 19,000.

KOMORN, or COMORN (Hungarian, *Rév-Komárom*), a royal free town of Hungary, and capital of the trans-Danubian county of Komárom, lies at the eastern extremity of the island of Csallóköz or Schütt and at the confluence of the Waag with the Danube, 48 miles west-northwest from Budapest, with which city as also with Vienna it is directly connected by railway, in 47° 46′ N. lat., 18° 7′ E. long. Komorn is celebrated chiefly for its fortifications, which, owing to their favorable position and extended line of têtes-de-pont, are believed to be impregnable, and are capable of holding a force of some 30,000 defenders. The town is the seat of the county administration, and of a royal court of law and has Roman Catholic, Greek Orthodox, Lutheran, and Calvinist churches, a Jewish synagogue, Roman Catholic and Protestant gymnasia, county and town halls, a military hospital, two savings banks, and a shipping agency. The streets are for the most part narrow, irregular and gloomy. The commercial relations of Komorn with the chief towns on the Danube are facilitated by its important steam-packet station. The inhabitants carry on a brisk trade in grain, timber, wine, flour, and fish. The civil population at the end of 1880 amounted to 13,108, mostly Magyars and Germans by nationality.

The walls of the fortifications of Komorn were commenced from the land side in 1272. They were much strengthened and extended two hundred years later by King Matthias (Corvinus). The new fort was begun by Ferdinand I. about 1547, and received additions in 1673 under Leopold I. In 1543, 1594, 1598, and 1663 Komorn was beleaguered by the Turks. It was raised to the dignity of a royal free town in 1751. In 1767, 1768, September, 1848, and April, 1854, it suffered severely from fire, and in 1763, 1822, and 1851 from earthquakes. The fortifications, having been neglected during the latter half of the 18th century, were enlarged and to a great extent reconstructed between 1805 and 1809. During the revolutionary war of 1848–49 Komorn was a principal point of military operations, and was long unsuccessfully besieged by the Austrians, who on the 11th July, 1849, were defeated there by General Görgei, and on the 3d August by General Klapka. On the 27th September the fortress capitulated to the Austrians upon honorable terms, and on the 3d and 4th was evacuated by the Hungarian troops. The treasure of the Austrian national bank was removed here from Vienna in 1866, when that city was threatened by the Prussians.

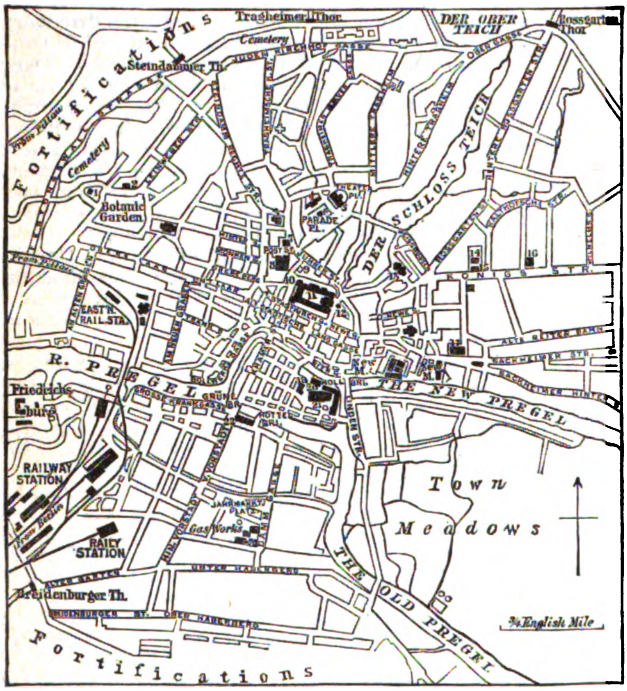
KOMOTAU, a town and district of Bohemia, at the foot of the Erzgebirge, and at the junction of the Buschtiehrad, Dux-Bodenbach, and Aussig-Teplitz lines of railway, about 10 miles north-northwest of Saaz, in 50° 27′ N. lat., 13° 26′ E. long. An old but thriving town, Komotau is the seat of the military and judicial authorities of the district, as also of boards of mining and of customs. The industrial establishments comprise manufactories of woollen cloth, linen and paper, dyeing houses, breweries, distilleries and vinegar works, a sugar of lead manufactory and an iron foundry. The amount of beer delivered in 1880 was 535,588 gallons. Lignite is worked in the neighborhood. At the end of 1880 the population was 10,111.

KONGSBERG, a mining town in the district of Buskerud, Norway, is situated on the Laagen, 500 feet above the sea, and about 60 miles southwest of Christiania by rail. With the exception of the church and the town-house, the buildings are mostly of wood. The origin and whole industry of the town are connected with the Government silver-mines in the neighborhood. Their first discovery was made by a peasant in 1623, since which time they have been worked with varying success. Over a hundred mines have been opened, but of these only three are now of any importance. The annual profit averages about £22,000. During last century Kongsberg was much more important than it now is, and contained more than double its present population. Dr. Clarke in his *Travels* (1823) gives a good description of the place, and mentions a mass of native silver, nearly 600 ℔ in weight, found there, which is preserved in the museum at Copenhagen. Within the town of Kongsberg are situated the smelting-works, the mint, and a Government weapon factory. The population of the town in 1875 was 4311.

KÖNIGGRÄTZ (Bohemian, *Králové Hradec*), a fortified town and episcopal seat in Bohemia, at the confluence of the Adler with the Upper Elbe, and at the junction of the Reichenberg-Pardubitz and Northwestern lines of railway, in 50° 10′ N. lat., 15° 49′ E. long. Wax candles, gloves, shoes, woollen cloths, and musical (wind) instruments are manufactured. The population in 1880 was 6173. The place is chiefly notable from the battle of Königgrätz, or Sadowa, fought in its neighborhood on 3d July, 1866, when the defeat of the Austrians under Benedek decided the German supremacy of Prussia, and led to the acquisition of Venice by Italy and the constitutional independence of Hungary. See Jähn's *Die Schlacht bei Königgrätz*, 1876.

KÖNIGINHOF (in Czech, *Dvur Kralové*), chief town of a department in the northeast of Bohemia, is situated on the left bank of the Elbe, about eighty miles northeast of Prague. In the tower of one of the churches Hanka discovered the Königinhof MSS. in 1817 (see vol. xi. p. 393). The Zaboj monument in the market-place commemorates the discovery. Cotton-weaving, yarn-spinning, and brewing are the leading industries. In 1421 Königinhof was stormed by the Hussites. On June 29, 1866, it was the scene of a Prussian victory over the Austrians. The population in 1869 was 6222.

KÖNIGSBERG (in Polish *Krolewiec*), chief town of a government district in the province of East Prussia, and since 1843 a fortress of the first rank, is situated on the Pregel, 4½ miles from its mouth in the Frische Haff, 25 miles from the sea-coast, and 397 miles northeast of Berlin, in 54° 43′ N. lat. and 20° 30′ E. long. It consists of three formerly independent parts—the Altstadt (old town) to the west, Lobenicht, to the east, and the island of Kneiphof, together with numerous suburbs, embraced in a circuit of 9½ miles. The Pregel, spanned by many bridges, flows through the town in two branches, which unite below the Green Bridge. Its greatest breadth within the town is from 80 to 90 yards. It is frozen from November to March. Although an old town, Königsberg does not retain many marks of antiquity. The Altstadt has long and narrow streets, but the Kneiphof quarter is roomier. Of the seven market-places only that in the Altstadt retains something of its former appearance. Among the more interesting buildings are the schloss, a long rectangle begun in 1255 and added to later with a Gothic tower 277 feet high, and the chapel (built 1592) in which Frederick I. placed the Prussian crown on his own head in 1701; and the cathedral, begun in 1322, restored in 1856, a Gothic building with a tower 164 feet high. Behind the schloss is the parade ground, with the statue of Frederick William III. by Kiss. To the east is the Schlossteich, a long narrow ornamental lake covering 12 acres, with beautifully laid out tree-shaded banks. The northwest side of the parade-ground is occupied by the new university buildings, completed in 1873; along with the new exchange on the south side of the Pregel, they are the finest architectural feature of the town. The university was founded in 1544 by Albert I., Duke of Prussia; it possesses a library of 200,000 volumes. Among its famous professors have been Kant (born in Königsberg in 1724), to whom a monument was erected in 1864, Herder, Herbart, Bessel, Voigt, K. E. von Baer, F. Neumann, and others. In the summer session of 1880 it had a teaching staff of 88; in the winter session 1880–81 its students numbered 808. Königsberg has also four gymnasia, two commercial schools of the first rank, an academy of painting with a public picture gallery, and a school of music, besides other educational establishments. The hospitals and benevolent institutions are numerous. The protected position of its harbor has made Königsberg one of the important trading cities of Germany. Ships of more than 1500 tons have to discharge cargo at Pilau, at the entrance to the Haff, connected with Königsberg by rail; and the grain trade with the interior is carried on by barges. The chief imports and exports of Königsberg are grain, spirits, colonial wares (especially tea), petroleum, coal, iron, herrings, flax, hemp, and wool. The exports by sea for the third quarter of 1881 amounted to 46,508 tons, and the imports from Russia alone to 42,479 tons. The number of ships that entered Königsberg and Pilau in 1879 was 1653 (278,000 tons); the number that cleared was 1656 (299,000 tons). The corresponding figures for 1880 were not so large. The manufactures of Königsberg are not very important. They include iron, machinery, beer, spirits, sail-cloth, cloth, oil, flour, leather, and its specialty "marchpane." There is also yarn-spinning, cloth-printing, dyeing, tanning, and tobacco manufacture. The population, in 1858 only 83,000, was 140,896 in 1880.



Plan of Königsberg.

1. Observatory.
2. Zoological Museum.
3. Polish Church.
4. New University Buildings.
5. Theatre.
6. Statue of Frederick William III.
7. New Altstadt Ch.
8. Post-Office.
9. Kant's House.
10. Statue of Kant.
11. Schloss.
12. Statue of Frederick I.
13. Reformed Ch.
14. Academy of Painting.
15. Town Museum.
16. Library.
17. Roman Catholic Church.
18. Hospital.
19. Bank.
20. Old University Buildings.
21. Cathedral.
22. Exchange.

The Altstadt of Königsberg grew up around the castle built in 1255 by the Teutonic Order, to restrain the neighboring heathens. Its first site was near the fishing village of Steindamm, but after its destruction by the Prussians in 1263 it was rebuilt in its present position. By 1327 all three parts, which were only united in 1724 by Frederick William I., had acquired city rights. In 1340 Königsberg entered the Hanseatic League; and in 1361 it was in direct alliance with England. From 1457 it was the residence of the grand master of the Teutonic Order, and from 1525 till 1618 of the Dukes of Prussia. The trade of Königsberg was much hindered by the constant shifting and silting up of the channels leading to its harbor; and the great northern wars did it immense harm. By the end of the 17th century it had almost recovered; and during the 19th century the opening of the railway system in East Prussia and Russia gave its commerce a new departure, making it the principal outlet for the Russian staples—grain, seeds, flax, and hemp. It has now regular steam communication with Memel, Stettin, Kiel, Amsterdam, and Hull. The local shipping is unimportant.

KÖNIGSHÜTTE, a town in the circle of Beuthen in the government district of Oppeln, Prussia, is situated in the middle of the Upper Silesian coal and iron district, about 55 miles southwest of Oppeln. In 1869 it was incorporated with various neighboring villages, and raised to the dignity of a town. The largest iron-work in Silesia is situated at Königshütte, and includes puddling works, rolling-mills, and zinc-works. Founded in 1797, it was formerly in the hands of Government; but it is now carried on by a company. In 1877 it employed about 3000 hands, and turned out about 54,000 tons of raw iron, 41,700 tons bar-iron, etc., 750 tons raw zinc, and 19,600 tons of steel goods for railways, etc. In the neighborhood of the town there are coal-mines, chalk-quarries, and brick-fields. The population in 1852 was 4495; in 1875 it was 26,040.

KONITZ, or **Könitz**, a town of the German empire, in the Marienwerder district of the province of West Prussia, situated near the railway, about 68 miles southwest of Dantzic. It was the first fortified post established in Prussia by Balk, the grand master of the Teutonic Order, and it continued for a long time to be a place of military importance. Wool and iron are the chief objects of the local industry. The inhabitants numbered 8046 in 1875; about 3000 are Roman Catholics and 550 Jews. There is a history of the town by Uppenkamp (Konitz, 1873).

KONOTOP, a district town of Russia, in the government of Tchernigoff, 137 miles northeast of Kieff, on the railway from this town to Kursk. Its 10,000 inhabitants live by agriculture, boat-building, and trade. Situated in a district which produces a good deal of corn, and is also engaged in cattle and sheep-breeding, it has a brisk and rapidly increasing trade in agricultural produce. The town was founded in 1635 by the Poles, who built a strong citadel, the ruins of which still exist. In 1648 it was taken by the Cossacks of Khmelnitzky, and in 1659, during Vígovsky's insurrection, Russian troops besieged it.

KÖPENICK, or **Cöpnick**, a town in the circle of Teltow in the government district of Potsdam, Prussia, is situated on an island at the influx of the Dahme into the Spree, 8 miles S.E. of Berlin. Two bridges connect it with the mainland. It has a royal palace, with a ritter-saal and a chapel, and a normal school (in the palace). Silk-weaving, calico-printing, iron-rolling, and the manufacture of sugar, shoddy, glass, chemicals, gold-leaf, etc., are the chief industries. There are also steam saw-mills, and some little shipping. Köpenick was the residence of the heathen prince Jaczo, and later of the electors of Brandenburg. It was at Köpenick that Frederick the Great was tried by court-martial, when crown-prince. The population in 1875 was 7113.

KOPREINITZ, an ancient royal free town of Hungary, in the province of Croatia and Slavonia and county of Körös, is situated about 16 miles northeast of the county town Körös, (Kreutz), and on the Zákány-Zágráb line of the Hungarian state railway, in 46° 13′ N. lat., 16° 50′ E. long. The most interesting building is the old castle or fort, still in a good state of preservation, and now used as barracks. There are also in the town Roman Catholic and Greek Orthodox churches, a Jewish synagogue, a town-hall, and a municipal savings bank, besides the usual Government offices. Both the weekly and occasional fairs are well attended, but the trade is chiefly confined to the agricultural products of the neighborhood. The communal lands, extending principally over a level plain, yield large quantities of grapes, fruit, beans, timber, and grain, especially maize. Population in 1880, 6049.

KOPRILI, KIUPRILI, or KJÖPRÜLÜ, a town in the vilayet of Prisrend, Macedonia, Turkey, is situated on both sides of the Vardar, the ancient Axius. Its Christian inhabitants call it Velesa, probably a corruption of Bylazora, described by Polybius as the chief city of Pæonia. Owing to the position of the town on sloping hills, the streets are steep; there are, however, numerous well-built houses. A wooden bridge crosses the river at this point. Mulberry trees and maize are grown in the neighborhood. The population of Koprili, which has given its name to a celebrated family of viziers, is about 15,000.

KORAN. See MOHAMMED.

KORAT, a small territory, tributary to Siam, is situated to the northeast of Bangkok, on the borders of Siam and Cambodia. The approach to it from Bangkok is through an extensive malarious forest, called by the natives, on account of its fatal character, Dong Phya Phai, the forest of the king of fire. The chief mountain is named Khasjai, and from it flows the river Mahot. The productions and exports from Korat comprise stags' and panthers' skins, raw silk, manufactured silk and cotton, peacocks' tails, ivory, elephants' bones, and a small quantity of sugar. The copper-mines of Korat are said to be rich; silk of rather inferior quality is brought from Laos, Ubone, and Bassac. Elephants, buffaloes, and oxen are abundant in the province. Korat is governed by a ruler who has absolute power of life and death. It pays a tribute of gold, silver, and silk to Siam, and has to furnish a large levy of men when required. Sir John Bowring estimates the population of the whole district at 60,000. Korat, the chief town, lies about 170 miles northeast of Bangkok. It is surrounded by a wall, and stands on a stream whose banks are bordered with little plantations of betel and cocoa-nut trees. Outside the town proper is the Chinese quarter, consisting of sixty or seventy houses surrounded by a strong palisade 9 feet high. The Chinese number about 600, and are the industrious trading element in the population. The native name of Korat is Nakhon Raxa Sema, or frontier town. The population is 5000 or 6000.

KORDOFAN, a province of the Egyptian Sudan, which, though marked off from the surrounding territory by no very definite confines, may be said to lie between 12° and 16° N. lat. and between 29° 30′ and 32° 30′ E. long. On the east it does not reach the Nile, and on the west it is usually held to be separated from Darfur by a neutral strip of country. It consists for the most part of a rolling steppe in which a hill of 50 feet is a landmark for a day's journey; but towards the west there are a few isolated peaks such as Jebel Abu Senun and Jebel Kordofan, which rise to a height of 150 to 800 feet above the plain, and in the northwest there are two considerable groups, Jebel Katul and Jebel Kagga. The general elevation of the country above sea-level is given as from 1410 to 1840 feet. A granitic sand with abundance of mica and felspar forms the upper stratum throughout the greater part of the area; but an admixture of clay, which is observable in the north, becomes strongly marked in the south, where there are also stretches of black vegetable mould. Beneath there appears to unfold itself an unbroken surface of mica schist. River or stream there is really none, though a few temporary watercourses or *khórs* exist in the rainy season; and the only permanent lakes are El Birkeh, El Rahad, and Shirkeleh, which are formed by the great Khor Abu Hable in the south. During the rainy season the water collects in myriads of little depressions, but owing partly to rapid evaporation and partly to the porous character of the soil the surface of the country is soon as dry as before. The water which has found its way through the granitic sand flows over the surface of the mica schist and settles in the hollows. Wells consequently sunk so as to reach the solid rock obtain a supply of water more or less abundant according to the spot which they happen to strike; and it is the existence of these which renders human life possible in Kordofan. It is estimated that (apart from those in a few areas of depression—Cagmar, Abu Haraze, Bara, and Mulbes—where the sand stratum is very thin and water is reached at the depth of a few feet) there are about 900 of these wells. They are narrow shafts going down from 75 to 150 or 200 feet, and supported "from the bottom to a little above the water-level" by the long roots of the mimosa, wound around so as to form a complete casing. The water is raised by rope and bucket at the cost of enormous labor, and none is available for irrigation. The very cattle are trained to go a long time without drinking. Entire villages migrate after harvest to the neighborhood of some plentiful well; and in El Obeyd water becomes a regular article of trade soon after the close of the rains. As there is no highland area draining into Kordofan, the underground reservoirs are dependent on the local rainfall, and a large number of the wells are dry during many months. The rainy season lasts from June to September, rain falling every three or four days in brief but violent showers. The wind during that period is from the south or southwest; the air is extremely oppressive; and fevers prevail among the foreign residents. In September the north winds begin to take their turn, and from the middle of October they blow steadily throughout the winter, and produce what Europeans consider a delightful climate. With March begins the dry and sultry summer. The settled population of Kordofan is estimated at 164,740, the nomadic at 114,000. The former, who are scattered over the country in about eight hundred and sixty villages, are of very mingled blood, especially in the neighborhood of the capital, but the Ghodiat, Gilledat, and Gowanieh appear to be the original stock. Of the nomadic tribes the most noteworthy are the Hasanieh, the Kababish, and the Bagara. The last-mentioned—who roam about the southern parts of the country—are a dark red-bronzed race remarkable for their magnificent physique. The staple crop in Kordofan is the dokhn or *Penicillaria typhoides*. Eaten both uncooked and in various culinary conditions, it forms the main food of nine-tenths of the population, and furnishes the raw material for the sweetish Kordofan beer or merissa. Cattle are largely bred by the Bagara, and camels by the Kababish; and horses, goats, donkeys, and sheep are kept in small numbers. Since the ostrich has been almost hunted out of the country, the chief article of importance for trade is the gum yielded by the many mimosa trees, which along with the hijlij, the tamarisk, and the ṭalḥ, tend to relieve the monotony of the steppe. Salt and iron ore exist within the province, but they have not become of any practical value.

Of the movements by which the present composite ethnology of Kordofan was attained little record is recoverable. In 1790 Sheikh Nasib of Sennaar subjugated the district; and under his rule the inhabitants prospered. But, piqued by his neighbor's success, Ibn Fadhl of Darfur invaded Kordofan with a powerful army numbering no less than 12,000 or 14,000 camels, and completely defeated the Sennaar governor Melek il Hashma. The Darfur supremacy continued till 1821, when Mohammed Aly undertook the conquest of Nubia and Sennaar. The defterdar, Mohammed Aly's son-in-law, subjugated Kordofan, and continued to rule it with worse than a rod of iron till he was recalled on account of his cruelties.

[1] See the *Travels* of Sultan Teima (1821), Ruppell (1824), Holroyd (1837), Russeger (1837), Pallme (1844), Brehm (1848), Graf von Schlieffen (1853), Petherick, *Egypt, the Sudan, and Central Africa*, London, 1861; Major H. G. Prout, *General Report on Province of Kordofan*, Cairo, 1877; Marno, *Reise in der Egypt. Equat. Provinz*, Vienna, 1879. The Italian travellers Matteucci and Massari traversed Kordofan in 1880, in their great journey across the continent. The geographical nomenclature is still in many cases uncertain.

KOREÁ, a petty native state in Chutiá Nágpur, Bengal, India, and between 22° 55′ 50″ and 23° 49′ 15″ N. lat., and between 81° 58′ 15″ and 82° 48′ 15″ E. long., and having an area of 1631 square miles. The state consists of an elevated table-land of coarse sandstone, varying from 2477 to 3370 feet above sea-level. Large forest tracts of *sál* timber exist. Iron is found throughout the state, and a tribe of Kols, called Agariás from their occupation, are largely engaged in iron-smelting. The field crops consist of rice, wheat, barley, Indian corn, *maruá*, pulses, oil-seeds, cotton, etc., while the jungle produces stick lac and resin. The population in 1872 was returned at 21,127, viz., 11,093 males and 10,034 females (Hindus, 10,807; Mohammedans, 140; "others," 10,180). Of aboriginal tribes, the most numerous and influential are the Gonds (4644); next in importance are the Cheros (3009). The chief's family call themselves Chauhán Rájputs, and claim descent from a chief of that clan, who conquered Koreá six hundred years ago.

KORITSA, GORITSA, GEORTCHA, or GHIORGHIA, a town of Albania, in the Turkish vilayet of Janina, situated in a spacious plain 45 miles east of Berat and 30 miles west of Kastoria. It is a place of about 10,000 inhabitants, containing a considerable number of well-built houses scattered among its cottages of unbaked mud. To its position on the route between the Adriatic and the Archipelago it is indebted for a flourishing trade. The metropolitan church is a large edifice richly adorned in the interior with paintings and statues.

KÖRNER, KARL THEODOR (1791–1813), German patriot and poet, was born at Dresden, September 23, 1791. His father, a prosperous lawyer, made his house in Dresden a centre of literary, musical, and artistic society, and was an intimate friend of Schiller; and his mother, a daughter of the copper-plate engraver Stock of Leipsic, enjoyed Goethe's friendship through life, and in her later years claimed it for her son. Theodor Körner was at first so delicate a child that his parents made the paternal vineyard—the same in which Schiller sat and wrote *Don Carlos* a few years before—his summer schoolroom. They prescribed for lessons, gymnastics, riding, swimming, fencing, and the like, till the delicate boy grew into a young athlete, with a joyous, affectionate disposition which won the hearts of all who knew him. Partly at the Kreuzschule in Dresden, but chiefly with private tutors at home, Körner now studied languages, history, and mathematics. He was an adept at various kinds of fine wood-turning, could sketch, and play the guitar; but his happiest hours were spent over the volumes of Goethe and Schiller—the household gods; and under their influence the boy began to write verses which his parents forbore to praise, but which displayed, even then, much of the facility and grace of his later poems. At the age of seventeen he went to the school of mines in Freiberg, and worked enthusiastically for two years at mathematics, mineralogy, and chemistry. The poems he wrote during this period were collected and published under the title *Knospen*. From Freiberg Körner went to the university of Leipsic, where for some months he studied philosophy, history, and anatomy. He founded there a poetical association, and became a member of the "Macaria" and more than one student club; but he was unfortunately drawn into the hostilities then rife between two parties in the university, and, after fighting several party duels, was at last forced to leave the town to escape the results of a street fray in which he took part. From Leipsic he went to Berlin, and then to Vienna, with letters to his father's old friends, the Prussian ambassador Von Humboldt and Friedrich Schlegel. Two little pieces which he wrote for the stage, *Die Braut* and *Der grüne Domino*, were acted at the Vienna Court Theatre in July, 1812, with great success; and, with the consent of his parents, he gave up all his former plans, with the hope of being able to make a living by literature alone. His other works followed with astonishing rapidity. In some fifteen months appeared some dozen dramatic pieces and the librettos of a few operas (*Das Fischermädchen*, *Der vierjährige Posten*, and *Die Bergknappen*), besides many short poems. One after the other all his plays were received at the Vienna Theatre with applause. *Zriny*, founded on an heroic incident in Hungarian history, was the favorite with the public; but Goethe praised *Die Braut*, *Der grüne Domino*, and *Die Sühne*. In January, 1813, at the age of one and twenty, Körner was appointed poet to the Court Theatre in Vienna. With the preparation of the libretto of an opera, *Die Rückkehr des Ulysses*, for Beethoven, and with the writing, printing, and stage preparation of his plays, the young poet's hands were now full; very busy and very happy he describes himself in his letters. His betrothal to a young Viennese lady, known now only as the "Toni" of his correspondence, was another source of happiness; but this bright career came suddenly to an end. In the early spring of 1813 there was published the *Fatherland's Call to Arms in the Struggle for Liberation*, and Körner was one of the first to answer the summons. He left Vienna in March, and at Breslau joined the Prussian free-corps then forming under the command of Lützow. When the corps was solemnly consecrated in the village church at Rogau a few days later, the service was opened with a chorale, set to Körner's words, "Dem Herrn Allein die Ehre;" and almost immediately afterwards, when Petersdorf was sent on a mission to Dresden, to try to unite the Saxons in the common cause, the young poet was sent with him, and on this occasion published his spirited prose *Address to the People of Saxony*. Here Körner saw his parents and friends for the last time. In April he was made lieutenant by the vote of his comrades; and a little later, having left the infantry, he was made adjutant to Lützow himself. At Kitzen, near Leipsic, during the three weeks' armistice, he was severely wounded through the treachery of the enemy, but after several adventures escaped to Carlsbad, where he remained till he was well enough to resume his former post. Lützow's free-corps was in almost daily action when the young adjutant was welcomed back. His cheerful zeal and self-denying helpfulness had endeared him to all his comrades, and it was his wild war songs, sung by many voices to old national melodies round the camp fires at night, that helped to spread that fervor in the corps which made it peculiarly terrible to the enemy. The poems written by him at this time are published under the title *Leyer und Schwert*. They include the lines "Abschied vom Leben," which were composed during the night when he lay wounded in the wood by Kitzen. The letters written by Körner to his parents at this time are tender and thoughtful—often aflame with patriotic fervor, but with now and then a ring of intense sadness which forebodes the end. This was very near. His last poem, "Das Schwertlied," was scribbled in his pocket-book at dawn on the 26th of August, when the corps was prepared for action; and he was reading it to a friend when the order to attack was given. It is the wildest of all his war-songs, a love-rhapsody to his sword,—the soldier's bride; and it was this poem that suggested the refrain of Mrs. Hemans's beautiful verses to his memory. In the engagement that followed, on the high road between Gadebusch and Schwerin, Körner, as adjutant, fought at Lützow's side. The French were in great force, but were overcome and fled. Among the hottest in pursuit was Körner, who was mortally wounded, as he rode through a wood, by a shot from one of the fugitive *tirailleurs* who lay hidden there. He was buried with full military honors under an old oak on the road from Lübelow to Dreikrug, by the village of Wöbbelin, where there is now a monument to his memory.

Körner's position in the literature of his country is a peculiar one. He was not quite two and twenty when he died, and his works are necessarily but first-fruits—might all be included in the modest title *Knospen*—plentiful indeed, and full of promise of flowers to come. His earlier poems were hardly more than graceful and pleasing, and even his popular dramas scarcely entitle him to a high place in the literature of his country. It was with the war that Körner's true inspiration came. Had he lived a lifetime, he could never have excelled the production of those few impassioned weeks; but the homage which all Germany paid, and still pays, to the young poet's memory is due, not to his lyric genius alone, but to his bright youth also, and heroic death. His works have passed through many editions. That published in one volume, with a preface by Karl Streckfuss (Berlin, 1879), includes a sketch of his life, extracts from his letters, a few English translations of his poems, and stanzas to his memory by German and English poets, of which last Felicia Hemans is the chief. There is an indifferent English translation of the life of Körner by his father, with selections from his works, by G. F. Richardson, 2 vols., 1827. (F. M.)

KOROTCHA, a district town, in the government of Kursk, Russia, 100 miles south of Kursk, on the Korotcha river. Its 7000 inhabitants live by gardening, exporting great quantities of dried cherries, by making candles and leather, and by trade; the merchants purchase cattle, grain, and salt in the south, and send them to Moscow. Founded in 1638, Korotcha formerly was a small fort erected against the invasion of Tartars.

KOROTOYAK, a town of Russia, in the government of Voronezh, on the right bank of the Don, 6 miles from the Davydovka railway station, and 47 miles south of Voronezh. It was founded in 1642 by emigrants from interior provinces of Russia, and had a small wooden fort. Owing to the proximity of Ostrogojsk, which is a trading place of some importance, its trade is insignificant, and its 9000 inhabitants live by agriculture and some trade in grain.

KOSCIUSKO, or KOSCZIUSKO, THADDEUS (1746–1817), Polish patriot, was descended from an old family of small proprietors in the province of Lithuania, and was born in 746. From his father he inherited a taste for music, and in the other branches of education he showed such marked aptitude at the cadet school of Warsaw that along with some other youths he was sent at the expense of the state to complete his education at Versailles, Brest, and Paris. On his return to Poland he was appointed captain of artillery, but on account of the unfortunate result of his attachment to the daughter of a nobleman he in 1777 went to Paris, whence he sailed with the French fleet to aid the North American States in their war of independence. Under Washington he displayed great firmness and intrepidity in various trying circumstances, and rose to be general of a brigade. In 1786 he returned to his native country, where he lived in retirement until the reorganization of the army in 1789, when he was appointed major-general. In the war with Russia which followed the adoption of the new constitution of 1791 he conducted himself with conspicuous valor and skill, and at Dubienka, with a force of only 4000 men, held an army of 20,000 Russians at bay. All his efforts were, however, rendered fruitless by the pusillanimity of King Stanislaus, who in March, 1792, agreed to a humiliating peace, upon which Kosciusko, along with several other leading officers, resigned his commission. A second partition of Poland was consummated in August, 1793, but a spirit of resistance gradually gathered force and culminated in the insurrection of 1794, when Kosciusko was recalled to Cracow and appointed generalissimo and dictator. With an army of 5000 he marched to meet the Russians, who were advancing upon Cracow in greatly superior numbers, and after a strenuous conflict of four hours' duration completely defeated them. On receipt of the intelligence Warsaw rose against the Russian authorities, putting 7000 persons to death; and after instituting a new government Kosciusko went in pursuit of the enemy, who retired towards the Prussian frontiers. But for the interposition of Prussia the emancipation of Poland would have been accomplished. King Frederick William, however, advanced against Warsaw with an army of 40,000 men, to which Kosciusko could oppose only 15,000. He was defeated at Szczekocin, but retreated in good order upon Warsaw, which he defended with stubborn persistence, until the diversion of an insurrection in Great Poland caused them to raise the siege. Meantime an immense force of Russians was advancing against Warsaw in two divisions, the one under Suwaroff and the other under Fersen. Kosciusko resolved to attack Fersen before his junction with Suwaroff, but, as he had only 4000 men to meet 14,000 Russians, his small army was in a few moments completely enveloped by superior numbers, and he himself fighting desperately fell pierced by many wounds. A tradition that as he fell he gave utterance to the words "Finis Poloniæ" found currency several years afterwards, but when it came to his knowledge he indignantly denied it. For two years he remained a prisoner at St. Petersburg, but, gaining his liberty after the accession of Paul I., he went to England and then to America. Returning to France in 1798, he took up his residence at Fontainebleau. In 1806 he refused to allow Napoleon, whose professions he rated at their proper value, to use his name to incite a rising in Poland against Russia; and the forged address put forth by Napoleon in his name was never accepted by his countrymen as genuine, although Kosciusko was unable to disavow it until eight years after it was issued. In 1814, when the Russian army entered France on the fall of Napoleon, Kosciusko had a long interview with the emperor Alexander of Russia, who it is said promised to him to restore to Poland its ancient boundaries. In 1815 he settled in Switzerland, devoting himself chiefly to agricultural pursuits. His death, October 17, 1817, was the result of an accidental fall from his horse. If as a statesman Kosciusko was more ardent than sagacious, he manifested a skill and daring as a soldier which but for the overwhelming nature of his task would have gained him a place among the most renowned generals of his time, while his noble and chivalrous patriotism, untainted by any desire after self-glorification, has secured him the world's universal admiration and esteem.

See the lives by Falkenstein (1827, 2d ed. 1834), Chodzko (1837), and Paszkowski (1872), and also *Pologne et Russie, légende de Kosciusko*, by Jules Michelet (1851), reprinted in *La Pologne martyr* by the same author (1863).

KOSI, a town in Muttra (Mathura) district, Northwestern Provinces, India, in 27° 47′ N. lat., 77° 28′ E. long., with a population in 1872 of 12,770.

KÖSLIN, or CÖSLIN, chief town of a circle and government district in the province of Pomerania, Prussia, is situated at the foot of the Gollenberg, 5 miles from the Baltic coast, and about 86 miles northeast of Stettin (105 by rail). It is regularly built, and is the seat of a local court. In the large market-place is the statue of Frederick William I., erected in 1824. The industries include the manufacture of soap, tobacco, iron, paper, bricks, and tiles, beer and other goods. Population in 1875, 14,814.

Köslin was built in 1188 by the Saxons, and made a town in 1266. In 1532 it embraced the Reformation. It was severely tried in the Thirty Years' War, and in the Seven Years' War. In 1720 it was burned. On the Gollenberg, stands a monument to the memory of the Pomeranians who fell in the war of 1813–15. The town formerly possessed a mint of its own.

KOSLOFF, or **Kozlov**, a town in the government of Tamboff, Russia, on the railway between Ryajsk and Saratoff, 45 miles west of Tamboff, on the Lesnoy Voronezh river. It had its origin in a small monastery, which was founded in the forest in 1627; nine years later, an earthwork was raised close by, for the protection of the Russian frontier against the Tartars. Situated in a very fertile country, on the highway to Astrakhan and at the head of the water communication with the Don, the town soon became the centre for the trade with these countries; as the junction of the railways leading to the Sea of Azoff, to Tsaritsin on the Lower Volga, to Saratoff, and to Orel, its importance has recently been still further increased. Large transactions in grain, and also in horses and tallow, are effected in the rich agricultural districts of Kosloff, as well as in those of Lipetsk and Borisoglebsk, for the Moscow market, or for Western Europe, *via* Orel; manufactured wares are imported for the supply of the neighboring districts. There are also in the town and district several tallow-melting houses, one manufactory of woollen cloth, and several distilleries. The town is built of wood, and its unpaved streets are dirty. Population, 27,000.

KOSTENDIL, **Giustendil**, or **Djustendil**, a town in the extreme south of the principality of Bulgaria, Turkey, is situated on the Strouma, the ancient Strymon. It is fortified and contains several factories. The surrounding district is fertile, and gold and silver mining is carried on. Population about 8000.

KOSTER, or **Coster**, **Laurens** (1370?–1440), the first Dutch printer, whose claims to be considered at least one of the inventors of the art (see **Printing**) have been recognized by many investigators. His real name was Laurens Janssoen,—Koster (*i. e.*, sacristan) being merely the title which he bore as an official of the great parish church of Haarlem. We find him mentioned several times between 1417 and 1434 as a member of the great council, as an assessor (*scabinus*), and as the city treasurer. He probably perished in the plague that visited Haarlem in 1439–40; his widow is mentioned in the latter year. His descendants through his daughter Lucia can be traced down to 1724.

See Peter Scriver, *Beschryvinge der Stad Harlem*, Haarlem, 1628; Scheltema, *Levensschets van Laurens d. Koster*, Haarlem, 1834; Van der Linde, *De Haarlemsche Costerlegende*, Hague, 1870.

KOSTROMA, a central government of Russia in Europe, surrounded by those of Vologda, Vyatka, Nijni Novgorod, Vladimir, and Yaroslav, lies mostly on the left bank of the Upper Volga, and has an estimated area of 32,700 square miles. Its surface is generally undulating, with hilly tracts on the right bank of the Volga, and extensive flat and marshy districts in its eastern parts. The rocks belong chiefly to the Permian system, a small tract being occupied by representatives of the Jurassic, and both being deeply covered with Quaternary clays. The soil in the east is for the most part sand or a sandy clay; a few patches are covered with fertile black earth. Immense forests, yielding excellent timber for shipbuilding, and in many cases still untouched, occupy no less than 70 per cent. of the surface of the government (13,230,000 acres in 1870). The export of timber is greatly facilitated by a series of navigable tributaries of the Volga, such as the Kostroma, Unzha, Neya, and Vyksa, and many others of less importance. The climate is severe: frosts of −22° Fahr. are common in January, and the mean temperature of the year is but 38.1° (summer, 64.5°; winter, −13.3°). The population, which numbered 1,176,000 in 1870, is Russian, with some Meryas,—the indigenes of this part of Russia,—Tcheremisses and Tartars. Agriculture is in a low state of development; 4,000,000 acres are under crops, with a return (1,415,000 quarters of corn in 1877) unequal to the wants of the population. Flax is cultivated to some extent, and exported. Stock-breeding has steadily decreased since 1861; in 1870 there were only 394,500 horned cattle (against 420,000 in 1857), and the number has since much decreased. Bee-keeping is an important branch of industry in some districts. The chief articles of commerce are timber, fuel, pitch, tar, mushrooms (yearly value upwards of £5000), and various kinds of wooden wares for building and household purposes, which are largely manufactured by the peasantry in villages, and exported to the steppe provinces of the Lower Volga and Don. Boat-building for river traffic is also carried on. Some other small industries, such as the manufacture of silver and copper wares, leather wares, etc., are also prosecuted in the villages; but the trade in linen and towelling, formerly the staple, is now declining. There are now several cotton factories, spinning mills, and engineering and chemical works. The government of Kostroma is divided into twelve districts:—Kostroma, Nerekhta, Kineshma, Makarieff, Yurievets, Galitch, Tchukhloma, Soligalitch, Boui, Kologriv, Vetluga, and Varnavin.

Kostroma, a town of Russia, capital of the government of the same name, 230 miles northeast of Moscow and 55 miles from Yaroslav. It is situated on the left bank of the Volga, at the mouth of the navigable Kostroma river, with suburbs on the opposite side of the Volga. It is one of the oldest towns of Russia, having been founded by Youri Dolgorouky in 1152. Its forts were often the refuge of the great princes of Moscow during war, but the town was plundered more than once by Tartars. The cathedral, built in the 13th century, and situated in the *Kreml*, or former citadel, is a fine monument of old Russian architecture. Kostroma has been renowned since the 16th century for its linen, which was exported to Holland, and the manufacture of linen and linen-yarn is still carried on to some extent, flax being purchased in the governments of Kostroma and of Pskoff. There are also in the town and in its province several important cotton-mills, tanneries, saw-mills, an iron-foundry, and a machine factory. Owing to its situation on the Volga, and at the mouth of a navigable river, Kostroma carries on an active trade—importing grain and exporting linen, linen-yarn, leather, and especially timber and wooden wares. Population, 30,000.

KOTAH, a native state in Rájputána, India, situated between 24° 30′ and 25° 51′ N. lat., and 74° 40′ and 76° 59′ E. long. It is entirely surrounded by native territory, being bounded on the N. by Bundi, on the E. by Gwalior and Tonk, on the S. by Jhaláwár, and on the W. by Udáipur. The area is 3797 square miles, with an estimated population of 310,000. Kotah slopes gently northwards from the high table-land of Málwá, and is drained by the Chambal with its tributaries, all flowing in a northerly or northeasterly direction. The Mokandarra range, from 1200 to 1600 feet above sea-level, runs from southeast to northwest, forming the southern border of Kotah, and separating it from Jhaláwár. The Mokandarra Pass through these hills, in the neighborhood of the highest peak (1671 feet), has been rendered memorable by the passage of Colonel Monson's army on its disastrous retreat in 1804. The defile is strikingly picturesque, and forms one of the chief outlets between the Deccan and Northern India. There are extensive game preserves, chiefly covered with grass. In addition to the usual Indian grains, wheat, cotton, opium, and a little tobacco of good quality are cultivated. The manufactures are very limited. Cotton fabrics are woven, but are being rapidly superseded by the cheap products of Bombay and Manchester. Articles of wooden furniture are also constructed. The chief articles of export are opium and grain; salt, cotton, and woollen cloth are imported.

Kotah is an offshoot from Búndi state, having been bestowed upon a younger son of the Búndi rájá by the emperor Shah Jahán in return for services rendered him when the latter was in rebellion against his father Jahángír. The affairs of the state having fallen into confusion, the administration is now superintended by a British political officer. Many of the state nobility hold lands on a semi-feudal tenure. The estimated gross revenue of the state in 1876 was £253,275, of which the land yielded over £170,000. Tribute of £38,472 (including maintenance of a contingent known as the Deoli Irregular Force) is paid to the British Government, and £1439 to Jeypore. The climate is very sultry during the prevalence of the hot winds at the commencement of summer, and is considered unhealthy during the rainy season. Endemic fevers invariably appear after the close of the rains.

KÖTHEN, or Cöthen, chief town of a circle in the duchy of Anhalt, Germany, is situated on the Ziethe, at the junction of several railway lines, about 42 miles northwest of Leipsic by rail. It consists of an old and a new town with four suburbs. It has two palaces, one of which in the old town contains various scientific collections and a library of 20,000 volumes. The industries include ironfounding and the manufacture of agricultural and other machinery, malt, beet-root sugar, leather, spirits, etc.; a tolerably active trade is carried on in grain, wool, potatoes, and vegetables. In 1875 the population, including the garrison, was 14,403.

Said to have been an important Wendish city, Köthen was captured and destroyed by Henry I. in 927. In 1300 it was burned by the margrave of Meissen. In 1547 it was presented by the emperor to General Ladron, from whom it soon passed by purchase to its old possessors. Hahnemann, the founder of homœopathy, lived and worked in Köthen, and a homœopathic establishment still exists in the town. Till 1853 Köthen was the capital of the duchy of Anhalt-Köthen.

KOTRI, a town in Karáchi (Kurrachee) district, Sind, India, situated on the right bank of the Indus, in 25° 22′ N. lat., and 68° 22′ E. long. The population in 1872, including the neighboring hamlets of Khánpur and Miáne Múltáni, was 7949—namely 5166 Mohammedans, 2455 Hindus, 304 Christians and 24 Parsís. Kotri is the northern terminus of the Sind Railway, which communicates with the seaport of Kurrachee (106 miles). The principal buildings, besides the Protestant and Roman Catholic churches, are the civil hospital, court-house, subordinate jail, post-office, Government, and other schools, and travellers' bungalow. The Indus Steam Flotilla maintains an extensive establishment, having its offices in the old fort, with workshops for the repair of steamers and barges. There is a large transit traffic in beer, wine, and spirits, metals, railway materials, piece goods, silk, wool, cotton, grain, oil-seeds, indigo, *ghí*, oil, saltpetre and sugar. Water from Kotri is forwarded to Kurrachee, especially for the manufacture of ice and for drinking purposes. In 1878 the Indus Valley State Railway was opened from Kotri to Sukkur, by which the importance of Kotri as a place of transshipment has been greatly diminished.

KOTTBUS, or Cottbus, chief town of a circle in the government district of Frankfort, Prussia, is situated on the Spree, about 72 miles southeast of Berlin by rail, and at the intersection of several important railway lines. It contains a mediæval castle, and is the seat of a chamber of commerce. The chief industries of the busy little town are wool-spinning and the manufacture of cloth. Cotton-spinning, and the manufacture of tobacco, machinery, beer, brandy, etc., are also carried on, while its trade is active. In 1875 the population, including the garrison, was 22,612. At one time Kottbus formed a private lordship, but in 1462 it passed by the treaty of Guben to Brandenburg.

KOTZEBUE, August Friedrich Ferdinand von (1761–1819), German dramatist, was born on the 3d of May, 1761, at Weimar, where his father was a councillor of legation. Having attended the gymnasium of Weimar, he went in his sixteenth year to the university of Jena, and afterwards studied about a year in Duisburg. In 1780 he completed his legal studies, and was admitted an advocate. Through the influence of Count Görtz, Prussian ambassador at the Russian court, he became secretary at St. Petersburg to the governor-general Von Baur, by whom he was recommended to the Empress. In 1783 he received the appointment of assessor to the high court of appeal in Revel, where he married a daughter of lieutenant-general Von Essen. He was ennobled in 1785, and became president of the magistracy of the province of Esthonia. Before leaving Germany he had published some unimportant writings; in Revel he acquired a considerable reputation by his *Leiden der Ortenbergischen Familie* (1785), his *Kleine Gesammelte Schriften* (1787–91), and his two plays, *Menschenhass und Reue* and *Die Indianer in England* (1789). The good impression produced by these works was almost effaced by a cynical book, *Doctor Bahrdt mit der eisernen Stirn*, which appeared with the name of Knigge on the title-page. After the death of his first wife Kotzebue retired from the Russian service, and resided for some time in a country house which he had built near Narva. At this time he manifested extraordinary literary activity, publishing within a few years, besides *Die jüngste Kinder meiner Laune* (in 5 volumes), upwards of twenty plays. In 1798 he accepted the office of dramatist to the court theatre of Vienna, resigning it in about two years with a pension of 1000 florins. On his way to St. Petersburg, where his sons were being educated, he was arrested in April, 1800, and sent to Siberia. Fortunately he had written a comedy which flattered the vanity of Paul I.; and a translation of this play so delighted the emperor that Kotzebue was brought back, received an estate from the crown lands in Livonia, and was made director of the German theatre in St. Petersburg. He returned to Germany when the emperor Paul died, and in 1802 was admitted into the Academy of Sciences at Berlin. Here, in association with Merkel, he edited *Der Freimüthige*, and began his *Almanach dramatischer Spiele*, which he continued to issue until his death. He also wrote several plays in Berlin, and made some enemies by the bitterness with which he attacked Goethe. Towards the end of 1806 he was again settled in Russia, and in the security of his estate in Esthonia wrote many satirical articles against Napoleon in *Die Biene* and *Die Grille*. As councillor of state he was attached in 1816, to the department for foreign affairs in St. Petersburg, and in 1817 he went to Germany as a sort of spy in the service of Russia, with a salary of 15,000 roubles. In his weekly journal (the *Literarisches Wochenblatt*) he scoffed at the pretensions of those Germans who demanded free institutions, and became an object of such general dislike that he was obliged to leave Weimar for Mannheim. He was especially detested by young enthusiasts for liberty; and one of them, Karl Ludwig Sand, a theological student, formed a deliberate resolution to kill him. On the 23d of March, 1819, Sand called at Kotzebue's house in Mannheim, and stabbed him to the heart, crying, "Here, thou betrayer of the Fatherland!" The assassin was executed, and the Government of Germany made his crime an excuse for placing the universities under strict supervision. Besides his plays, and the other works already mentioned, Kotzebue wrote a history of the German empire, and a book on the ancient history of Prussia, neither of which has solid merit. He was also the author of *Erinnerungen aus Paris* (1804) and *Erinnerungen von einer Reise aus Livland nach Rom und*

Neapel (1805). He wrote more than one hundred plays, the majority of which are now forgotten. Although destitute of poetic insight, he had remarkable facility in the invention of effective situations; and a respectable place in German literature is secured for some of his comedies by the liveliness with which their characters are portrayed, and by the sprightliness of their dialogue. There is a complete edition of his dramatic works in 28 volumes (1797–1823), another in 44 volumes (1827–29), and a third in 40 volumes (1840–41).

KOTZEBUE, Otto von (1787–1846), Russian navigator, son of the subject of last notice, was born at Revel on December 19, 1787. After being educated at the St. Petersburg school of cadets, he accompanied Krusenstern on his voyage of 1803–6. After his promotion to lieutenant, Kotzebue was placed in command of an expedition fitted out at the expense of the imperial chancellor, Count Rumantsoff, in the brig *Rurick*. In this vessel, with only twenty-seven men, Kotzebue set out, on July 30, 1815, to find a passage across the Arctic Ocean, and explore the less known parts of Oceanica. Proceeding by Cape Horn, he reached on April 16, 1816, Schouten and Lemaire's Isle of Dogs. After cruising about the Pacific for some time, and discovering various islands and groups, —as the Krusenstern group, and the Kutusoff and Suwaroff Islands in the east of the Caroline archipelago,—Kotzebue made for Kamchatka, and on June 29 reached New Archangel. In the middle of July he proceeded northwards, coasting along the northwest coast of America, discovering and naming Kotzebue Gulf or Sound and Krusenstern Cape. Returning by the coast of Asia, he again sailed to the south, sojourned for three weeks at the Sandwich Islands, and on January 1, 1817, discovered New Year Island. After some further cruising in the Pacific he again proceeded north, but a severe attack of illness compelling him to return to Europe, he reached the Neva on August 3, 1818, bringing home with him a large collection of previously unknown plants and much new ethnological information. In 1823 Kotzebue, now a captain, was intrusted with the command of a new expedition, in two ships of war, the main object of which was to take reinforcements to Kamchatka. There was, however, a staff of scientific men on board, who collected much valuable information and material in geography, ethnography, and natural history. The expedition left Cronstadt on August 23, and, proceeding by Cape Horn, visited the Radak and Society Islands, reaching Petropaulovsk in July, 1824. Many positions along the coast were rectified, the Navigator Islands visited, and several discoveries made. The expedition returned by the Mariannes, Philippines, New California and Sandwich Islands, reaching Cronstadt on July 10, 1826. There are English translations of both Kotzebue's narratives:—*A Voyage for the Purpose of Exploring a Northeast Passage, undertaken in the years* 1815–18, 3 vols. (1821); and *A New Voyage Round the World in the Years* 1823–26 (1830). The narrative of the second voyage is generally considered to be rather highly colored, while in the first Kotzebue animadverts in strong terms on the conduct of the English missionaries in the Society and Sandwich Islands, who, however, were defended both by Ellis and Mr. Charles Darwin. Three years after his return from his second voyage, Kotzebue retired to his estate in Esthonia, where he died February 15, 1846.

KOUSSO, Kosso, or Cusso, a drug recently introduced into English medicine as a remedy for tapeworm. It consists of the flowers of *Hagenia abyssinica*, Willd. (*Brayera anthelminthica*, Kunth), a handsome rosaceous tree 60 feet high, growing throughout the tableland of Abyssinia, at an elevation of 3000 to 8000 feet above the sea-level. The drug as imported is in the form of cylindrical rolls, about 18 inches in length and 2 inches in diameter, and comprises the entire inflorescence or panicle kept in form by a band wound transversely round it. The flowers have a light brown hue, or in the case of the female flower a reddish tinge, for which reason the latter is sometimes distinguished as red kousso. The active principle of kousso is stated by Flückiger to be kosin, $C_{31}H_{38}O_{10}$; it is supposed to be a compound ether of isobutyric acid, since it gives off the odor of this substance when its solution in concentrated sulphuric acid is diluted with water. Kosin appears to have been first obtained as a definite crystalline substance by Merck, who prepared it in the form of tasteless yellowish rhombic needles or prisms, soluble in chloroform, ether, benzol, and bisulphide of carbon, very soluble in boiling but only sparingly so in cold alcohol. It is not decomposed by boiling dilute acids. The koussin of Bedall appears to be an impure substance containing variable quantities of crystalline kosin. Kousso yields on distillation a stearoptene-like oil having the odor of the drug, also traces of valerianic and acetic acids. The medicinal properties of kousso were first investigated in 1822 by Brayer, a French physician of Constantinople, but the drug did not come into use in Europe until 1850; in 1864 it was introduced into the British pharmacopœia. In medicine it is used in the form of an unstrained infusion of ¼ to ½ oz. of the coarsely powdered flowers, which are swallowed with the liquid. Administered in this form it sometimes causes vomiting; hence an extract of the flowers, prepared by percolating them with castor oil, to dissolve out the active principle, has been introduced. Kousso is considered to be an effectual vermifuge for both *Tœnia solium* and *Bothriocephalus latus*. In its anthelmintic action it is nearly allied to male fern.

See Bruce, *Travels*, v. p. 73, 1790; Brayer, *Notice sur une nouvelle plante de la famille des Rosacées employée contre le Tœnia*, 1822; *Pharmaceutical Journal*, x: p. 15; *Pharmacographia*, 2d ed., p. 256–259; *Bulletin de Thèrapeutique*, 1876, p. 556.

KOVNO, a northwestern province of European Russia, is bounded on the N.E. and S.E. by the provinces of Courland and Vilna, and on the S. and S.W. by Russian Poland and by Prussia, a narrow strip touching the Baltic near Memel. It has an estimated area of 23,680 square miles. The level uniformity of its surface is broken only by two low ridges which nowhere rise above 800 feet. The geological character is varied, the Silurian, the Devonian, the Jurassic, and the Tertiary systems being all represented; the Devonian is that which occurs most frequently, and all are covered with Quaternary boulder-clays. The soil is either a sandy clay or a more fertile kind of black earth. The government is well watered by the Niemen, the Windau, the Courland Aa, and the Duna, which have navigable tributaries. In the flat depressions covered with boulder-clays there are many lakes and marshes, whilst forests, now greatly reduced, still cover about 18 per cent. of the surface of the government. The climate is comparatively mild, the mean temperature at Kovno being 44° Fahr. The population (1,156,040 in 1870) is very varied, consisting of Lithuanians proper and Zhmuds, Jews, Slavs, and Germans: 82 per cent. are Catholics, 13 Jews, 3 Protestants, and 2 belong to the Greek Church. The Poles number only 3000, and the Russians (White, Little, and Great) 182,000. The chief occupation of the inhabitants is agriculture, 60 per cent. of the whole surface being under crops; both grain and potatoes are exported. The yield of corn (2,270,000 quarters prior to 1857), is now about 2,879,000 quarters per annum. Flax is also cultivated, and the linseed is exported. Stock-breeding is not carried on to any considerable extent; but, owing to the number of lakes, the fishing industry has some importance. The manufacturing industries, if distillation be left out of account, are trifling. Trade, especially the transit trade, is brisk, from the situation of the government on the Prussian frontier, the custom-houses of Yurburg and Taurogen being among the most important in Russia.

Kovno has seven districts: Kovno, Novoalexandrovsk, Ponevyezh, Rossieny, Shavli, Telshi, and Vilkomir. The principal towns are Kovno (32,050 inhabitants), Shavli (15,400), Vilkomir (11,150), Rossieny (10,700), and Novoalexandrovsk (8250).

The territory which now constitutes the government of Kovno was formerly part of Lithuania. During the 13th, 14th, and 15th centuries the Livonian and Teutonic knights continually invaded and plundered it, especially the western part which was peopled with Zhmuds. In 1569 it was annexed, along with the rest of the grand principality of Lithuania, to Poland; and it suffered very much from the wars of Russia with Sweden and Poland, and from the invasion of Charles XII. in 1701. In 1795 the principality of Lithuania was annexed to Russia, and until 1872, when the government of Kovno was constituted, the territory now forming it was a part of the government of Vilna.

KOVNO, the **KAUNE** of the Lithuanians, capital of the above government, is situated on the railway between St. Petersburg and Berlin, 503 miles southwest from the former. It consists of two parts, the new town, built on the right bank of the Niemen, and an old town, situated on the left bank of the Vilia which here joins the Niemen. By its situation at the confluence of two navigable rivers, some few miles above the mouth of the Nevyaja, and close to a place where the Niemen sharply changes its northern direction into a western one, Kovno, which is supposed to have been built in the 11th century, soon acquired importance both as a fortified place and as a centre for trade. In its early history it often suffered from the attacks of the crusaders, and fell alternately under their dominion and under that of the Lithuanians. Its citadel was destroyed in 1400, and from that time it became the centre of an active trade, being visited by German and English merchants. In the 16th, 17th, and 18th centuries it was the chief emporium for trade with Lithuania, and rivalled Königsberg. Henry of Valois said it was the best jewel of the kingdom. But continuous wars destroyed this commerce, and, when Kovno became a Russian town, in 1795, it was already a very poor place, which numbered in 1817 but two hundred houses. Owing to its advantageous situation, it has again acquired commercial importance. It has several remarkable old churches, two of which have been transferred to the Greek confession, and a beautiful old guild-hall now transformed into an imperial palace. Its population (33,050) is most varied; one-half are Jews engaged in petty trades and commerce. Salt, salted fish, coal, and various manufactured wares are brought here from Prussia on vessels which return with cargoes of corn, linseed, timber, rags, bones, and wool, purchased in the governments of Vilna, Minsk, Grodno, and Tchernigoff.

KOVROFF, a town in Russia, situated in the government of Vladimir, on the railway between Moscow and Nijni Novgorod, 40 miles east-northeast of the capital of the province, on the right bank of the Klazma river. It has become, of late years, an important manufacturing centre,—cottons, machinery, and railway carriages being the principal items. It also carries on an active trade in the export of wooden wares and in the import of grain, salt, and fish, brought from the Volga provinces for the use of the government of Vladimir. Population 5000.

KOZELSK, a district town of the government of Kaluga in European Russia, situated 43 miles southwest of Kaluga, on the left bank of the river Zhizdra. The principal building is the cathedral, erected in 1700, and rebuilt by Catherine II. after the fire of 1777. In the first half of the present century sailcloth was largely manufactured in the town; but this industry has declined, and, though there are oil-mills, tanneries, rope-walks, and breweries, many of the working classes have to seek employment elsewhere. Population in 1870, 13,400.

Kozelsk emerges in the middle of the 12th century. In 1238 it was utterly destroyed, and all its inhabitants put to the sword by the Tartar invaders. During the 15th century it formed a bone of contention between the Lithuanian princes and the grand-dukes of Moscow. Ivan the Terrible surrounded it with a wooden palisade. Captured by Dolgorukoff in 1607, it withstood a heavy siege at the hands of Ismailoff.

KRAFFT, or **KRAFT**, **ADAM** (*c.* 1455–1507), sculptor of the Nuremberg school, was born, probably at Nuremberg, about the middle of the 15th century, and died, some say in the hospital, at Schwabach, abuot 1507. Of his life few particulars are known beyond the dates of several of his works. He seems to have emerged as sculptor about 1490, the date of the seven reliefs of scenes from the life of Christ, which, like almost every other specimen of his work, are at Nuremberg. The date of his last work, an Entombment, with fifteen life-size figures, in the Holzschuher chapel of the St. John's cemetery, is 1507.

Besides these, Krafft's chief works are several monumental reliefs in the various churches of Nuremberg; the alto-relievo Entombment outside St. Sebald's church; Christ Bearing the Cross, above the altar of the same church; and various works made for public and private buildings, as the relief over the door of the Wagehaus, a St. George and the Dragon, several Madonnas, and some purely decorative pieces, as coats of arms. His masterpiece is perhaps the magnificent tabernacle, 62 feet high, in the church of St. Laurence, 1493–1500. See Wanderer's *Adam Kraft und seine Schule*, 1869.

KRAJOVA, or **CRAJOVA**, a town in the circle of Dolschi, Roumania, is situated near the Schyl, a tributary of the Danube, about 110 miles west of Bucharest. There are prosperous salt-works situated in the town; and from its position at the junction of the Carpathian highroads with the route from Bucharest to Widdin its trade (largely in the hands of Jews) is important. In 1873 its population was 22,764.

Krajova was the former capital of Little Wallachia. In 1397 it was the scene of a victory of the waiwode Marcea over the Turkish sultan Bajazet; and there, in October, 1853, a fight between the Russians and Turks took place.

KRANTZ, or **CRANTZ**, **ALBERT** (*c.* 1450–1517), German historian, was a native of Hamburg. He studied law, theology, and history at Rostock and Cologne, and after travelling through Western and Southern Europe was appointed professor, first of philosophy and subsequently of theology, in the university of Rostock, of which he was rector in 1482. In 1492 he returned to Hamburg as theological lecturer, canon, and prebendary in the cathedral. By the senate of Hamburg he was employed on more than one diplomatic mission abroad, and in 1500 he was chosen by the king of Denmark and the duke of Holstein as arbiter in their dispute regarding the province of Dithmarschen. As dean of the cathedral chapter, to which office he was appointed in 1508, Krantz applied himself with zeal to the reform of ecclesiastical abuses, but, though opposed to various corruptions connected with church discipline, he had little sympathy with the drastic measures of Wickliffe or Huss. A deathbed utterance of his, somewhat desponding in its tone, with reference to Luther and his ninety-five theses has occasionally, but unfairly, been interpreted as a summary condemnation of that Reformer. Krantz died December 7. 1517.

Krantz was the author of a number of historical works which for the period when they were written are characterized by exceptional impartiality and research. The principal of these are *Chronicon regnorum aquilonarium Daniæ, Sueciæ, et Norvegiæ*, Strasburg, 1545; *Vandalia, sive historia de Vandalorum vera origine*, etc., Cologne, 1519; *Saxonia*, 1520; and *Metropolis sive Historia ecclesiæ in Saxonia*, 1548. See life by N. Wilckens, Hamburg, 1722.

KRASNOYARSK, a town of Eastern Siberia, capital of the extensive province of Yeniseisk, which stretches as a long strip from the Chinese frontier formed by the Sayan mountains to the shores of the Arctic Ocean. It is situated on the left bank of the Yenisei river, at its confluence with the Katcha, and on the highway from Moscow to Irkutsk, 662 miles west-northwest from the latter. It was founded by Cossacks in

1628, and during the early years of its existence it was more than once besieged by the Tartars and Kirghiz. It became the capital of the province in 1822, and is now the seat of the provincial administration. Its commercial importance depends entirely upon the gold-washings of the Yeniseisk district, supplies for which are sent from Krasnoyarsk. The climate is very cold, but dry, so that in the steppe which surrounds the town there is but little snow, even in mid-winter. The Yenisei river is frozen for one hundred and sixty days at Krasnoyarsk. Population, 13,000.

KREMENETZ, a district town of Russia, in the government of Volhynia, in the high valley of the Ikva, one of the tributaries of the basin of the Pripat, situated 30 miles east from Radziviloff, the great custom-house on the railway between Kieff and Lvoff. It is a poor place, the 11,800 inhabitants of which follow agriculture, raise tobacco, and excavate flint. But the Jews, who are numerous in the town, carry on a brisk trade in grain, which is stored here for export to Galicia and Odessa. The picturesque ruins of an old castle on a crag close by the town are usually known under the name of the castle of Queen Bona; it was built, however, but in the 8th or 9th century. The hordes of Batyi vainly besieged it in 1241 and 1255. From that time Kremenets was alternately under the dominion of Lithuania and Poland, till 1648, when it was taken by the Zaporojtsi Cossacks. During the years 1805 to 1832 its Polish lyceum was the centre of superior instruction for the western provinces of Little Russia; but after the Polish insurrection of 1831 the lyceum was transferred to Kieff, and is now the university of that town.

KREMENTCHUG, a Russian town in the government of Poltava, situated 74 miles by rail to the southwest of the government town, on the railway between Kharkoff and Nicolaieff, and on the left bank (here flat and sandy) of the Dnieper. It is supposed to have been founded in 1571; by its situation at the southern terminus of the navigable course of the Dnieper, and on the highway from Moscow to Odessa, it early acquired a great commercial importance, which it still retains; by 1655 it was a wealthy town. In 1765 it became capital of "New Russia." It now has a suburb, Kryukoff, on the right bank of the Dnieper, united with the town by a railway bridge. Nearly all commercial transactions in salt with White Russia are effected at Krementchug, the salt being deposited in large storehouses in Kryukoff, and then sent by boat to the northwest. The town is also a centre of the tallow trade with Warsaw; considerable quantities of timber, too, are floated down to this place and thence sent to the neighboring provinces. Nearly all the trade in the brandy manufactured in the government of Kharkoff and destined for the governments of Ekaterinoslaff and Taurida is concentrated here, as also is the trade in linseed between the districts situated on the left affluents of the Dnieper and the southern ports. Other articles of commerce are rye, rye-flour, wheat, oats, and sarrasine, which are sent, partly up the Dnieper to Pinsk, partly by land to Odessa and Berislaff, but principally to Ekaterinoslaff, on light boats floated down during the spring floods. Although thus busily employed, the town does not wear the aspect of a commercial place, the linseed being mostly warehoused in the houses of the Jews who carry on this trade, and the important banking operations being also chiefly in the hands of Jews. The Dnieper is crossed at Krementchug by a remarkable tubular bridge 1081 yards long, over which passes the railway from Kharkoff to Balta; there is also a bridge of boats. The manufactures consist of carriages, agricultural machinery, and tobacco. Population, 31,000.

KREMNITZ (Hungarian, *Körmöczbánya*), a mining town in the cis-Danubian county of Bars, Hungary, lies in a deep valley and on the Hungarian state railway, 82 miles north of Budapest, in 48° 42′ N. lat., 18° 46′ E. long. It is the seat of a board of mining control, and of the management of the mint, and has an office of woods and forests. As noteworthy buildings may be mentioned the castle, several Roman Catholic and the Lutheran churches, a Franciscan monastery (founded 1634), the town-hall, and the mint, where the celebrated Kremnitz gold ducats are struck. The great bulk of the inhabitants find employment in connection with the gold and silver mines, which, though far less productive than formerly, still yield considerable quantities of ore. By means of a tunnel 9 miles in length, constructed in 1851–52, the water is drained off from the mines into the Garam or Gran. In 1880 the population was 8552, mostly Germans.

According to tradition Kremnitz was founded in the 8th century by Saxons. In 1100 it was raised to the dignity of a royal free town. In the middle of the 12th century the population was much augmented by German colonists, and in 1328 the commune received special privileges at the hands of Charles Robert of Anjou. From 1424 to 1433 the town was frequently at the mercy of the Hussites. After the catastrophe at Mohács (1526) it suffered repeatedly from the Turks, and during the 17th century both from the forces of successive Transylvanian princes and from Ottoman hordes.

KREMSIER (in Czech, *Kromeriz*), chief town of a district in Moravia, Austria, is situated in the fertile region of Hanna on the March, about 25 miles southwest of Olmütz. It is the seat of several local courts, and is the summer residence of the bishop of Olmütz, whose palace, surrounded by a fine park and gardens, and containing a picture gallery, library, and various collections, forms the chief object of interest. Kremsier has both a German and a Slav upper-gymnasium, a higher commercial school, a convent, and a hospital. Its industries include printing, and the manufacture of sugar, malt, and pottery. In 1870 the population was 9918.

In 1131 Kremsier was the seat of a bishopric. It suffered considerably during the Hussite war; and in 1643 it was taken and burned by the Swedes. After the rising of 1848, the Austrian congress met in the palace at Kremsier from November, 1848, till March, 1849.

KREUTZER, CONRADIN (1782–1849), German musical composer, owes his permanent fame almost exclusively to one opera, *Das Nachtlager von Granada*, which has kept the stage for nearly half a century in spite of the changes of taste. It is written in the style of Weber, and is remarkable especially for its flow of genuine melody and depth of feeling. The same qualities are found in Kreutzer's part songs for men's voices, which at one time were extremely popular in Germany, and are still listened to with pleasure. Amongst these *Der Tag des Herrn* ("The Lord's Day") may be named as the most excellent. It is indeed a masterpiece of its kind. Kreutzer was a prolific composer, and wrote a number of operas which have disappeared from the stage and are not likely to be revived. His life also is devoid of interesting features, and may be summed up in few words. He was born November 22, 1782, at Mösskirch in Baden, and received his musical training from Albrechtsberger, the famous contrapuntist of Vienna. For the theatre of that city he composed most of his operas, including *Das Nachtlager von Granada*, produced in 1834. For a time (1812–1816) he was chapel-master to the king of Würtemberg, and later on (1840) became conductor of the opera at Cologne. He died December 14, 1849, at Riga, where he had accompanied his daughter Cecilia Kreutzer, a singer of some renown.

KREUZNACH, or CREUZNACH, chief town of a circle in the government district of Coblentz, Prussia, is situated on the Nahe, a tributary of the Rhine, about 40 miles southeast of Coblentz. It consists of the old town on the right bank of the river, the new town on the left, and the island Badewörth, all of which are connected by a fine stone bridge. There is an iron bridge between the island and the right bank. Kreuznach is the seat of a local court, and it has a gymnasium, a business-school, and a hospital. On the Badewörth is the kurhaus, built in 1872, with baths and gardens, and also the chief spring, the Elizabethquelle, impregnated with iodine and bromine, and prescribed for scrofulous and various other affections. The climate is mild, moderately damp, and on the whole equable. The chief industries of the town are marble-polishing and the manufacture of leather and tobacco, and various knick-knacks in agate. Vines are grown on the neighboring hills. The population in 1875 was 13,772.

The earliest mention of the springs of Kreuznach occurs in 1478; but it was only in the early half of the 19th century that Dr. Prieger (whose marble statue adorns the town) brought them into prominence. Now the annual number of visitors is about seven thousand. In the 9th century Kreuzberg was known as Cruciniacum. In 1065 it was presented by Henry IV. to the bishop of Spires, from whom it passed (after becoming a town in the early part of the 13th century) to the counts of Sponheim and the Palatinate. In 1814 it became Prussian. During the 17th century Kreuznach was more than once taken and plundered; and in 1689 the French reduced the strong castle of Kauzenberg to the ruin which still surmounts the Schlossberg to the northwest of the town.

KRILOFF, KRUILOFF, or KRYLOFF, IVAN ANDREEVITCH (1768–1844), the great national fabulist of Russia, was born February 14, 1768, at Moscow, but his early years were spent at Orenburg and Tver. His father, a distinguished military officer, died in 1779; and young Kriloff was left with no richer patrimony than a chest of old books, to be brought up by the exertions of an heroic mother. In the course of a few years his mother removed to St. Petersburg, in the hope of securing a Government pension; and there Kriloff obtained a post in the civil service, but he gave it up immediately after his mother's death in 1788. Already in 1783 he had sold to a bookseller a comedy of his own composition, and by this means had procured for himself the works of Molière, Racine, Boileau; and now, probably under the influence of these writers, he produced *Philomela* and *Cleopatra*, which gave him access to the dramatic circle of Knyazhin. Several attempts he made to start a literary magazine followed each other with little success; but, along with his plays, they served to make the author known to the polite society of the capital. For about four years (1797–1801) Kriloff lived at the country seats of the prince Sergius Galitzin, and when the prince was appointed military governor of Livonia he accompanied him as official secretary. About the years which follow his resignation of this post very doubtful information has been preserved, the common opinion being that he wandered from town to town under the influence of a passion for card-playing. Before long he found his place as a fabulist, the first collection of his *Fables*, twenty-three in number, appearing in 1809. From 1812 to 1841 he held a congenial appointment in the Imperial Public Library—first as assistant, and then as head of the Russian books department. His death took place November 21, 1844. His statue in the Summer Garden is one of the finest monuments in St. Petersburg.

Kriloff's success as a fabulist was as rapid as it has been enduring. Honors were showered upon him while he yet lived: the Academy of Sciences admitted him a member in 1811, and bestowed upon him the same gold medal which was accorded to Karamzin for his *History of the Russian People*; in 1838 a great festival was held under imperial sanction to celebrate the jubilee of his first appearance as an author; and the emperor assigned him a handsome pension. Before his death about 77,000 copies of his *Fables* had found sale in Russia; and his wisdom and humor had become the common possession of the many. Nor is the reason far to seek. He was at once poet and sage. In spite of a superficial indifference to political matters, he observed everything with keen and collected interest. His fables for the most part struck root in some actual event, and they told at once by their grip and by their beauty. Though he began as a translator and imitator, he soon showed himself a master of invention, who found abundant material in the life of his native land. To the Russian ear his verse is of matchless quality; while word and phrase are direct, simple, and eminently idiomatic, color and cadence vary with the theme. This perfection was the result of sustained elaboration, for, though physically indolent, Kriloff was a hard intellectual worker, and had an infinite faculty of taking pains. Of his carelessness in dress, absence of mind, and general irreverence towards etiquette, the stories told are many.

A collected edition of Kriloff's works appeared at St. Petersburg, 1844. Of the numerous editions of his *Fables*, which have been often translated, may be mentioned that illustrated by Trutovski, 1872. The author's life has been written in Russian by Pletneff, by Lebanoff, and by Grot, *Liter. zhizn Kruilova*. "Materials" for his life are published in vol. vi. of the *Sbornik Statei* of the literary department of the Academy of Sciences. W. R. S. Ralston has prefixed an excellent sketch to his English prose version of the *Fables*, 1868, 2d ed. 1871.

KRISHNAGAR, town and headquarters of Nadiyá district, Bengal, India, situated on the left bank of the Jalangí river, 23° 23′ N. lat., 88° 32′ E. long The municipal limits comprise an area of 7 square miles and a population in 1872 of 26,750 persons—Hindus, 18,114; Mohammedans, 8076; Christians, 560. Besides the usual Government officers and courts, Krishnagar is also a station of the Church Missionary Society and of a Roman Catholic mission, each body having its own church and schools. The town is a seat of considerable trade, and is noted for its manufacture of colored clay figures, carried on by a few artists of the *kumbhar* or potter caste.

KROLEVETZ, a district town of Russia, in the government of Tchernigoff, 108 miles east of the government town. Its 14,000 inhabitants live by agriculture and gardening, by linen manufactures, and by trading in agricultural produce and salted fish imported from the province of Ekaterinoslaff, and in manufactured wares. There are two important fairs, one for horses and manufactured wares, and the other for cattle.

KROTOSCHIN (in Polish, *Krotoszyn*), chief town of a circle in the government district of Posen, Prussia, is situated about 32 miles southwest of Posen. It has a local court, three churches, a synagogue, steam sawmills, and a steam brewery, and carries on trade in grain and seeds. The neighboring castle of Krotoschin is the chief place of a mediatized principality of the prince of Thurn and Taxis, which was formed in 1819. The population of Krotoschin in 1875 was 8034.

KRÜDENER, BARBARA JULIANA VON WIETINGHOFF, BARONESS VON (1766–1824), authoress of the romance of *Valérie*, but better known by the religious fervor and pious mysticism of her later years, was born of noble and wealthy parents at Riga, November 21, 1766. Her education, which was an elaborate one, was received partly in her father's house and partly in Paris. While still very young she was married to the Baron von Krüdener, a Russian diplomatist twenty years her senior, whom she accompanied to Copenhagen and subsequently to Venice; the union did not prove a very happy one, and for some years the couple lived apart. It is understood that *Valérie*, published by Madame Krüdener in 1804, is to a considerable extent an autobiography of this period of her life; if this be so, it is impossible to exonerate her of all blame for the domestic misfortunes which befell her. After the death of her husband she resided for some time in Paris, mingling freely with a large and brilliant social circle, but afterwards she retired to her property in Livonia, where her sense of the vanity of earthly things gradually deepened, and religious yearnings were quickened which ultimately found satisfaction in the doctrine and worship of the Moravian community. In 1808 she saw much of Jung Stilling at Carlsruhe and of Oberlin in Steinthal; and the religious convictions now formed were held by her with such earnestness that she felt constrained to adopt the vocation of an itinerant preacher. Her obvious sincerity, her culture and refinement, her social standing, enabled her to attract considerable notice throughout Baden, in Strasburg, and in Switzerland, especially in Geneva; and at Heilbronn in 1815 she could reckon even an emperor (Alexander I. of Russia) among her attentive hearers. Her activity, however, which was hardly favorable to established church order, soon became distasteful to the authorities, and after being invited to withdraw from more than one German state, she again retired into private life on her estate in 1818. Led by her enthusiasm of humanity to St. Petersburg, she was dismissed by the emperor for having declared her sympathy for the struggling cause of Greece. Ill health now came upon her, and she was advised by her physicians to seek a warmer climate. On the southward journey she died at Karasu-Bazar on December 25, 1824. Her life has been written by Eynard (*Vie de Madame de Krüdener*, 2 vols., Paris, 1849).

KRUMEN, Croomen, Krus, or Croos, a negro people on the west coast of Africa. The name is properly Kra or Krao, though the corrupt form Crewmen has sometimes been put forward as the original. Ethnographically it ought to be confined to the tribes settled in the neighborhood of the Sinoe in the republic of Liberia, where their chief towns are known as Settra Kru, Little Kru, and Nana Kru; but, as they were the first West African people who ventured to take service on board European vessels, it is now generally applied to about a score of tribes living along 200 miles of coast who in this respect have followed their example. In spite of the fact that the Krus have come into close connection with Europeans for a long series of years, the information in regard to them is of the scantiest description. They are an independent as well as an enterprising people, and keep themselves very much apart from other tribes. It is said that they have never furnished even a nominal convert to Christianity. They are now mainly engaged as traders or agents; and comparatively few of the Krumen proper are to be found serving as boatmen or sailors. As soon as they have amassed a competency they return to their native country. They keep no slaves themselves, and they are never found in slavery abroad. The men are tall, strong, and well-proportioned, with bluish-black complexion, woolly and abundant hair, and a greater frequency of beard than is common among negroes. They appear to be dolichocephalic and prognathic. Their women are of a lighter shade than negro women generally, and in several respects come much nearer to a European standard. Tribal or clan marks are worn on the face; the Krumen examined by Schlagintweit, for example, had a blue vertical stroke on the brow; those seen by Wittstein at Monrovia had a black stroke and an arrow directed from the ear to the eye. Dr. Bleek classifies the Kru language with the Mandingo family, and in this he is followed by Latham; Dr. Koelle, who published a Kru grammar (1854), considers it as distinct.

Further details will be found in Quatrefages and Hamy, *Crania Ethnica*, part ix., 1878–79, page 868; Schlagintweit-Sakunlunski, in the *Sitzungsbericht* of the Academy at Munich, 1875; Nicolas, in *Bull. de la Soc. d'Anthrop.*, Paris, 1872.

KRUMMACHER. Three members of this family have attained some popularity as religious writers in Germany and indeed throughout Reformed Protestant Christendom.

1. Friedrich Adolf Krummacher was born July 13, 1768, at Tecklenburg, Westphalia, studied theology at Lingen and Halle, and became successively rector of the grammar school at Mörs, professor of theology at Duisburg, preacher at Crefeld and afterwards at Kettwich, consistorialrath and superintendent in Bernburg, and pastor of the Ansgariuskirche in Bremen (1824), where he died on 14th April, 1845. He was the author of numerous religious works, but is best known by his *Parabeln*, first published in 1805, which have gone through numerous German editions (9th ed., Essen, 1876), and have been translated into English and other European languages.

2. Gottfried Daniel Krummacher, born at Tecklenburg, April 1, 1774, was pastor successively in Bärl, Wulfrath, and Elberfeld. He was the leader of the "pietists" of Wupperthal, and published several volumes of sermons, including one entitled *Israel's Wanderings*. His death occurred on January 30, 1837.

3. Friedrich Wilhelm Krummacher, son of Friedrich Adolf, was born at Mörs, January 28, 1796, studied theology at Halle and Jrena, and became pastor successively at Ruhrort (1823) and Gemarke, near Barmen (1825). In 1847 he received an appointment to the Dreifaltigkeitskirche in Berlin, and in 1853 he became court preacher at Potsdam. He died December 10, 1868. F. W. Krummacher was an influential promoter of the Evangelical Alliance. His best known works are *Elias der Thisbiter* (1828–33; 6th ed., 1874), well known to English readers, and *Elisa* (1837), also translated, but much less popular both in England and Germany than its predecessor. He published several volumes of sermons, and an *Autobiography* appeared in 1869.

KRUSENSTERN, Adam John (1770–1846), Russian navigator, hydrographer, and admiral, was born in Esthonia on November 8, 1770. In 1785 he entered the corps of naval cadets, after leaving which, in 1788, with the grade of midshipman, he served in the war against Sweden. Having been appointed to serve in the English fleet for several years (1793–99), he visited America, India, and China. Having published a paper pointing out the advantages of direct communication between Russia and China by Cape Horn and the Cape of Good Hope, he was appointed by the emperor Alexander to make a voyage to the east coast of Asia to endeavor to carry out the project. Two English ships were bought, Krusenstern commanded the one and Lisiansky the other. Leaving Cronstadt in August, 1803, Krusenstern proceeded by Cape Horn and the Sandwich Islands to Kamchatka, and thence to Japan. Returning to Europe by the Cape of Good Hope, after an extended series of explorations, Krusenstern reached Cronstadt in August, 1806, his being the first Russian expedition to circumnavigate the world. The emperor conferred several honors upon him, and he ultimately became admiral. As director of the Russian naval school Krusenstern did a great deal to improve the education and the position of the cadets, and in other ways the Russian navy was much indebted to his enlightened exertions. He was also a member of the scientific committee of the marine, and his contrivance for counteracting the influence the iron in vessels has on the compass was adopted in the navy. He died at Revel, August 24, 1846.

Krusenstern's *Voyage Around the World in 1803* was published at St. Petersburg in 1810–14 in 3 vols., with folio atlas of 104 plates and maps (English edition, 2 vols., 1813; French edition, 2 vols., and atlas of 30 plates, 1820). His narrative contains a good many important discoveries and rectifications, especially in the region of Japan, and the contributions made by the various savants were of much scientific importance. A work of permanent value is Krusenstern's *Atlas of the Pacific Ocean*. with its accompanying *Recueil des Mémoires Hydrographiques*, 3 vols., St. Petersburg, 1824–35. See *Memoir* by his daughter Madame Bernhardi, translated by Sir John Ross, 1856.

KUBA, or Kudial-kala, a town of the Caucasus, in the government of Baku, Russia, 120 miles northwest from Baku, and 25 miles west of the Caspian. Its situation at the foot of the highlands of Caucasus, on a plain watered by the numberless branches into which the Kubinka river and other smaller streams divide at their issue from the mountain valleys, makes the neighborhood very suitable for gardening, which is the chief occupation of the 11,300 inhabitants of Kuba, mostly Mussulman Shiites. They also make carpets with very bright colors, and some silks, which are exported to Transcaucasia and Russia; whilst Jews, who are numerous, carry on an active trade in rough silk, madder, and silk and woollen goods, exported to Russia and Persia. The town, which formerly was a Persian fort, and still is protected on one side by brick walls, is badly built and dirty; it suffers very much from fever. An unsuccessful attempt was made by the military authorities in 1825 to transport the town to New Kuba, 8 miles distant; the new settlement did not increase, and the settlers returned to Kuba.

KUBAN, a Russian district and government at the northwest extremity of the Caucasus, comprising the entire basin of the river of that name. It is bounded on the N. by the lands of the Don Cossacks and the steppes of Stavropol, E. by the watershed of the river basins of the Caspian and sea of Azoff, S. and S. W. by the Caucasian Alps, and W. by the Black Sea and Straits of Kertch. Its area comprises 27,728 square miles. Ekaterinodar, the chief town (population 30,000), is the residence of the governor, who, being also ataman in chief of the Kuban Cossacks, is invested with military and civil power. Climate varies greatly, the highest temperature reaching 104° Fahr., the lowest seldom falling below 10° Fahr. The country is very healthy, except in the lowlands, where fever prevails. The soil is of extreme fertility, yielding an abundance of wheat, maize, and tobacco. Fruit, such as apples, pears, cherries, is plentiful, and the vine is cultivated with success near Temrouk and Taman. The upper valleys are richly covered with forests abounding in fir, oak, ash, beech, hornbeam, etc.; the lower parts consist of extensive pasture lands and swamps. The animals include the stag, roe-deer, bear, wild boar, wolf, fox, ibex, and chamois, also the bison (which, however, is very rare) in the virgin forests of the Teberda; numerous water-fowl, such as ducks, geese, swans, pelicans, also the pheasant, partridge, bustard, and mountain turkey. The rivers and lakes are plentifully supplied with fish, trout abounding in the mountain streams and the sturgeon at the delta of the river Kuban. The mineral wealth consists of coal, salt, petroleum, and ozokerite. The river Kuban (the ancient Hypanis, see Caucasus, vol. v. p. 221) is navigable in flat-bottomed boats over a distance of 100 miles between Temrouk and Ekaterinodar. The delta comprises several lakes.

It is on the upper banks of the Kuban that the Ass or Osses, and the enigmatic corner of *Asia Propria*, are believed to have been located. The history of the original settlements of the various native tribes named below, and their language and worship before the introduction of Mohammedanism, remain a blank page in the legends of the Caucasus. The peninsula of Taman, a land teeming with relics of ancient Greek colonists, has been occupied successively by the Cimmerians, Sarmatians, Khazars, Mongols, and other nations. The Genoese, who had established an extensive trade in the 13th century, were expelled by the Turks in 1484, and in 1784 Russia obtained by treaty the entire peninsula and the territory on the right bank of the Kuban,—the latter being granted by Catherine II. in 1792 to the Cossacks of the Dnieper. Then commenced the bloody struggle with the Circassians which continued for more than half a century. The mountaineers were finally subdued in 1864, and 400,000 of their number expatriated.

Those, however, who elected to remain have become more prosperous than they had ever been. The population of Kuban, 862,473, embraces 510,038 Cossacks, 108,346 settlers of Russian origin, 4,280 foreigners, and 95,602 natives. Cossack villages are military settlements, the men carrying arms as well as following the plough. They are exempt from the poll-tax (3 to 4 roubles) to which the others are subjected, but military service is compulsory, as is gratuitous labor in the construction and repair of roads, bridges, etc. Not only domestic but even field work is conducted mostly by women, remarkable for physical strength and endurance. Corn-growing, the rearing of cattle, and fishing are the most profitable occupations. The native mountaineers, known under the general name of Circassians, but locally distinguished as the Karatchai, Abadsikh, Khakoutchy, Shapsough, have greatly altered their mode of life since the pacification of the Caucasus, still, however, maintaining Mohammedanism, speaking their vernacular, and strictly observing the customs of their ancestors. When during the late Russo-Turkish war insurrections broke out amongst the natives on the Terek, in Dagestan, and Abkhasia, these tribes remained peaceful and perfectly loyal. Their villages, especially those of the Karatchai, are striking examples of human industry, poverty being quite unknown; for the general emancipation in 1867 put an end to intestine strife, the predatory expeditions of former times, and the parasitic existence of numerous chiefs on the forced labor of serfs. The native population, as well as the Cossacks, enjoy certain rights of self-government, and are allowed to hold meetings to that end. Exports include wheat, tobacco, leather, wool, petroleum, and live cattle: imports drygoods, groceries, and hardware. Local industry is limited to a few tanneries, petroleum refineries, and spirit distilleries; but Russian and foreign capitalists have of late obtained concessions for exploring the petroleum region stretching between Khadaji and Taman, and the coal mines of Khumarinsky in the upper valley of the Kuban.

KUBLAI KHAN (or Kaan, as the supreme ruler descended from Jenghiz was usually distinctively termed in the 13th century) (1216–1294) was the most eminent of the successors of Jenghiz (Chinghiz), and the founder of the Mongol dynasty in China. He was the second son of Tuli, youngest of the four sons of Jenghiz by his favorite wife. Jenghiz was succeeded in the khanship by his third son Okkodai, or Ogdai (1229), he by his son Kuyuk (1246), and Kuyuk by Mangku, eldest son of Tuli (1252). Kublai was born in 1216, and, young as he was, took part with his younger brother Hulaku (afterward conqueror of the caliph and founder of the Mongol dynasty in Persia) in the last campaign of Jenghiz (1226–27). The Mongol poetical chronicler, Sanang Setzen, records a tradition that Jenghiz himself on his deathbed discerned young Kublai's promise and predicted his distinction.

Northern China, Cathay as it was called (vol. v. p. 545), had been partially conquered by Jenghiz himself, and the conquest had been followed up till the kin or "golden" dynasty of Tartars, reigning at Kai-fung-fu on the Yellow River, were completely subjugated (1234). But China south of the Great Kiang remained many years later subject to the native dynasty of Sung, reigning at the great city of Linggan, or Kinsai (*King-sz'*, "capital"), now known as Hang-chow-fu. Operations to subdue this region had commenced in 1235, but languished till Mangku's accession. Kublai was then named his brother's lieutenant in Cathay, and operations were resumed. By what seems a vast and risky strategy, of which the motives are not quite clear, the first campaign of Kublai was directed to the subjugation of the remote western province of Yunnan. After the capture of Talifu (well known in recent years as the capital of a Mohammedan insurgent sultan) Kublai returned north, leaving the war in Yunnan to a trusted general. Some years later (1257) the khan Mangku himself entered on a campaign in West China, and died there, before Ho-chow in Sz'chuen (1259).

Kublai assumed the succession, but it was disputed by his brother Arikbugha, and by his cousin Kaidu, and wars with these retarded the prosecution of the southern conquest. Doubtless, however, this was constantly before Kublai as a great task to be accomplished, and its fulfilment was in his mind when he selected as the future capital of his empire the Chinese city that we now know as Peking. Here, in 1264, to the northeast of the old city, which under the name Yenking had been an occasional residence of the Kin sovereigns, he founded his new capital, a great rectangular plot of 18 miles in circuit. The (so-called) "Tartar city" of modern Peking is the city of Kublai, with about one-third at the north cut off, but Kublai's walls are also on this retrenched portion still traceable.

The new city, officially termed Tai-tu ("great court"), but known among the Mongols and western people as Kaan-baligh (city of the khan;" see vol. iv. p. 639), was finished in 1267. The next year war against the Sung empire was resumed, but was long retarded by the strenuous defence of the twin cities of Siang-yang and Fan-ching, on opposite sides of the river Han, and commanding two great lines of approach to the basin of the Great Kiang. The siege occupied nearly five years. After this Bayan, Kublai's best lieutenant, a man of high military genius and noble character, took command. It was not, however, till 1276 that the Sung capital surrendered, and Bayan rode into the city (then probably the greatest in the world) as its conqueror. The young emperor, with his mother, was sent prisoner to Kaan-baligh; but two younger princes had been dispatched to the south before the fall of the city, and these successively were proclaimed emperor by the adherents of the native throne. An attempt to maintain their cause was made in Fuh-keen, and afterwards in Canton province; but in 1279 these efforts were finally extinguished, and the faithful minister who had inspired them terminated the struggle by jumping with his young lord into the sea.

Even under the degenerate Sung dynasty the conquest of Southern China had occupied the Mongols during intermittent campaigns of half a century. But at last Kublai was ruler of all China, and probably the sovereign (at least nominally) of a greater population than had ever acknowledged one man's supremacy. For, though his rule was disputed by the princes of his house in Turkestan, it was acknowledged by those on the Volga, whose rule reached to the frontier of Poland, and by the family of his brother Hulaku, whose dominion extended from the Oxus to the Arabian desert. For the first time in history the name and character of an emperor of China were familiar as far west as the Black Sea, and not unknown in Europe. The Chinese seals which Kublai conferred on his kinsmen reigning at Tabriz are stamped upon their letters to the kings of France, and survive in the archives of Paris. Adventurers from Turkestan, Persia, Armenia, Byzantium, even from Venice, served him as ministers, generals, governors, envoys, astronomers, or physicians; soldiers from all Asia to the Caucasus fought his battles in the south of China. Once in his old age (1287) Kublai was compelled to take the field in person against a serious revolt, raised by Nayan, a prince of his family, who held a vast domain on the borders of Manchuria. Nayan was taken and executed. The revolt had been stirred up by Kaidu, who survived his imperial rival, and died in 1301. Kublai himself died in 1294, at the age of seventy-eight.

Though a great figure in Asiatic history, and far from deserving a niche in the long gallery of Asiatic tyrants, Kublai misses a record in the short list of the good rulers. His historical locus was a happy one, for, whilst he was the first of his race to rise above the innate barbarism of the Mongols, he retained the force and warlike character of his ancestors, which vanished utterly in the effeminacy of those who came after him. He had great intelligence and keen desire of knowledge, with apparently a good deal of natural benevolence and magnanimity. But his love of splendor, and his fruitless expeditions beyond sea, created enormous demands for money, and he shut his eyes to the character and methods of those whom he employed to raise it. A remarkable narrative of the oppressions of one of these, Ahmed of Fenáket, and of the revolt which they provoked, is given by Marco Polo, in substantial accordance with the Chinese annals.

Kublai patronized Chinese literature and culture generally. Of the great astronomical instruments which he caused to be made specimens are still preserved at Peking, which are truly splendid as works of art, and not contemptible as works of science. Though he put hardly any Chinese into the first ranks of his administration, he attached many to his confidence, and was personally popular among them. Had his endeavor to procure European priests for the instruction of his people, of which we know through Marco Polo, prospered, the Roman Catholic Church, which did gain some ground under his successors, might have taken stronger root in China. Failing this momentary effort, Kublai probably saw in the organized force of Tibetan Buddhism the readiest instrument in the civilization of his countrymen, and that system received his special countenance. An early act of his reign had been to constitute a young lama of intelligence and learning the head of the Lamaite church, and eventually also Prince of Tibet, an act which may be regarded as a precursory form of the rule of the "grand lamas" of Lassa. The same ecclesiastic, Mati Dhwaja, was employed by Kublai to devise a special alphabet for use with the Mongol language. It was chiefly based on Tibetan forms of Nagari; some coins and inscriptions in it are extant; but it had no great vogue, and soon perished. Of the splendor of his court and entertainments, of his palaces, summer and winter, of his great hunting expeditions, of his revenues and extraordinary paper currency, of his elaborate system of posts and much else, an account is given in the book of Marco Polo, who passed many years in Kublai's service.

We have alluded to his foreign expeditions, which were almost all disastrous. Nearly all arose out of a hankering for the nominal extension of his empire by claiming submission and tribute. Expeditions against Japan were several times repeated; the last, in 1281, on an immense scale, met with huge discomfiture. Kublai's preparations to avenge it were abandoned owing to the intense discontent which they created. In 1278 he made a claim of submission upon Champa, an ancient state representing what we now call Cochin China. This eventually led to an attempt to invade the country through Tongking, and to a war with the latter state, in which the Mongols had much the worst of it. War with Burmah (or Mien, as the Chinese called it) was provoked in very similar fashion, but the result was more favorable to Kublai's arms. The country was overrun as far as the Irawaddy delta, the ancient capital Pagán, with its magnificent temples, destroyed, and the old royal dynasty overthrown. The last attempt of the kind was against Java, and occurred in the last year of the old khan's reign. The envoy whom he had commissioned to claim homage was sent back with ignominy. A great armament was equipped in the ports of Fuh-keen to avenge this insult; but after some temporary success the force was compelled to reembark with a loss of 3000 men. The death of Kublai prevented further action.

Some other expeditions, in which force was not used, gratified the khan's vanity by bringing back professions of homage, with presents, and with the curious reports of foreign countries in which Kublai delighted. Such expeditions extended to the states of Southern India, to Eastern Africa, and even to Madagascar.

Of Kublai's twelve legitimate sons, Chingkim, the favorite and designated successor, died in 1284–85; and Teimur, the son of Chingkim, took his place. No great king arose in the dynasty after Kublai. He had in all nine successors of his house on the throne of Kaan-baligh, but the long and imbecile reign of the ninth, Toghon Teimur, ended (1368) in disgrace and expulsion, and the native dynasty of Ming reigned in their stead. (H. Y.)

KUCHAN (a contracted form of *Kabushán*), a walled town and also a district of Persia, province Khórásán, inclosed north and south by the Hazar-Mazjíd and Ala-Dagh mountains. The town lies at the north foot of the Shah Jahan Kuh (11,000 feet), 3300 feet above the sea, in 37° 10′ N. lat., 58° 25′ E. long., about 80 miles northwest of Meshhed on the route to Shirván. It is an important place, seat of a district governor, and surrounded by extensive gardens and vineyards yielding excellent fruits and grapes from which a superior wine is made. Population, 20,000.

The district forms the western section of the longitudinal valley stretching between the above-mentioned ranges from Meshhed to Shirván and communicating by the Allaho-Akbar Pass (4200 feet) northwards with the Dara-Gez country on the frontier of the new Russian Trans-Caspian Territory. It is very fertile, largely cultivated, and well watered by the Upper Atrek river, which has its furthest source in an intermittent torrent just south of the pass. The whole valley is thickly dotted over with villages, while the slopes of the hills afford good pasture to the numerous flocks and herds of the warlike Zafaranlu Kurds, who guarded the frontier against the Akhal Tekke Turkomans until these marauders were reduced by the Russians in the spring of 1881. Of this region little was known until the explorations of Baker, Gill, O'Donovan, and Stewart (1874–81).

KUCH BEHAR, or Coosh Behar, a native state in Bengal, India, lying between 25° 57′ and 26° 32′ N. lat., and 88° 48′ and 89° 55′ E. long. It is entirely surrounded by British territory, being bounded on the N. by Jalpáigurí, on the E. by Goálpára, on the S. by Rangpur, and on the W. by Purniah districts. The state forms a level plain of triangular shape, intersected by numerous rivers. The greater portion is fertile and well-cultivated, but tracts of jungle are to be seen in the northeast corner, which abuts upon Assam. The soil is uniform in character throughout, consisting of a light, friable loam, varying in depth from 6 inches to 3 feet, superimposed upon a deep bed of sand. The whole is detritus washed down by torrents from the neighboring Himálayas. The rivers all pass through the state from north to south to join the main stream of the Brahmaputra. Some half dozen are navigable for small trading boats throughout the year, and are nowhere fordable; and there are about twenty minor streams which become navigable only during the rainy season. The streams have a tendency to cut new channels for themselves after every annual flood, and they communicate with one another by cross-country water-courses. There are no embankments or artificial canals, nor are any mineral products known to exist.

The population in 1872 was 532,565, distributed over an area of 1307 square miles. The Hindus numbered 127,928; the Mohammedans, 48,086. The Koch or Rájbansí tribe numbered 111,125 adult males, or 63 per cent. of the whole. This is a widely spread tribe, evidently of aboriginal descent, which is found throughout all Northern Bengal, from Purniah district to the Assam valley. They are akin to the Indo-Chinese races of the northeast frontier; but they have now become largely Hinduized, especially in their own home, where the appellation of "Koch" has come to be used as a term of reproach. Kuch Behar town, which contains the palace of the rájá, and has 7132 inhabitants, is the only populous place in the state. Even villages, in the ordinary sense of the word, are unknown, each well-to-do family living apart in its own homestead. Rice is grown on three-fourths of the total cultivated area. Jute and tobacco are largely grown for exportation over an increasing area year by year. The only special industries are the weaving of a strong silk from worms fed on the castor-oil plant, and of a coarse jute cloth used for screens and bedding. The external trade is chiefly in the hands of Márwárí immigrants from Upper India. The chief exports are jute, tobacco, oil, timber; salt, sugar, and piece goods are imported. The net revenue in 1870–71 amounted to £112,093, of which £25,719 was derived from *zamíndárí* estates in British territory. The climate is damp and malarious, but not so hot as in other parts of Bengal. The average annual rainfall is 123 inches.

As in the case of many other small native states, the royal family of Kuch Behar lays claim to a divine origin in order to conceal an impure aboriginal descent. The greatest monarch of the dynasty was Nar Náráyan, the son of Visu Sinh, who began to reign about 1550. He conquered the whole of Kámrúp, built temples in Assam, of which ruins still exist bearing inscriptions with his name, and extended his power southwards over what is now part of the British districts of Rangpur and Purniah. To his reign also is attributed the introduction of the well-known Náráyaní currency, the privilege of coining which has not yet been entirely abolished. His son, Lakshmí Náráyan, who succeeded him in Kuch Behar, became tributary to the Mughal empire. In 1772 a competitor for the throne, having been driven out of the country by his rivals, applied for assistance to Warren Hastings. A detachment of sepoys was accordingly marched into the state; the Bhutiás, whose interference had led to this intervention, were expelled, and forced to sue for peace through the mediation of the lama of Tibet. By the treaty made on this occasion, April, 1773, the rájá acknowledged subjection to the Company, and made over to it one half of his annual revenues. But though the Bhutiás were driven out, the rivalry of domestic faction continued. In 1863, on the death of the rájá, leaving a son and heir only ten months old, a British commissioner was appointed to undertake the direct management of affairs during the minority of the prince, and many important reforms have been thus successfully introduced.

KUEN-LUN, or Kouen-lun, the name given to the mountains between Western Tibet and the plains of Eastern Turkestan; it is derived from the Chinese geographers, and is probably a corruption of some Turkish or Tibetan word; it appears to be unknown locally. The name having been adopted, chiefly on the initiative of Humboldt, before any correct geographical knowledge had been obtained of the region to which it was applied, it has been used with inconvenient want of precision, and this has encouraged erroneous conceptions. Little precise information is yet available on the subject, but there is no reason to doubt that, within the limits to which actual exploration has gone, the mountains designated as Kuen-lun form the northern border of the highlands of Tibet, descending to the central Asian plain, just as those commonly spoken of under the name of Himalaya constitute the broad mountainous slope which descends to the lower levels of India.

Nothing can be said with confidence of the northern border of Tibet east of 82° E. long., but from this point westward to about the 75th meridian, it consists of a series of mountain ranges on a scale of magnitude quite analogous to that of the higher ranges of the Himalaya, and beyond the last-named meridian merges into the Thian-Shan mountains. A line of demarcation between the summit of the Tibetan plateau and its northern flank can, in the present condition of our knowledge, only be fixed in an arbitrary manner, and it may for convenience be regarded as following the watershed line from which the streams flow northward to the plain of Eastern Turkestan. Using the name Kuen-lun in the sense thus explained, the zone it includes will be seen to abut at its northwestern extremity on the series of elevated plateaus known under the name of Pamir, which extend over a distance of nearly 200 miles to a little beyond 39° N. lat. Here the width of the zone is about 100 miles. To the eastward it becomes broader, and on the 79th meridian is nearly 150 miles across. In this region the chief ranges appear to be laid out, generally, in a northwest and southeast direction, like those of Western Tibet, with transverse ridges at irregular intervals. The transverse direction would seem to predominate in the outer portion of the zone nearest to the plain of Turkestan, but the geographical details are too little known to permit us to say more on this point. Of the longitudinal ranges two are of conspicuous magnitude, running approximately parallel to one another about 60 or 70 miles apart; the more northern or outer may be spoken of as the main Kuen-lun; the other, which separates the waters of the Indus which run off to the southwest, from those of the streams which pass down to the plains of Khotan, Yarkand, and Kashgar, constitutes the watershed before referred to, and has been called the Mustagh or Karakorum range, from two of the best known passes across it. The latter of these great lines of elevation, from which the Kuen-lun slope of the Tibetan plateau may be said to commence, is of very considerable altitude throughout its summits, rising more than 28,000 feet above sea-level, and few of the passes falling below 18,000, or even 19,000 feet, over a length of some 400 miles. Its flanks are covered with enormous glaciers, some of them being continuous for distances of 60 or 70 miles. The main Kuen-lun is not much inferior in magnitude, one of its peaks rising about 25,000 feet, while the points between that elevation and 20,000 feet are numerous. The passes lie between 18,000 feet on the east and 13,000 feet on the west. The valleys between these ranges vary in elevation from about 15,000 feet to 10,000 feet, the drainage in some cases collecting in small lakes, in others forming streams which, after flowing for some distance parallel to the separating ridges, suddenly change their direction and run off to the northeast through deep transverse lines of rupture in a manner analogous to that observed on the border of the Himalayan mountain slope.[1]

The whole of the region is described as remarkable for its general barren character. The mountain sides are naked and the valleys for the most part narrow and steep. There is a complete absence of forest, and trees of any sort are only found at the lower levels bordering on the northern plain,—walnuts, poplars, and willows alone being mentioned, besides a few fruit trees. The vegetation is scanty and botanically poor, brushwood being found along some of the rivers, and pastures in the bottoms of the deep valleys among the higher ranges. Among the shrubs are species common in Tibet, such as tamarisk, juniper, astragalus, willow, rose, barberry, and clematis. The animal life also appears to be mainly that found in the neighboring parts of Tibet.

Some facts of interest relating to the geological structure of these mountains may be gathered from the fragmentary reports of Dr. Stoliczka, the accomplished geologist who so prematurely died from the results of exposure in these inhospitable regions. The summit of the Karakorum Pass is of Triassic age, and cretaceous beds are found in some of the ranges on the north of the Kuen-lun main range, associated with Palæozoic deposits supposed to be Carboniferous and Silurian. For the greater portion of the year the climate is very rigorous. The extremes of temperature are great, and the rainfall little.

The population is small. The fixed settlements are confined to the outer valleys; few villages or hamlets are found above 6000 feet of altitude, and hardly any over 8000 feet. The upper valleys are occupied by a nomadic population, wholly pastoral in their habits.

The tract may be regarded as appertaining politically to the sovereigns for the time being of the principalities lying in the plain below it. But from the nature of the case any recognized authority hardly extends beyond the permanently inhabited region. (E. S.)

KUKA, or **KUKAWA**, the capital of the kingdom of Bornu in Central Africa, is situated in 12° 55′ N. lat. and 13° 25′ E. long., 4½ miles from the western shores of Lake Tsad or Chad[2] in the midst of an extensive and for the most part uncultivated plain. The soil of the whole district consists of a layer of sand resting on clay, beneath which are found sand and lime. At a depth of 40 or 50 feet water is reached, usually sweet, but sometimes brackish. From a distance Kuka presents a very dead and monotonous appearance, there being no minarets or lofty buildings of any sort. The walls, built of earth, are about 20 feet in height. There are two distinct towns, separated by more than half a mile. The western town or Billa Futebe is the larger of the two, measuring from west to east about a mile and a half, and rather less from north to south. The plan is rectangular, and there is a gate in each of the four sides. From west to east runs the main thoroughfare, known as the Dendal, which widens out to the west into the market place. About the middle of the Dendal stands the sheikh's secondary palace. The eastern town or Billa Gedibe is somewhat longer and narrower than the western. The Dendal continues from its western gate till closed at the east end of the town by the great palace of the sheikh, gradually widening out into a large open square. The larger dwelling-houses of Kuka are of mud or earth, with windowless walls and flat roofs; the poorer houses are mere huts of straw or reeds, varying in shape from that of a bell to that of a sugar-loaf. In almost every court-yard there is at least one large shady tree, whose branches are tenanted by storks, herons, or a variety of lesser birds; and the whole place is vocal with song. Kuka is a wealthy town. It always contains a large number of strangers —merchants, pilgrims, and adventurers—attracted even from Mecca, Medina, Morocco, Egypt, Tunis, Tripoli, by the fame of the sheikh's liberality. The town enjoys the rare advantage of being absolutely free from all taxation of trade or industry. In the Monday market, which is held outside the western gate, there are often more than 10,000 buyers and sellers. It is at once a fair for horses, cattle, camels, and other live stock, a fruit, grain, and vegetable market, a meat market, and a slave market. The currency consists mainly of Maria Theresa dollars and cowries. For the Mohammedans, not only of Bornu but of the neighboring countries, Kuka serves as a kind of university town. In its streets are to be seen bands of mendicant students, who spend the day in collecting alms from the people, and after supper gather round the fires which they kindle in the public squares, and noisily and mechanically recite the verses of the Koran far into the night. A less cheerful feature of the street life is the unusual number of blind beggars. The population is estimated at 60,000.

Kuka was founded by Sheikh Mohammed al Amin el Kanemi. It received its name from a kuka or monkey bread tree (*Adansonia digitata*) which attracted the attention of the settlers as a rare thing in the district. In 1840 the town was laid waste by King Mohammed Sherif of Wadai; and when it was restored by Sheikh Omar he gave it the present double form. It is probably from this feature of the place that the plural *Kukawa* has become the ordinary designation of the town in Kano and throughout the Sudan; though the local inhabitants generally use the singular *Kuka*. Kuka has been visited by Denham and Clapperton, Beurmann, Vogel, Barth, Rohlfs, and Nachtigal.

For further details see Barth, *Travels in Central Africa*, London, 1858; Rohlfs, *Quer durch Afrika*, Leipsic, 1874; Nachtigal, *Sahara und Sûdân*, Berlin, 1879, vol. i. p. 581-748. The last is the most elaborate account.

KUKU KHOTO, in Chinese **KWEI-HWA-TCHENG** or **GUI-HUA-TCHENG**, a city of the Chinese province of Shan-se, situated to the north of the Great Wall, in 40° 50′ N. lat. and 111° 45′ E. long., about 160 miles west of Kalgan. It lies in the valley of a small river which joins the Hoang-ho 50 miles to the south. There are two distinct walled towns in Kuku Khoto, at an interval of a mile and a half; the one is the seat of the civil governor and is surrounded by the trading town, and the other is the seat of the military governor and stands in the open country. In the first or old town more especially there are strong traces of Western Asiatic influence; the houses are not in the Chinese style, being built all round with brick or stone and having flat roofs, while a large number of the people are still Mohammedans, and, there is little doubt, descended from western settlers. The town at the same time is a great seat of Buddhism,—the lamasseries containing, it is said, no less than 20,000 persons devoted to a religious life. As the southern terminus of the routes across the desert of Gobi from Uliassutai and the Thian Shan, Kuku Khoto has a large trade, exporting flour, millet, and manufactured goods, and importing the raw products of Mongolia. A Catholic mission and a Protestant mission are maintained in the town.

Early notices of Kuku Khoto will be found in Gerbillon (1688–1698), in Du Halde (vol. ii., English edition), and in Astley's *Collection* (vol. iv.). Recent travellers who have visited it are Elias (*Journ. Roy. Geog. Soc.*, 1873) and Peftsoff.

KULDJA, the name of two towns in the valley of the Ili in Central Asia, situated about 25 miles apart.

I. **OLD KULDJA**, the present capital of the Kuldja territory, restored to China by Russia in 1881, other wise known as Tartar Kulja, Nin Yuan, or Kuren, lies about ¼ mile to the north of the river, in 43° 58′ N. lat. and 81° 25′ E. long. The walled town is nearly square, each side being about a mile in length; and the walls are not only 30 feet high but broad enough on the top to serve as a carriage drive. Two broad streets cut the inclosed area into four nearly equal sections. Since 1870 a Russian suburb has been laid out on a wide scale. The houses of Kuldja are almost all clay-built and flat-roofed, and except in the special Chinese quarter in the eastern end of the town it is only a few public buildings that show the influence of Chinese architecture. Of these the most noteworthy are the Tarantchi and Dungan mosques, both with turned-up roofs, and the latter with a pagoda-looking minaret. The population is mainly Mohammedan, and there are only two Buddhist pagodas. A small Chinese Roman Catholic church has maintained its existence through all the vicissitudes of modern times. Paper and vermicelli are manufactured with rude appliances in the town. The outskirts are richly cultivated with wheat, barley, lucerne, and poppies. Schuyler estimated the population, which includes Tarantchis, Dungans, Sarts, Chinese, Calmucks, and Russians, at 10,000 in 1873; it has since increased.

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[1] For information as to the geographical details which have been collected reference may be made to the map published in the *Royal Geog. Soc. Journal*, vol. xlviii., accompanying Captain Trotter's account of the results of Sir T. D. Forsyth's mission to Kashghar.

[2] The fear lest the town should be submerged by the lake led the sheikh to found (1878) a new residence (Kherwa) on a range of sand hills about two hours north of Kuka.

II. New Kuldja, Manchu Kuldja, or Ila, which lies lower down the valley on the same side of the stream, has been a pile of ruins whitened with bleaching bones since the terrible massacre of all its inhabitants by the insurgent Dungans in 1868. It was previously the seat of the Chinese Government for the province, with a large penal establishment and strong garrison; its population was about 70,000.

See Schuyler, *Turkistan*, London, 1876; Dilke in *Proc. Roy. Geog. Soc.*, 1874; Ujfalvy in *Tour du Monde*, 1879; E. D. Morgan in *Proc. Roy. Geog. Soc.*, 1881; and Ili, vol. xii. p. 741.

KULLU, a valley and subdivision of Kángrá district, Punjab, India, situated between 31° 20′ and 32° 26′ N. lat., and 76° 58′ and 77° 50′ E. long. It is bounded on the N. by the Central Himálayan range, on the S. by the Sutlej river, on the S.W. by the Dháoladar or Outer Himálaya, Bias river, and the states of Suket and Mandi, and on the W. by Bára Bangahál hills. The Sainj, which joins the Bias at Lárgi, divides the tract into two portions, Kullu Proper and Sioráj. Kullu Proper, north of the Sainj, together with Inner Seoráj, forms a great basin or depression in the midst of the Himálayan systems, having the narrow gorge of the Bias at Sárgi as the only outlet for its waters. North and east the Bára Bangahál and Mid-Himálayan ranges rise to a mean elevation of 18,000 feet, while southward the Jalori and Dháoladhar ridges attain a height of 11,000 feet. The greater portion of Kullu must thus ever remain an utter wilderness. The higher villages stand 9000 feet above the sea; and even the cultivated tracts have probably an average elevation of 5000 feet. The houses consist of four-storied chálets in little groups, huddled closely together on the ledges or slopes of the valleys, picturesquely built with projecting eaves and carved wooden verandas. The Bias, which, with its tributaries, drains the entire basin, rises at the crest of the Rohtang Pass, 13,326 feet above the sea, and has an average fall of 125 feet per mile. Its course presents a succession of magnificent scenery, including cataracts, gorges, precipitous cliffs, and mountains clad with forests of deodar, towering above the tiers of pine on the lower rocky ledges. Great mineral wealth exists, but the difficulty of transport and labor will probably always prevent its proper development. Hot springs occur at three localities, much resorted to as places of pilgrimage.

The census of 1872 disclosed a population of 90,313, spread over an area of 1926 square miles—Hindus numbering 90,206; Mohammedans, 100; and Christians, 7. The character of the hillmen resembles that of most other mountaineers in its mixture of simplicity, independence, and superstition. Tibetan polyandry still prevails in Seoráj, but has almost died out elsewhere. The temples are dedicated rather to local deities than to the greater gods of the Hindu pantheon. Out of a total of 799,834 acres, only 32,884 are returned as actually under cultivation. The staple spring crops include wheat, barley, poppy, tobacco, and oilseeds; the autumn crops are maize, rice, pulses, and millets. Tea cultivation has recently been introduced into the valley. Rice, wheat, opium, tobacco, tea, and honey are exported. Manufactures are almost unknown. The climate is not healthy. Intermittent fevers and bowel complaints are endemic, while epidemics of virulent contagious fever and cholera break out from time to time. Goitre and cretinism also occur. The average annual rainfall ranges from 45 to 50 inches. The mean temperature in August is 78° Fahr., in November 55°.

KULM (in Polish, *Chelmo*), chief town of a circle in the government district of Marienwerder, Prussia, is situated on the high banks of the Vistula, about 24 miles northwest of Thorn. It is regularly built, and contains an old-fashioned town-house, a gymnasium, a high school, and a cadets' institution founded in 1775 by Frederick II. It carries on trade in grain and has some shipping. The population in 1875 was 9628.

Kulm gives name to the oldest bishopric in Prussia, although the bishop resides at Pelplin. It was taken about 1220 by Duke Conrad, of Masovia. Frederick II. pledged it in 1226 to the Teutonic Order, from whom it passed by the second peace of Thorn in 1466 to Poland; and it was annexed to Prussia in 1772. It joined the Hanseatic League, and used to carry on very extensive manufactures of cloth. The battle of Kulm, won August 30, 1813, over the French by the Prussians and Russians,[1] took place at the village of Kulm in Bohemia, about 3 miles northeast of Teplitz.

KULMBACH, or Culmbach, a town in the administrative district of Upper Franconia, Bavaria, is picturesquely situated on the White Main, and on the Bamberg-Hof line of the Bavarian State Railway, about 11 miles northwest from Baireuth, in 50° 6′ N. lat., 11° 28′ E. long. The town has several linen manufactories and a large cotton spinnery, but is chiefly famed for its many extensive breweries, the latest returns showing an annual production of 4,115,637 gallons of beer, of which 3,719,478 gallons were exported. On an eminence near the town stands the former fortress of Plassenburg, which during the 15th and 16th centuries was the residence of the margraves of Brandenburg-Kulmbach. It was dismantled in 1807, and is now used as a prison. The population in November, 1881, was officially estimated at 6000.

KUM, a walled city of Persia, in the province of Irak-Adjemi, in a hilly district at the western edge of the Great Salt Desert, 85 miles south of Teheran, on the main route to Ispahan, and at the northern extremity of the lofty Kuru-Kuh range, which runs thence for over 600 miles southeast to the Bam highlands. It is a long, straggling, half-ruined place, with empty bazaars, and neglected streets full of holes and pitfalls. Yet it ranks second to Meshhed in sanctity, thanks to the famous shrine of Masuma Fatima, sister of the imám Riza, which also contains the remains of ten kings and four hundred and forty-four "saints," and whose gilded copper dome has been completed by the present shah. Like Kerbela, Kum is a favorite place of interment for the faithful, and is yearly visited by thousands of devout Shiah pilgrims. At one time it is said to have contained 100,000 inhabitants, and its former greatness is still attested by the surrounding ruins, of which Sir Thomas Herbert quaintly remarks that they "may gaine beliefe to the inhabitants, who say it was once comparable in pride and greatness to mightie Babylon." Even in that traveller's time it was still a flourishing place, with well-built houses "sweet and wel-furnished, her streets wide, her bazzar faire and her mosque of most honourable esteem." But the neighborhood now presents the aspect of a vast necropolis, while not more than 4000 of its 20,000 houses are occupied. Cotton of good quality and the castor-oil plant are extensively cultivated in the district, which is watered by the Gonsir and a few other intermittent streams draining east to the great desert. Population estimated at 20,000.

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[1] [Colloredo's Austrian Corps was also engaged in the conflict of the 30th August.—Am. Ed.]

KUMÁUN, a district in the Northwestern Provinces of India, lying between 28° 55′ and 30° 50′ N. lat., and 78° 52′ and 80° 56′ E. long. It consists of two distinct tracts—the sub-Himálayan ranges, and the *bhábhar* or waterless forest, averaging from 10 to 15 miles in breadth, which stretches between the forests and the Taráí. See HIMÁLAYA, vol. xi. p. 735. Of the entire area of the highlands, only 500 square miles are returned as cultivated and 100 square miles as culivable. The southern or *bhábhar* portion was up to 1850 an almost impenetrable forest, given up to wild animals; but since then the numerous clearings have attracted a large population from the hills, who cultivate the rich soil during the hot and cold seasons, returning to the hills in the rains. The rest of Kumáun is a maze of mountains, some of which are among the loftiest known. In fact, in a tract not more than 140 miles in length and 40 in breadth, there are over thirty peaks rising to elevations exceeding 18,000 feet (see vol. xi, p. 737). The rivers rise chiefly in the southern slope of the Tibetan watershed north of the loftiest peaks, amongst which they make their way down valleys of rapid declivity and extraordinary depth. The principal are the Káli or Gogra, and the Pindar and Káilganga, whose waters join the Alaknanda. The valuable timber of the yet uncleared forest tracts in Kumáun is now under official supervision. The chief trees are the *chír* or three-leaved Himálayan pine, the cypress, fir, alder, *sál* or ironwood, and *saindan*. Limestone, sandstone, slate, gneiss, and granite constitute the principal geological formations of the district. Mines of iron, copper, gypsum, lead, asbestos, and coral exist; but they are not thoroughly worked.

The census of 1872 disclosed a population of 433,314, of whom 425,963 were returned as Hindus and 5569 as Mohammedans. The Kumáunis are a tolerably fair, good-looking race, active, cheerful, honest and industrious. Polyandry is unknown, but polygamy is frequent. The 4606 villages of the district are scattered about the hillsides, the houses being built of stone laid in mud, and roofed with slates, or with planks or thatch. The only native town is Almora. There are large bazaars at the European stations of Naini Tal and Ranikhet. The area available for cultivation is small; but wherever possible the hillsides have been terraced. The soil except in some of the villages is poor and stony, and requires much manure. On the better kinds of land rice, wheat, and tobacco are grown; on the others wheat, barley, mustard, vetches, flax, Indian corn, millets, pulses, sugar-cane, cotton, oilseed, etc. The staple food of the peasantry is *mandua* (*Eleusine corocana*). Potatoes are becoming common. Fruit is very plentiful, and the oranges are of excellent quality. The tea plantations form now an important and valuable feature in the district, but are almost entirely in the hands of European owners. In 1876–77 the gardens covered an area of 2222 acres, yielding 261,060 ℔ of tea. The only other manufacture is the weaving of coarse woollen clothing. The imports from Tibet include beasts of burden, salt, coarse cloths, and Chinese silk. The exports to Tibet are grain, cotton goods, broadcloth, quilts, hardware, tobacco, sugar, spices, dyes, tea, and timber. To the plains of India Kumáun sends grain, clarified butter, tea, ginger, turmeric, red pepper, drugs, spices, bark, honey, wax, a little iron and copper, timber, and wild jungle produce. The roads in the hills are for the most part only bridle-paths, more or less well laid out, but all now well bridged. Except in the *bhábhar* and deep valleys, the climate is mild. The rainfall of the outer Himálayan range, which is first struck by the monsoon, is double that of the central hills, in the average proportion of 80 inches to 40. No winter passes without snow on the higher ridges, and in some years it is universal throughout the mountain tract. Frosts, especially in the valleys, are often severe. Kumáun is occasionally visited by epidemic cholera. Leprosy is most prevalent in the east of the district. Goitre and cretinism afflict a small proportion of the inhabitants. The hill fevers at times exhibit the rabid and malignant features of plague. The *mahámari* pestilence, which was formerly confined to Garhwál, has of late years extended its ravages to Kumáun.

KUMPTA, or COOMPTAH, a town and port in North Kánara district, Bombay, India, 14° 26′ N. lat., 74° 27′ E. long., with a population in 1872 of 10,932. It is the chief commercial town in the district. The average annual value of its trade, which consists chiefly of cotton, spices, and grain, the first coming from Dhárwár district and the rest from the upland country of Kánara, is returned for the five years ending 1873–74 at £481,811 of import and £868,049 of export.

KUNCH, a town in the Northwestern Provinces of India, in 25° 59′ N. lat., and 79° 12′ E. long., with a population in 1872 of 14,448 (11,956 Hindus and 2492 Mohammedans). It has markets for cotton and wheat, for molasses, rice, and tobacco, and for salt. The bazaar ways are narrow, tortuous, unmade, undrained, with poor-looking and often ruinous shops; both trade and population are declining.

KUNGUR, a district town of Russia, in the government of Perm, 58 miles south-southeast of the capital of the government, on the Sylva, a tributary of the Tchusovaya. Formerly a blockhouse erected to protect the Russian settlements against the Tartars, it has acquired commercial importance by manufacturing of boots, which are exported in great quantities to the mines of the Ural mountains and to the furthest gold-washings of Western and Eastern Siberia; more than 1500 men are engaged in this trade. There are also several tallow-melting houses, candle, soap, and glue works, tanneries, and a yard where steamers are made for the navigation of the Kama and its tributaries. The leather of Kungur, which is renowned for its quality, is sold in the eastern provinces of Russia, and reaches Orenburg and Irbit, whilst the tallow is sent to St. Petersburg. The wharf on the Sylva is one of the most important in the basin of the Kama. Population 10,800.

KURDISTAN, or KÚRDISTÁN,[1] is a convenient geographical designation for the lands inhabited by the Kurds, but the name is not used in the country in this general sense, nor indeed would it be technically correct, for in a very small portion only of the region in question is the population exclusively Kurdish.

Geography.—The furthest point to which the Kurds extend northwestward is the junction of the two arms of the Euphrates near Kharpút, in about 39° N. lat. and 39° E. long., while their southeastern limit may be defined as the frontier of Luristan, south of Kirmánsháhán, in about 34° N. lat. and 47° E. long. The whole of this space, which is roughly calculated to embrace an area of at least 60,000 square miles, is mountainous, being in fact a section of the great chain which, known in antiquity at one extremity as Taurus and at the other as Zagrus, bisects Asia Minor from west to east, and then turning to the southeast buttresses the great Persian plateau in a series of ranges rising step over step above the valley of the Tigris. Kurdistan thus defined may be divided, according to its physical features, into three separate sections. The first section, stretching from Kharpút to the Persian frontier, has been thus described by Consul Taylor, who resided for many years in the country.

"The general features," he says, "of this tract are high mountains, inclosing fertile valleys and an undulating upland, bounded on the southwest by the Tigris, and intersected at several points by numerous streams having their rise in the northern districts of the Diarbekir pashalic, and emptying themselves into that river. The scenery in the highlands yields to no other portion of Turkey for variety and romantic beauty, while the numerous rivers and streams flow through charming landscapes and thickly wooded valleys, bathing in their course the bases of castles and towns famous in profane and ecclesiastical history."

To supplement Mr. Taylor's general description, it may be enough to say that there are three principal ranges running from west to east through this portion of Kurdistan:—(1) The Dújik and Mezoor Dagh (Paryadres and Abus of antiquity, and Mount Simus of Armenian history), a lofty, rugged, and inaccessible range which fills up the entire space between the two arms of the Euphrates, being connected with Anti-Taurus to the westward, and culminating far to the east in the isolated peaks of the greater and lesser Ararat; (2) The Mudikán range, south of the Murád-sú, which is a continuation of the true Taurus, and which is prolonged under the names of Nimrúd Dágh, Sipán Dágh, and Ala Dágh, till it reaches the Persian frontier to the northeast of Lake Van (in this range all the headwaters of the Tigris rise, flowing south under the names of Debeneh-sú, Ambár-sú, Batmán-sú, and the rivers of Arzen and Bohtán, and joining the main stream between Diarbekir and Jezireh); and (3) Mount Masius, or Jebel-Túr, an inferior range, south of the Tigris, which divides Kurdistan from the great Mesopotamian desert.

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[1] With reference to the *u* sound in this group of words it is to be observed that *Kurd* is always to be pronounced like the English *gourd*, not as in *curds* and whey.

The second or central division of Kurdistan, which may be regarded as extending north and south from Lake Van to Sulimaníeh, is of a more exclusively mountainous character. With the exception indeed of the districts of Amadíeh, Shekelabád, and Koi-Sanják on the immediate skirts of the Tigris basin, and the open country of Azerbiján beyond the great range to the southwest of Lake Urumíeh, where the Kurds of the mountains have overflowed into Persia, there is hardly a square mile of level land anywhere to be found. The ranges of this division, which preserve a general direction of north-northwest and south-southeast, are throughout much broken up by transverse ridges, and seem to be tossed about in inextricable disorder, a few peaks, such as the Jebel-Júdí above Amadíeh (which almost certainly represents the Ararat of the Bible) and the Gawár (or Jawár) Dágh near Julamerik in the Hakkári country, rising to a stupendous height, and thus dominating the surrounding mountains, while several large rivers, and especially the Khabúr and the Upper and Lower Záb, running in narrow and precipitous beds, burst at right angles through the gorges of the chain, and descend upon the Tigris valley in a series of cataracts amid scenery of the wildest and most impressive grandeur. The usual elevation of the hills in this part of Kurdistan is not less than 10,000 feet above the level of the sea, while some of the highest peaks reach probably to an altitude of 14,000 or even 15,000 feet.

In the third or southern division of Kurdistan, which includes the Turkish pashalic of Sulimaníeh and the Persian provinces of Ardelán and Kirmánsháhán, the mountain chain diminishes both in height and breadth. The average height of the hills is here only about 5000 or 6000 feet, and the loftiest range, that of the Bend-i-Núh, or Noah's Hill, which forms the southern barrier of the gates of Zagrus,[1] and upon which, according to the tradition of Babylonia, as opposed to the tradition of Assyria, the ark is supposed to have rested, does not exceed an elevation of 8000 feet. The pass also which traverses the range at this point, and conducts from the lowlands of Holwán to the upper plain of Kirrend, is only ten miles in length. At the foot of the great range on the western side are the fertile plains of Shahrizor, Zoháb, and Ghilán, where rice is extensively cultivated, while on the Persian side, though rocky ridges run out to the eastward both in Ardelán and Kirmánsháhán, the general character of the country is open, and cereals are everywhere produced in extraordinary abundance.

Population.—There are no means of calculating the total Kurd population with even approximate accuracy, for neither in Turkey nor in Persia has a Government census ever been attempted, and the revenue tables which regulate taxation and conscription, and ought therefore to guide inquiry, are wilfully distorted for political purposes to such an extent as to be quite unreliable. From the materials, however, which have been recently collected by the British consular officers employed in Asia Minor, with a view of testing the relative strength of the Mohammedan and Christian populations, it seems pretty clear that the Turkish Kurds exceed one million and a half in number, while the estimates of travellers who have resided in Persian Kurdistan give about 750,000 souls for the aggregate of the tribesmen and sedentary Kurds dwelling along the mountains from Ararat to Kirmánsháhán, together with the scattered colonies of the interior. The following rough table, then, has been compiled from the above sources.

Turkey.	
Pashalic of Erzeroum, including sanjaks of Ersingán, Baiburt, and Bayazíd, with Deyrsim mountains, ...	350,000
Pashalic of Diarbekir, with sanjaks of Malatíeh and Mardin and dependent tribes, ...	320,000
Pashalic of Betlis, with sanjaks of Músh and Sa'ert, and districts of Mudikán, Sasún, Shirwán, and Northern Bohtán, ...	130,000
Pashalic of Van, with sanjak of Hakkári and nomad tribes of the Arab and Persian frontier, .	170,000
Pashalic of Kharpút, with part of Deyrsim, . .	130,000
Pashalic of Mosul, including sanjaks of Southern Bohtán, Amadíeh, Rowandiz, and Koi-Sanják, with tribes of Bilbass, Balik, etc., ...	250,000
Pashalic of Sulimaníeh, with dependencies to Baghdad frontier, ...	150,000
Total of Turkish Kurds, . . .	1,500,000
Persia.	
Kurds of Azerbiján, including Mikris of Saúj-Bolák, Bilbass of Lahiján, Zerzas of Ushnei, Shekáks, Hyderánli, Jeláli, and frontier tribes from Ararat to Sardasht, ...	250,000
Kurdistan Proper or Sinna-Ardelán, ...	120,000
Province of Kirmánsháhán, including tribes of Gurán, Kalhúr, Zengeneh, etc., ...	230,000
Kurds of Khorásán, at Bujnurd and Kúchán, and scattered communities in Irák, ...	150,000
Total of Persian Kurds, . . .	750,000

Attempts have been made to classify this Kurdish population as sedentary and nomad, and in connection with the classification to distinguish between tribal and non-tribal communities; but all such divisions are arbitrary and fallacious, and ought not to be admitted in a statistical account of the nation. No doubt the original Kurdish organization was tribal, and the prevailing habits of the tribes have always been nomadic and pastoral; but such habits are ever liable to be modified by local circumstances, and at the present day it is quite incorrect to suppose that the tribal Kurds are universally pastoral and migratory, while the non-tribal Kurds are sedentary and agricultural. In reality the distinction between living in villages as cultivators and living in tents as shepherds mainly depends on the localities where the tribes happen to be established. The Deyrsimlis, for instance, who inhabit the ranges of Dujik and Mezoor between the two arms of the Euphrates, and who number, according to Consul Taylor's estimate, above 200,000 souls, reside almost exclusively in villages, owing to the severity of their northern climate, while they follow agricultural and pastoral pursuits indifferently. But, on the other hand, the tribes to the south, who have easy access to the Mesopotamian plains, prefer a nomadic life, sheltering their flocks and herds in the warm pastures beyond the Tigris during the winter, and driving them up in the summer to feed on the rich herbage of the mountain sides; and the same rule may be held to apply generally throughout Kurdistan, the tribesmen, whose natural instincts lead them to migrate between summer and winter quarters, becoming sedentary only when obstacles, either political or geographical, are placed in the way of their movements. With regard also to the distinction that is sometimes drawn between tribal and non-tribal Kurds, the hypothesis being that the latter, who live in villages and cultivate the soil, are the descendants of the aboriginal peasantry, while the former, who live in tents and support themselves with their flocks, are conquering invaders, the explanation will certainly not hold good. There is in reality no ethnic distinction between the two classes. Tribal Kurds who settle in villages very soon lose their distinctive name, and mix with the peasantry of the neighborhood, while it constantly happens that a chief of village extraction, either by his individual character or through Government support, founds a new tribe and takes his place among the aristocracy of the nation. It may be added that in respect to the relative importance of the two classes the sedentary Kurds greatly outnumber the nomads, but that they are not so wealthy, nor so independent, nor do they stand nearly so high in popular estimation.

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[1] It is this range, and not the Jebel-Júdí, as is generally supposed, that represents the Nisir of the cuneiform inscriptions, where the ark is said to have rested in the Chaldæan account of the flood; and the same tradition is to be traced in the belief which universally prevailed in Babylonia almost to modern times, that the waters of the great deluge penetrated no farther to the eastward than the "peak of Holwán." See Sachau's *Bírúní*, p. 28.

Character.—The Kurds generally bear a very indifferent reputation, a worse reputation, perhaps, than they really deserve. Being aliens to the Turks in language and to the Persians in religion, they are everywhere treated with mistrust, and live as it were in a state of chronic warfare with the powers that be. Such a condition is not of course favorable to the development of the better qualities of human nature. The Kurds are thus wild and lawless; they are much given to brigandage; they oppress and frequently maltreat the Christian populations with whom they are brought in contact,—these populations being the Armenians in Diarbekir, Erzeroum, and Van, the Jacobites and Syrians in the Jebel-Túr, and the Nestorians and Chaldæans in the Hakkári country,—but they are not as a general rule either fanatical or cruel. In the Hakkári country, indeed, they live under ordinary circumstances in perfect amity with the Nestorians, from whom in outward appearance they are hardly distinguishable. It must be added, too, that they are naturally brave and hospitable, and in common with many other Asiatic races possess certain rude but strict feelings of honor. Perhaps the most distinguishing characteristic of the Kurdish chief is pride of ancestry. This feeling is in many cases exaggerated, for in reality the present tribal organization does not date from any great antiquity. In the list indeed of eighteen principal tribes of the nation, which was drawn up by the Arabian historian Massoudi, in the 10th century, only two or three names are to be recognized at the present day. A 14th century list, however, translated by Quatremère,[1] presents a great number of identical names, and there seems no reason to doubt that certain families both in Bohtán and Hakkári, which are extant at the present day, can really trace their descent from the Ommeyide caliphs, while the Babán chief of Sulimaníeh, representing the old Sohrans, and the Ardelán chief of Sinna,[2] who also represents an elder branch of the Gurúns, each claim an ancestry of at least five hundred years. There was up to a recent period no more picturesque or interesting scene to be witnessed in the East than the court of one of these great Kurdish chiefs, where, like another Saladin, the bey ruled in patriarchal state, surrounded by an hereditary nobility, regarded by his clansmen with reverence and affection, and attended by a bodyguard of young Kurdish warriors, clad in chain armor, with flaunting silken scarfs, and bearing javelin, lance, and sword as in the time of the crusades.

Language and Religion.—The present Kurdish language, which is called Kermánjí—a title difficult to explain—is an old Persian patois, intermixed to the north with Chaldæan words and to the south with a certain Turanian element, which may not improbably have come down from Babylonian times. Several peculiar dialects are spoken in secluded districts in the mountains, but the only varieties which, from their extensive use, require to be specified are the Zaza and the Gurán. The Zaza is spoken throughout the western portion of the Deyrsim country, and is said to be unintelligible to the Kermánjí-speaking Kurds. It is largely intermingled with Armenian, and may contain some trace of the old Cappadocian, but is no doubt of the same Aryan stock as the standard Kurdish. The Gurán dialect again, which is spoken throughout Ardelán and Kirmánsháhán[3] chiefly differs from the northern Kurdish in being entirely free from any Semitic intermixture. It is thus somewhat nearer to the Persian than the Kermánjí dialect, but is essentially the same language. It is a mistake to suppose that there is no Kurdish literature. Many of the popular Persian poets have been translated into Kurdish, and there are also books relating to the religious mysteries of the Ali-Olláhis in the hands of the Deyrsimlis to the north and of the Guráns of Kirmánsháhán to the south. European scholars too have been assiduous of late years in investigating the various Kurdish dialects. The New Testament in Kurdish was printed at Constantinople in 1857. The Rev. Samuel Rhea published a grammar and vocabulary of the Hakkári dialect in 1872. Lerch, Brugsch, Chodzko, Beresine, Blau, and many others have discussed different branches of the subject in the scientific magazines of the Continent; and quite recently (1879) there has appeared under the auspices of the Imperial Academy of St. Petersburg a French-Kurdish dictionary compiled originally by Mons. Jaba, many years Russian counsel at Erzeroum, but completed by Ferdinand Justi by the help of a rich assortment of Kurdish tales and ballads, collected by Messrs. Socin and Pryne in Assyria. Justi's preface to the dictionary gives a good account of the present state of Kurdish studies in Europe and Asia.

The religion of the Kurds also furnishes a very curious subject of inquiry. The great body of the nation, in Persia as well as in Turkey, are Sunnis of the Shafe'í sect, but in the recesses of the Deyrsim to the north and of Zagrus to the south there are large half-pagan communities, who are called indifferently Ali-Ollahi and Kizzil-básh, and who hold tenets of some obscurity, but of considerable interest. Outwardly professing to be Shí'ahs or "followers of Ali," they observe secret ceremonies and hold esoteric doctrines which have probably descended to them from very early ages, and of which the essential condition is that there must always be upon the earth a visible manifestation of the Deity. While paying reverence to the supposed incarnations of ancient days, to Moses, David, Christ, Ali and his tutor Salmán-el-Farsi, and several of the Shí'ah imams and saints, they have thus usually some recent local celebrity at whose shrine they worship and make vows; and there is, moreover, in every community of Ali-Ollahis some living personage, not necessarily ascetic, to whom, as representing the Godhead, the superstitious tribesmen pay almost idolatrous honors. Among the Gurâns of the south the shrine of Baba Yadgár, in a gorge of the hills above the old city of Holwán, is thus regarded with a supreme veneration, while in the family of a certain Syed who resides in the neighborhood the attributes of divinity are supposed to be hereditary. Similar institutions are also found in other parts of the mountains, which may be compared with the tenets of the Druses and Ansaris in Syria and the Ismaelis in Persia.

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[1] See *Notices et Extraits des MSS.*, vol. xiii. p. 305. Of the tribes enumerated in this work of the 14th century who still retain a leading place among the Kurds, the following names may be quoted:—*Gurániek* of Dartang, modern Guráns; *Zengeneh*, in Hamadan hills, now in Kirmánsháhán; *Hasnani* of Kerkuk and Arbil, now in the Deyrsim mountains, having originally come from Khorásán according to tradition; *Sohrieh* of Shekelabad and Tel-Haftún, modern Sohrán, from whom descend the Babán of Sulimanieh; *Zerzari* of Hinjarin mountains, modern Zerzas of Ushnei (cuneiform pillars of Kel-i-shin and Sidek noticed by author); *Julamerkieh*, modern Julamerik, said to be descended from the caliph Merwán-ibn-Hakam; *Hakkarieh*, Hakkári inhabiting *Zusan* of Arab geography; *Bokhtieh*, modern Bohtán. The *Rowadi*, to whom Saladin belonged, are probably modern Rewendi, as they held the fortress of Arbil. Some twenty other names are mentioned, but the orthography is so doubtful that it is useless to try to identify them.

[2] The *Sheref-nameh*, a history of the Kurds dating from the 16th century, tells us that "towards the close of the reign of the Jenghizians, a man named Baba Ardelán, a descendant of the governors of Diarbekir, and related to the famous Ahmed-ibn-Merwán, after remaining for some time among the Guráns, gained possession of the country of Shahrizor;" and the Ardelán family history, with the gradual extension of their power over Persian Kurdistan, is then traced down to the Saffavean period.

[3] The Gurán are mentioned in the *Mesalik-el-Absár* as the dominant tribe in Southern Kurdistan in the 14th century, occupying very much the same seats as at present, from the Hamadan frontier to Shahrizor. Their name probably signifies merely "the mountaineers," being derived from *gur* or *giri*, a "mountain," which is also found in Zagrus, *i. e.*, *za-giri*, "beyond the mountain," or *Pusht-i-koh*, as the name is translated in Persian. They are a fine, active, and hardy race, individually brave, and make excellent soldiers, though in appearance very inferior to the tribal Kurds of the northern districts. These latter indeed delight in gay colors, while the Guráns dress in the most homely costume, wearing coarse blue cotton vests, with felt caps and coats. The Guráns have for a long period abandoned nomadic habits, and are now almost universally congregated in villages and occupied with the cultivation of the soil, so that in a great part of Kurdistan the name Gurán has become synonymous with an agricultural peasantry, as opposed to the migratory shepherds.

Climate, Productions, Fauna, etc.—In a country like Kurdistan, which extends over five or six degrees of latitude, and ranges in altitude from 1500 to 15,000 feet above the sea, there is of course every variety of climate and produce. In the northern part of this region the hills are covered with pine forests, while the valleys abound with walnuts, sycamores, and planes, and all sorts of fruit trees, and in summer the hillsides and uplands are covered with a luxuriant herbage. The winters are here very rigorous, and the tribes, as far as they can, migrate at that season to the plains. In Central Kurdistan the pine forests cease and give way to dwarf oak and elms, the mastic, holly, etc., while further to the south large trees almost disappear, and a rough scrub takes their place. A succinct and graphic description of Turkish Kurdistan is given by Consul Taylor in his notes of travel published in the *Geographical Journal* for 1865.

"The modern Turkish province of Kurdistan," he says, "watered by an infinity of noble streams, with a salubrious climate and rich soil, yields to no other province in the empire for the variety and richness of its vegetable and animal produce, while its numerous mountain chains abound in mineral wealth. Among its natural vegetable productions, galls, gum-tragacanth, madder-roots, and the pistachio-nut, from which the natives extract a fine oil used in making soap, are the most important,—the annual value of the export of the former alone being upwards of £35,000. Oleaginous seeds and olive oil are produced in large quantities, and the quality of the former is so superior that it finds its way to many of the northern governments. Sheep's wool was exported in 1863 to the value of £70,000; and mohair, the produce of the Angorah goats, that thrive so wonderfully in the neighborhood of Jezireh, was eagerly sought after and bought up by native traders from Kaiseríeh and Constantinople in the same period tô the amount of £20,000.

"The manufacture of native cotton cloths, shallees made from mohair, and short woollen cloaks is actively pursued; and the shallee, for texture and variety of color and pattern, shows the extraordinary natural intelligence of the Kurdish workman. Diarbekir is famous itself for its silk piece-goods, similar to those of Aleppo and other parts of Syria, but, from its greater cheapness and durability, more in request among the poorer classes of the mountains between Diarbekir and the Black Sea. Sheep are exported in large quantities from the mountains and desert to Aleppo, Damascus, and Beyrout, and camels, purchased from the Arabs, to Kaiseríeh and other parts of Asia Minor. The uplands and hills abound in several species of polecat, martin, foxes, and wolves, whose furs add considerably in value to the sum total of the export list. A beautiful species of spotted lynx may be included among the former, although it is far more scarce than those enumerated. A rough estimate of the whole annual value of the animal and vegetable produce of the pashalic, whether consumed at home or exported (exclusive of food), will amount to more than £700,000 sterling."

This account is generally applicable to Central and Southern Kurdistan as well as to the pashalics of Diarbekir and Erzeroum, but it requires to be supplemented in some particulars. The rice and corn which are grown by the Kurds of the Tigris basin and the Persian plains form a very important staple of export, while the hill forests supply charcoal, wild silk, manna, and gum-mastic, in addition to the produce noticed in Consul Taylor's list, to a very large extent; and it may be further noted that along the whole range of mountains from Jezireh to Susa there is an outer ridge of low gypsum hills, which abounds throughout its whole extent with petroleum and naphtha springs. Mineral oils are not at present much appreciated by either Turks or Persians, but in the future of Kurdistan this important source of wealth cannot be left out of account.

With regard to the fauna of Kurdistan a few words must suffice. Neither lions nor tigers are ever found in the mountains, though the former frequent the banks of the Tigris and the latter are common in the Caspian forests. The wild animals of Kurdistan are the leopard and the lynx, the wild cat, bear, hyæna, wild boar, wolf, jackal, and fox, the *marûl* (or red deer), the roe and hog deer (and fallow deer and antelope on the skirts of the hills), the wild goat (or ibex), the wild sheep (or moufflon), together with badgers, hares, many varieties of the polecat or martin, and the ordinary smaller animals. Of game birds the most remarkable are the *Kebk-i-Derv* (or large partridge, first brought to the notice of naturalists by Consul Brandt), the gray and red-legged partridge, the *Tihoo*, quail, woodcock, and snipe, three varieties of bustard, the gray crane, and wild geese and ducks in abundance.

It has not been found possible to compute the amount of revenue which is raised from the Kurds. Consul Trotter remarks on this subject:

"The Turkish Kurds are found in almost every possible stage, from that of thorough subjection to the Government (as in many of the Diarbekir and Erzeroum villages, where they pay all the regular taxes and are also drawn for the conscription) up to the semi-independent Kurds of Bohtán, of Mudikán, and of the Deyrsim, who never pay taxes except at the rare intervals that the Government is able to occupy their country with a military force, and who have never hitherto, except on very rare occasions, supplied soldiers to the army either regular or irregular."

And, if this uncertain liability to taxation is true of the Kurds of Erzeroum and Diarbekir, it applies equally to the districts of Hakkári and Rowandiz, and to the great tribes such as the Herki, Hartúshi, and Hyderánli, who migrate between Persia and Turkey. In Sulimaníeh, on the other hand, as well as in the Persian provinces of Azerbijan, Ardelán, and Kirmánsháhán, the revenue derived from the Kurdish population is fixed, and may be estimated at £1 per house instead of the £1 6s. which is the usual Osmanli rate.

Antiquities.—Kurdistan abounds in antiquities of the most varied and interesting character. There is in the first place a series of rock-cut cuneiform inscriptions, extending from Malatíeh on the west to Myandáb (in Persia) on the east, and from the banks of the Arras on the north to Rowandiz on the south, which record the glories of a Turanian dynasty, who ruled the country of Nairi during the 8th and 7th centuries B.C., contemporaneously with the lower Assyrian empire. Intermingled with these are a few genuine Assyrian inscriptions of an earlier date; and in one instance, at Van, a later tablet of Xerxes brings the record down to the period of Grecian history. The most ancient monuments of this class, however, are to be found at Holwán and in the neighborhood, where the sculptures and inscriptions belong probably to the Guti and Luli tribes, and date from the early Babylonian period. Excavations at this spot or in the mounds along the course of the Diyáleh, which is the great river of Southern Kurdistan, or more especially at Yassin Tepeh, the site of the ancient city of Shahrizor, would probably lead to the discovery of relics cognate with those which have been found in the palaces of Nineveh and Babylon.

Information has also been recently received that a cemetery full of inscribed sepulchral urns has been laid bare by a landslip in the mountains between Sulimaníeh and Kirmánsháhán, and the description is calculated to arouse the liveliest interest, though until the spot has been visited by some European scholar no definite opinion can be given as to the character and antiquity of the remains.

In the northern Kurdish districts which represent the Arzanene, Intilene, Anzitene, Zabdicene, and Moxuene of the ancients there are also many interesting remains of Roman cities, well worth examining. Arzen, Miyafarikin (ancient Martyropolis), and Sisauronon have already been reported on by Consul Taylor, but there is still abundant room for research, and attention should be especially directed to the ruins of Dunisir near Dara, which Sachau the great Orientalist has recently identified with the Armenian capital of Tigranocerta, a city that has long been the despair of comparative geographers. Of the Macedonian and Parthian periods there are remains both sculptured and inscribed at several points in Kurdistan: at Bisitun, in a cave at Amadíeh, at the Mithraic temple of Kereftú, on the rocks at Sir Púl-i-Zohab near the ruins of Holwán, and probably in some other localities, such as the Bálik country between Lahiján and Koi-Sanják, which have never been visited by Europeans; but the most interesting site in all Kurdistán, perhaps in all Western Asia, is the ruined fire temple of Pái Kúlí on the southern frontier of Sulimaníeh, a spot that has been hurriedly visited by two or three European travellers, but never thoroughly examined. Among the debris of this temple, which are scattered over a bare hillside, are to be found above one hundred slabs, inscribed with Parthian and Pehlevi characters, the fragments of a wall which formerly supported the eastern face of the edifice, and bore a bilingual legend of great length, dating from the Sassanian period. Not more than half of the inscribed slabs have as yet been copied, time and labor being required to clear out the other slabs which lie imbedded in the earth on the slope of the hill down which they have rolled, and the locality, moreover, being one that cannot be easily examined or even visited, owing to its exposed position among the brigand tribes of the frontier, but it is to be earnestly hoped that when an opportunity does offer, every fragment of inscription may be recovered, so that it may be possible to reconstruct the entire legend, which, independent of its historical interest, is of special importance as the longest and latest specimen of the lapidary Pehlevi writing. There are also remarkable Sassanian remains in other parts of Kurdistan,—at Salmús to the north, and at Kirmánsháhán and Kasr-i-Shírín on the Turkish frontier to the south; and it is probable that an active search among the hills would discover many similar objects of interest. It may indeed be asserted that there is no region of the East at the present day which deserves a more careful scrutiny and promises a richer harvest to the antiquarian explorer than the lands inhabited by the Kurds from Erzeroum to Kirmánsháhán. Dr. Schultz in former times and Consul Taylor more recently have done much to illustrate Northern Kurdistan between Van and Diarbekir, but the inner mountains of Bohtán, Hakkári, Rowandiz, and the Bálik country are still almost a "terra incognita," and require careful examination.

History.—With regard to the origin of the Kurds, it was formerly considered sufficient to describe them as the descendants of the Carduchi, who opposed the retreat of the Ten Thousand through the mountains, but modern research ascends far beyond the period of the Greeks. We now find that at the dawn of history the mountains overhanging Assyria were held by a people named *Gútú*, a title which signified "a warrior," and which was rendered in Assyrian by the synonym of *Gardu* or *Kardu*, the precise term quoted by Strabo to explain the name of the Cardaces (Κάρδακες). These *Gútú* were a Turanian tribe of such power as to be placed in the early cuneiform records on an equality with the other nations of Western Asia, that is, with the Syrians and Hittites, the Susians, Elymæans, and Accadians of Babylonia; and during the whole period of the Assyrian empire they seem to have preserved a more or less independent political position. After the fall of Nineveh they coalesced with the Medes, and, in common with all the nations inhabiting the high plateaus of Asia Minor, Armenia, and Persia, became gradually Aryanized, owing to the immigration at this period of history of tribes in overwhelming numbers which, from whatever quarter they may have sprung, belonged certainly to the Aryan family.

The *Gútú* or Kúrdu were reduced to subjection by Cyrus before he descended upon Babylon, and furnished a contingent of fighting men to his successors, being thus mentioned under the names of Saspirians and Alarodians in the muster roll of the army of Xerxes which was preserved by Herodotus.

In later times they passed successively under the sway of the Macedonians, the Parthians, and Sassanians, being especially befriended, if we may judge from tradition as well as from the remains still existing in the country, by the Arsacian monarchs, who were probably of a cognate race. Gotarzes indeed, whose name may perhaps be translated "chief of the *Gútú*," was traditionally believed to be the founder of the Gurāns, the principal tribe of Southern Kurdistan,[1] and his name and titles are still preserved in a Greek inscription at Bisitun near the Kurdish capital of Kirmánsháhán. Under the caliphs of Baghdad the Kurds were always giving trouble in one quarter or another. In 224 A.D., and again in 293, there were formidable insurrections in Northern Kurdistan; and a third time, in 309, the Boide amír, Azad-ad-Dowleh, was obliged to lead the forces of the caliphate against the southern Kurds, capturing the famous fortress of Sermáj, of which the ruins are to be seen at the present day near Bisitun, and reducing the province of Shahrizor with its capital city now marked by the great mound of Yassin Teppeh. The most flourishing period of Kurdish power was probably during the 12th century of our era, when the great Saladin, who belonged to the Rewendi branch of the Hadabáni tribe, founded the Ayubite dynasty of Syria, and Kurdish chiefships were established, not only to the east and west of the Kurdistan mountains, but as far as Khorásán upon one side and Egypt and Yemen on the other. During the Mongol and Tartar domination of Western Asia the Kurds in the mountains remained for the most part passive, yielding a reluctant obedience to the provincial governors of the plains, and for the last three or four centuries they have been divided in their allegiance between the Turkish and Persian crowns. After Sultan Selim in 1514 had defeated the army of Shah Ismael, the founder of the Saffavean dynasty, he employed one of his generals, Sultan Hussein Beg of Amadíeh, to recover Shahrizor and its dependencies from Persia; and from that time to the present day the political status has not been materially disturbed. The frontier line indeed bisecting Kurdistan from north to south, which was agreed upon in 1047 A.H., between Sultan Murad IV. and Shah Saffi, after the recovery of Baghdad by the former sovereign, is substantially the same line that was adopted by the Russian and British commissioners who were employed in 1840–42 to mediate between the two Asiatic powers and delimit their respective territories. But in the meantime changes of some moment have occurred in the interior organization of Kurdistan. Both in Turkey and in Persia the independent power of the Kurds has been much curtailed. In Turkey the pashas of Kharpút, Erzeroum, and Diarbekir have been invested with larger powers of control, while the authority of the sultan has been further strengthened by the establishment of Turkish governors at Bayazíd, Van, Betlís, Amadíeh, and Sulimaníeh, in succession to the old hereditary Kurdish chiefs. With the tortuous policy, it is true, which is characteristic of the Osmánli race, the Porte has not unfrequently of late years encouraged the development of native strength in various parts of Kurdistan for a time and for certain special purposes; but, when the position of the local magnate has anywhere become one of political danger, the central Government has stepped in and without difficulty has reasserted its supreme authority.

In 1834, for instance, the famous Reshid Mohammed Pasha chastised the Kurds, who had everywhere broken loose from Siwas to Rowandiz, and adopted severe measures of repression, which are still remembered and dreaded. In 1843 again, Beder Khán Beg, who from his patrimonial government of Bohtán had extended his sway over the whole mountain range, and had sworn to exterminate the Nestorian Christians, was crushed immediately that the Porte put forth its strength against him; but the most notable instance of sudden Kurdish aggrandizement and collapse has occurred during the year 1881. Sheikh Obeidullah, chief of the small tribe of Oramar, who resided in a village of the mountains south of Lake Van, had acquired great local influence, owing to the sanctity of his family, but more especially from his own ascetic habits and his personal character. He seems to have really entertained the idea at one time of establishing an independent Kurdish kingdom, concentrating under his own individual authority all the scattered remnants of his race both in Persia and in Turkey. At any rate, having collected a very considerable force of Kurds in the summer of 1880, he suddenly burst in upon the plains of Persia and ravaged Azerbiján to the south of Lake Urumíeh, sweeping the country up to the walls of Maragha on one side of the lake and of Urumíeh upon the other. Having been joined by the Zerzas, the Mikris, the Bilbass, and all the tribes of the Persian frontier, it is considered certain that he might have marched on and pillaged Tabriz had he taken full advantage of the panic which followed on the first invasion; but, he having faltered and thus given time for the arrival of Persian reinforcements, the movement, which was at one time most serious, collapsed, and he retired to the mountains. Now the Turkish Government had unquestionably in the first instance encouraged Sheikh Obeidullah's increasing power and aspirations, not with a view of hostility to Persia, but in the hope that the establishment of a fanatical and great independent Kurdish principality about Lake Van would paralyze any movement of the Armenian nation towards the recovery of its liberty. The Porte indeed in all probability still cherishes the idea of thus controlling the action of its Christian subjects, though it has been compelled by the pressure of the European powers, and under the threat of reprisals from Persia, to arrest Sheikh Obeidullah and keep him under surveillance at Constantinople, while measures have been taken to prevent any immediate renewal of disturbances on the frontier.

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[1] "The Kalhúr tribes are traditionally descended from Gudarz-ibn-Gio, whose son Roham was sent by Bahman Keiáni to destroy Jerusalem and bring the Jews into captivity. This Roham is the individual usually called Bokht-i-nasser (Nebuchadnezzar), and he ultimately succeeded to the throne. The neighboring country has ever since remained in the hands of his descendants, who are called Gurāns" (*Sheref-Nameh*, Persian MS.). The same popular tradition still exists in the country, and ΓΩΤΑΡΖΗΟ ΓΕΟΠΟΘΡΟΣ is found on the rock at Bisitun, showing that Gudarz-ibn-Gio was really an historic personage. See *Journ. Roy. Geog. Soc.*, vol. ix. p. 114.

The policy of the Persian Government towards its Kurdish subjects has been not very dissimilar to the Turkish programme. Aware of the military efficiency of the tribes, the Persian crown as long ago as the time of Nadir Shah transferred a large colony of Shadillú and Zafferanlú Kurds to the Khorásán frontier, where, enjoying the rich lands of Bújnúrd and Kuchán, and strengthened by a line of fortresses, they have ever since been engaged in unceasing conflict with the Turkomans of the Attock, and from whence they afforded invaluable assistance, both in carriage and supplies, to the Russian columns in their late advance into the country of the Akhals. Persia has also raised several regiments of regular infantry from the Kurdish Shekáks of the north, as well as from the Guráns and Kalhúrs of the south, while the shah has also placed Persian governors over the Kurdish districts south of Lake Urumíeh, and has appointed princes of the blood to administer the more distant and unruly Kurdish provinces of Ardelán and Kirmanshábán. At present perhaps the only communities among whom a spirit of Kurdish nationality may be said to flourish free from the taint, be it for good or be it for bad, of foreign influence, are the Deyrsimlis of the Upper Euphrates and the Hakkáris of Central Kurdistan. (H. C. R.)

KURGAN, a district town of Western Siberia, in the government of Tobolsk, 352 miles south-southwest of the capital of the province, on the left bank of the Tobol river. It has its name from a lofty tumulus (*kurgan*), close by which a wooden fort was erected in the 17th century. It is situated in a wide steppe, covered with numerous lakes, the inhabitants of which are active in agriculture, cattle-breeding, and cattle-grazing, cattle being purchased in the Kirghiz steppe. It is now the chief centre of the region for trade in cattle, tallow, skins, and salt. Population, 6500.

KURILE ISLANDS, a chain of islands to the northeast of Asia, extending for about 795 miles from the southern extremity of the peninsula of Kamchatka to the northern extremity of Yezo, and forming the boundary between the Sea of Okhotsk and the outer ocean. Till 1875 the Little or Northern Kuriles belonged to Russia, and the Great or Southern Kuriles to Japan, but by the treaty of that date they were all recognized as Japanese. The principal islands, beginning at the north, are Shumshu (226 square miles), Paramushir (1135), Onekotan (244), Kharimkotan, Si Musir (161), Matua, Urup (563), Iturup (2656), and Kunashir. Like the peninsula of Kamchatka, the whole chain is of volcanic origin, and several of the islands—Yekarma, Musir, Raikoke, Matua, Iturup—are still centres of volcanic activity. Mr. Milne, who cruised among the islands in 1878, counted fifty-two well-defined volcanic peaks, and at least seventeen are known to give off steam. The peak of the island of Alaid, estimated to have an altitude of at least 12,000 feet, had two great eruptions in 1770 and 1793. None of the other eminences exceed 5000 feet in height. As the slopes are for the most part exceedingly regular, the production of the volcanoes must be assigned to a comparatively recent period; and the absence of stratification seems to indicate a continuity of action. The forces at work must have been enormous if, as appears probable, the chain was built up from the bed of the sea. To the east of the islands the "Challenger" expedition found a depth of 27,930 feet. The flora of the Kuriles is poor, especially towards the north; in the southern islands it is similar to that of Yezo. In Kunashir, Urup, and Iturup there are well-wooded portions. Sea-otters, wolves, and foxes are among the wild animals hunted for their skins. Many of the islands are altogether uninhabited, and none have more than the scantiest population. In 1868–70 Knipping estimated the total at from 200 to 300 persons, and since the treaty of 1875 a large number have removed to Saghalien and other parts of Russian territory. Ethnographically the people of the Kuriles are in the main identical with the Ainos of Yezo, those of the northern islands showing the influence of intercourse with Kamchatka. They are quiet, timorous, and well-behaved, do not practise polygamy, and carefully avoid intermarriage between blood relations. The poorer people burn their dead, the wealthier embalm them. Once a year in autumn they hold a great feast. Of a supreme deity they have some indistinct idea, but they sacrifice to the sun, the moon, and the sea, and worship the bear.

The Kurile Islands were discovered in 1634 by the Dutch navigator De Vrees. The Russians first learned about them from Japanese traders who visited Kamchatka in 1711; in the following year two Cossacks, Antsuiphoroff and Kozuirevskii, crossed over to Shumshu; and in 1766–67 a voyage was made among the islands to collect a fur tax. In 1795 a factory of the Russian American Company was established on Urup. Captain Golovnin was taken prisoner by the Japanese on Kunashir in 1811.

See Krasheninikoff, *Kamtchatka*, Gloucester, 1764; the *Voyages* of Krusenstern and Lapérouse; and Milne's paper in *Geol. Mag.*, 1880.

KURRACHEE, or KARÁCHI, a district in Sind, India, lying between 23° 34′ and 26° 57′ N. lat., and between 66° 41′ 30″ and 68° 49′ E. long., bounded on the N. by Shikárpur, on the E. by the Indus river and Hyderabad district, on the S. by the sea, and on the W. by Baluchistán. The area is 14,091 square miles; and the population in 1872 was 426,722. The district consists of an immense tract of land stretching from the mouth of the Indus to the Baluchi boundary. It differs in general appearance from the rest of Sind, having a rugged, mountainous tract along its western border. The country gradually slopes away to the southeast, till in the extreme south the Indus delta presents a broad expanse of low, flat, and unpicturesque alluvium. Besides the Indus and its mouths, the only river in the district is the Habb, forming the boundary between Sind and Baluchistán. The Manchhar Lake in Sehwán subdivision forms the only considerable sheet of water in Sind. The hot springs at Pír Mangho are 6 or 7 miles north of Kurrachee town.

In 1872 the population was 426,722 (males 242,516, and females 184,206)—the Hindus numbering 73,304, and the Mohammedans 348,586. Eight towns had a population exceeding 2000:—Kurrachee, 56,753; Kotri, 7949; Sehwán, 4296; Bubak, 5703; Dadu, 3357; Tatta, 7951; Mírpur Batoro, 2846; and Keti-Bandar, 2199.

In Kurrachee subdivision cultivation exists only on a few isolated spots, and depends upon wells, springs, or natural rainfall. Here the chief crops are *joár*, *bájra*, barley, and sugar-cane. In Jerruck and Sháh-bandar, where numerous canals carry the waters of the Indus through the alluvial flats, rice forms the staple crop; but wheat, sugar-cane, millets, cotton, and tobacco are also grown. In the barren hills of Kohistán, agriculture is practically unknown; and the nomad population devotes itself almost entirely to grazing cattle in the southern plains. The district trade is centred in Kurrachee town, the staple exports consisting of cotton, wool, and grain. Extensive salt deposits of the purest description occur on the Sirganda creek, a branch of the Indus. Sea fisheries form an important industry. The pearl oyster is found at several places along the coast, but the pearls are of inferior size and quality. The Indus valley line of the Sind, Punjab, and Delhi Railway runs from Kurrachee to Kotri within the district a distance of 106 miles. The administration is conducted by a collector-magistrate, assisted by several deputies. The total imperial revenue in 1873–74 amounted to £139,079, exclusive of £52,222 derived from the canals. Education in 1873–74 was afforded by forty-nine schools, attended by 3167 pupils. Kurrachee town and neighborhood, being open to the sea-breeze, are said to possess the healthiest climate in Sind. Fevers prevail at the setting in of the cold season, and in the hot weather external inflammations ulcers, and skin diseases are very troublesome. Cholera occasionally appears in an epidemic form. The rainfall is slight and fluctuating, the average hardly exceeding 5 inches per annum.

Kurrachee, or **Karáchi**, the chief town of Sind, India, and a large seaport, situated at the extreme northern end of the Indus delta, in 24° 51′ N. lat. and 67° 4′ E. long. The city is almost entirely a creation of British rule, its extensive commerce, splendid harbor works, and numerous flourishing institutions having all sprung up since the introduction of settled institutions; and the architecture of the town is essentially modern and Anglo-Indian. Before 1725 no town whatever appears to have existed on its site; but about that time some little trade began to centre upon the convenient harbor, and the silting up of Sháhbandar, the ancient port of Sind, shortly afterwards drove much of its former trade and population to the rising village. Under the Kalhora princes, the khán of Khelát obtained a grant of the town, but in 1795 it was captured by the Talpur Mírs, who built the fort at Manora, at the entrance to the harbor. They also made considerable efforts to increase the trade of the port, and at the time of the British acquisition of the province the town and suburbs contained a population of 14,000.

The census of 1872 returned the inhabitants of Kurrachee, including the cantonment, at 56,753, viz., Mohammedans, 29,156; Hindus, 23,404; Christians, 3397, and "others," 796. The municipal revenue of the town in 1874 amounted to £22,596, and the expenditure to £20,142. Trade has immensely developed of late years. In 1843–44 the total value of the trade was returned at £122,160, that of the exports being only £1010. In 1873–74 the value of the trade amounted to £3,507,684, viz., imports, £1,481,765, and exports £2,025,919. Up to 1851 only one English sailing ship had entered Kurrachee harbor, steamers and large vessels having to anchor outside and discharge by lighters. In 1853 the construction of the Napier Mole or causeway, 3 miles long, connecting the town with Kiamári island, and the subsequent extensive harbor improvements carried out between 1869 and 1873, at a cost of £450,000, have enabled vessels of any size to enter the harbor. In 1847–48 the number of vessels which entered the harbor was 891, all native craft, of a total burden of 30,509 tons. In 1873–74 the vessels visiting the harbor numbered 913, of a total burden of 161,284 tons.

KURSK, a government of European Russia conterminous with those of Tchernigoff, Orel, Voronezh, Poltava, and Kharkoff, and estimated to have an area of 17,417 square miles. The surface is irregular and even hilly, but the highest point (near the town of Tim) does not exceed 1016 feet of absolute elevation. Cretaceous and Eocene rocks prevail, and chalk, ironstone, mill-stones, potter's clay, and tripoli are among the economic minerals. The rich black earth of the government makes it one of the best agricultural districts of the country. No fewer than four hundred streams are counted within its borders, but none of them are of any service as waterways. To the Dnieper system belong the Seim, the Vorskla, the Psel, and the Tuskor; to the Don the Northern Donets and its tributaries. Besides oats, which form the staple crop, wheat, rye, potatoes, and buckwheat are largely grown. Beeswax is sent in considerable quantities to Moscow. Horse, cattle, and sheep breeding is on the decline. The manufacturing industries—wool dressing, distillation, tanning, linen-weaving—are gaining ground. Wool-spinning and the making of woollen sashes are so generally carried on by the peasant women as to be a matter of commercial importance.

The government is divided into fifteen districts—Kursk, Byelgorod, Graivoron, Dmitrieff, Korotcha, Lgoff, Novuii, Oskol, Oboyan, Putivl, Ruilsk, Staruii Oskol, Sudzha, Tim, Phatezh, Shtchigrui. The places with more than 5000 inhabitants are Kursk, Borisovka (30,000), Sudzha (with suburbs, 18,000), Byelgorod (16,097), Miropole (10,754), Kholka Mikhaielovka (10,000), Ruilsk (9445), Staruii Oskol (7091), Putivl (7046), Oboyan (6322), Korotcha, and Phatezh. The population of the government was 1,954,807 in 1870, chiefly Great Russians, but considerably modified by the Little Russian element. About 17 miles from the chief town, in a thickly-peopled district, is the site of the Korennaya fair, formerly the greatest of those in South Russia, and still with an annual trade valued at £900,000. It takes its name from an image of the Virgin found at the root (*koren*) of a tree, and yearly carried in solemn procession from Kursk to the spot of its discovery. The Kursk district contains more than sixty old town sites; and barrows (*kurgans*) are extremely abundant. Of the latter many have been destroyed to furnish manure for the soil, but not a few have been examined by such investigators as Professor Zamokvasoff (see the publications of the Statistical Committee of Kursk).

Kursk, the chief town of the above government, is situated 333 miles south of Moscow, at the confluence of the Kur with the Tuskor, and forms the meeting-place of the railways from Moscow, Kieff, and Kharkoff. The inhabitants number more than 30,000, or including the suburbs 45,000. Orchards and nursery gardens are among their chief means of subsistence, and gardeners from Kursk are numerous in the neighboring governments. The leather works are the most extensive of the industrial establishments. Though many of the public buildings of the town are constructed on a large scale, it is enough to mention the cathedral of the Resurrection, dating from 1733, the cathedral of St. Sergius (1762), and the Bogoroditskii monastery.

Kursk was already in existence in 1032. The defence of the town from an incursion of the Polovtsi is celebrated in *The Triumph of Igor*, an epic which forms one of the most valuable relics of early Russian literature. Down to the close of the 18th century the citadel, defended by the two rivers and a ditch, was a place of considerable strength; the remains are now comparatively few. The rank of government town was bestowed on Kursk in 1779.

KUSTENDJE, or **Küstendjie**, a seaport of Roumania on the coast of the Black Sea, 140 miles east of Bucharest, the terminus of the railway from Tchernavoda on the Danube, and the principal outlet for the produce of the Dobrudja. The harbor is well defended from the north winds, but those from the south, southeast, and southwest prove sometimes highly dangerous. Of the exports (valued at £217,828 in 1880) the chief are cereals, wool, skins, and cattle. Since the incorporation of the Dobrudja with Roumania in 1878 Kustendje gives its name to a province.

Kustendje is the Constantiana which was founded in honor of Constantia, sister of Constantine the Great. It lies at the seaward end of the Great Wall of Trajan, and has evidently been surrounded by fortifications of its own. In spite of damage done by railway contractors (see Henry C. Barkley, *Between the Danube and the Black Sea*, 1876) there are considerable remains of ancient masonry—walls, pillars, etc. A number of inscriptions have been found in the town and its vicinity which show that Tomi, the place of Ovid's banishment, must have been only a little way off.

In regard to the Kustendje inscriptions in general, see Allard, *La Bulgarie Orientale*, Paris, 1866; Desjardins in *Ann. dell' istit. di corr. arch.*, 1868; *Corpus inscript. lat.*, vol. iii.; and a paper on Weickum's collection in *Sitzungsbericht* of the Munich Academy, 1875.

KÜSTRIN, or **Cüstrin**, a town and fortress of the first rank in the circle of Königsberg-in-der-Neumark, in the government district of Frankfort, Prussia, is situated at the confluence of the Oder and Warthe, about 51 miles northeast of Berlin by rail. It consists of the town proper within the strong fortifications, a suburb on the left bank of the Oder, and one on the right bank of the Warthe. There are bridges over both rivers. Küstrin carries on several minor manufactures, and there is some shipping in the rivers. The population in 1875 (including the garrison) was 11,227.

About 1250 a town was erected on the site of Küstrin, where a fishing village originally stood. From 1535 till 1571 it was the residence of the margrave of Brandenburg-

Küstrin, who died without heirs. Küstrin was the prison of Frederick the Great when crown-prince, and the scene of the execution of his friend Katte.

KUTAIAH, **Kutaya**, or **Kiutahia**, the chief town of a sandjak in the vilayet of Khudavendikiar, Asia Minor, is situated on the Pursak, an affluent of the Sakaria, the ancient Sangarius. The town lies at an important point of the great road across Asia Minor from Constantinople to Aleppo. It has a busy trade, and a population variously estimated at from 40,000 to 60,000. Kutaiah has been identified with Cotiæum.

KUTAIS, a town of the Caucasus, Russia, capital of the province of same name, 60 miles east from Poti, and 4 miles from the Rion station of the railway between Poti and Tiflis. It is one of the oldest towns of the Caucasus; Procopius mentions it under the name of Kotatision. Persians, Mongolians, Turks, and Russians have again and again destroyed the town and its fortress. In 1810 it became Russian. It is situated now on both banks of the Rion river, which is spanned by an iron bridge. Its most remarkable building is the ruined cathedral, erected in the 11th century by the Bagratides, which is the most important representative of Georgian architecture. The fort Uhimerion, mentioned by Procopius, is now but a heap of ruins. During recent years Kutais has acquired some importance, and its population is rapidly increasing; it is now 12,000. The inhabitants make hats and silks, and trade in agricultural produce and wine. On the right bank of the Rion is a Government model garden, with a model farm for promoting the improvement of gardening, for which the warm and moist district of Imeritia is well adapted.

KUTTENBERG (in Czech, *Kutná Hora*), chief town of an official district in Central Bohemia, Austria, is situated on a small stream in a fertile region, about 180 miles northwest of Vienna by rail. It consists of the town and four suburbs, and among its buildings rich in historical and architectural interest are the Gothic five-naved church of St. Barbara, begun in 1368 and not yet finished, several other churches, the Wälscher Hof, formerly a royal residence and mint, the seminary, formerly a bishop's seat, and the Gothic town-house. The manufactures include starch, rapeseed oil, beer, sugar, brandy, and liqueurs; and there are various mills, and calico-printing and wool-spinning establishments. The mines in the neighborhood, discovered in 1237, used formerly to yield silver; now they give only copper and lead. The population in 1870 was 12,747.

KUTY, a municipal town in the Austrian province of Galicia, lies 20 miles southeast of Kolomea, and on the left bank of the Czeremosz, which here forms the boundary between Galicia and Bukowina, in 48° 16′ N. lat., 25° 10′ E. long. The trade, especially in prepared leather, is chiefly with Hungary and the northern or Moldavian portion of Roumania. The neighborhood of Kuty is picturesque and mountainous, and has productive salt springs. Population 8579, mostly of Armenian, Ruthenian, Polish, and Jewish extraction. Kuty formerly belonged to the old province of Ruthenia, in the kingdom of Poland.

KUZNETSK, a district town of Russia, in the government of Samara, situated on the railway between Samara and Penza, 158 miles west of the former. In the 18th century it was but a village peopled by smiths (whence its name), and it is through this trade that it has acquired its importance. The majority of its 15,000 inhabitants are engaged in the manufacture of agricultural implements, exported to a large amount, whilst others are employed in tanneries,—the black sheepskins of Kuznetsk being widely renowned in Russia,—and in the manufacture of leather and wooden wares, which last are largely exported to the southern steppe provinces and to the Caucasus.

KYOUK-HPYÚ, a district in British Burmah, lying between 18° 55′ and 19° 22′ N. lat., and 93° 25′ and 94° E. long. It consists of, first, a strip of mainland along the Bay of Bengal, extending from the An Pass, across the main range, to the Ma-í river, and, secondly, the large islands of Ramri and Man-oung, with many others to the south, lying off the coast of Sandoway. The mainland in the north and east is highly mountainous and forest-clad, and the lower portion is cut up into numerous islands by a network of tidal creeks. Between the mainland and Ramri lies a group of islands separated by deep, narrow, salt-water inlets, forming the northeastern shore of Kyouk-hpyú harbor, which extends for nearly 30 miles along Ramri in a southeasterly direction, and has an average breadth of 3 miles. The principal mountains are the Arakan Yomas, which send out spurs and sub-spurs almost to the sea-coast. The An Pass, an important trade route, rises to a height of 4664 feet above sea-level. The Dha-let and the An are navigable by large boats 25 and 45 miles respectively. Above these distances they are mere mountain torrents. Large forests of valuable timber cover an area of about 650 square miles. Kyouk-hpyú contains numerous "mud volcanoes," from which marsh gas is frequently discharged, with occasional issues of flame. The largest of these is situated in the centre of Cheduba Island. Earth-oil wells exist in several places in the district. The oil when brought to the surface has the appearance of a whitish-blue water, which gives out brilliant straw-colored rays, and emits a strong pungent odor. Limestone, iron, and coal are also found.

In 1872 the population was 144,177 (males 73,056 and females 71,121):—Buddhists, 129,702; Mohammedans, 3920; Hindus, 185; Christians, 47; "others," 10,323. The largest town is Ramrí, with a population in 1877 of 4028. Kjouk-hpyú, the headquarters, situated on Ramrí Island, has 2620. Out of a total area of 4309 square miles, no less than 3740 are returned as absolutely uncultivable, and in 1876–77 only 165 square miles were under tillage. The principal crops are rice, sugar-cane, *dhaní*, and tobacco. The manufactures consist of silk and cotton cloth, indigo, salt, pottery, coarse sugar, and sesamum oil. The total imperial and provincial revenue in 1876–77 was £43,454, besides a local revenue derived from port and municipal funds, etc.

L.

L REPRESENTS probably the same sound in all alphabets. That sound used to be called a "liquid," in which class *m*, *n*, and *r* were included. This arrangement was unsatisfactory, so far as *m* and *n* are concerned, for they have nothing common in their formation with the others. But *r* and *l* are very closely akin. They are both dentals—or more accurately front palatals—produced by raising the point of the tongue to the front part of the palate, immediately behind the gums. They differ in this: for *r* a small aperture is left over the tip of the tongue by which the air escapes; but for *l* the tongue reaches the top of the palate, but does not rest (as for *r*) against the sides of the mouth, and the voice escapes laterally by these side apertures. The slightness of the difference in the positions of the mouth for these two sounds explains their exchangeableness. Perhaps the most remarkable variation of the *l* sound is that which is heard in Welsh and denoted by *ll*, in such words as Llanberis, Llangollen, etc. An Englishman commonly sounds this as *thl*, which is certainly not right. But the best authorities on phonetics are not agreed as to the precise nature of the sound. Mr. Ellis thinks that it is produced by laying the left side of the tongue against the whole of the palate, and then forcibly ejecting the breath along the right side. But he admits that the sound thus produced differs very little from a voiceless or surd *l* (the common *l* is sonant), which stands therefore to *l* in the same relation as *f* does to *v*, or *wh* (really *hw*) to *w*. A simpler modification of the *l* sound is that heard in the Italian "gli" or in the Spanish "llano;" it is formed by raising the middle part of the tongue to the roof of the mouth, not the point against the front part of the palate, as for the ordinary *l*.

The peculiar nature of the *l* sound renders it apt to fall out before consonants with which it is inconsistent; this is specially seen in French plurals, such as "chevaux" from "cheval." It is also common but sporadic, in English; *e. g.*, in "walk," "talk," "palm," "alms," "half," "would," etc. As is frequently the case with such vanishing sounds, it has sometimes intruded through false analogy in words with which it has nothing to do, *e. g.*, in "could" (Old English "coude"), and rather strangely in some words of Latin origin, *e. g.*, participle, principle. The form of the letter L has varied slightly, but has always consisted of two straight lines at an angle. In Greek the form was generally Λ; and this has been preserved in the Cyrillic and Russian alphabets. But in the western Greek alphabet the form was generally ∠; and this appears in old Roman inscriptions, passing by degrees into the right angle with which we are familiar.

LA BADIE, LABADISTS (1610–1674). Jean de la Badie, a noted Pietist leader in the 17th century, was the son of Jean Charles de la Badie, governor of Guyenne; he was born in the town of Bourg not far from Bordeaux, on the 13th of February, 1610, and died in Altona, on the 13th of February, 1674. He was sent along with two brothers to the Jesuit school at Bordeaux, where his talents attracted the attention of his teachers, and they secured him for their order against the wishes of his parents. In 1626 he began to study philosophy and theology, and in due time made his profession. From a study of the Bible, of Augustine, Bernard, and the mystics, he was led to hold somewhat extreme views about the efficacy of prayer and the direct influence of the Holy Spirit upon believers, and adopted Augustinian views about grace, free will, and predestination, which brought him into collision with his order. The result was that he resigned and was separated from the Jesuits on the plea of ill health. He then became a preacher to the people, and was encouraged by his bishop to devote himself to this work. The study of Calvin's *Institutes*, however, taught him that he had more in common with the Reformed than with the Roman Catholic Church, and after various adventures he joined the Reformed Church of France at Montauban in 1650. His fame had preceded him, and his accession to the ranks of the Protestants was deemed a great triumph; no such man since Calvin himself, it was said, had left the Roman Catholic Church. He was called to the pastorate of the church at Orange on the Rhone, and at once became noted for the severity of the discipline he exercised. He set his face zealously against dancing, card-playing, and worldly entertainments. The unsettled state of the country, recently annexed to France, compelled him to leave Orange. He accepted a call to the French church in London, but did not stay there long; and after various wanderings he at length settled at Middleburg, where he was called to be pastor to the French-speaking congregation. His peculiar opinions were by this time (1666) well known, and his congregation and himself at once found themselves in conflict with the ecclesiastical authorities. Various "classes" and synods met and discussed the "seditious sermons and new and erroneous doctrine which De la Badie had preached in various of our churches before he had been inducted at Middleburg," and the result was the establishment of a separate church by De la Badie and his followers. He had gathered round him some enthusiastic disciples, Peter Yvon at Montauban, Peter Dulignon, Francis Menuret, and, more important than any, Anna Maria v. Schürman, whose book *Eucleria* is perhaps the best exposition of the tenets of her master. At Middelburg, at the head of his separatist congregation, De la Badie developed his views for a reformation of the Reformed Churches: the church is a communion of holy people who have been born again from sin; baptism is the sign and seal of this regeneration, and is to be administered only to believers; the Holy Spirit guides the regenerate into all truth, and the church possesses throughout all time those gifts of prophecy which it had in the ancient days; the community at Jerusalem is the continual type of every Christian congregation, therefore there should be a community of goods; the disciples should live together, eat together, dance together; marriage is a holy ordinance between two believers, and the children of the regenerate are born without original sin; marriage with an unregenerate person is not binding. The life and separatism of the community brought them into frequent collision with their neighbors and with the magistrates of Middelburg, and in 1670 they accepted the invitation of the princess Elizabeth, abbess of Herford in Westphalia, to take up their abode within her territories, and settled down in Herford to the number of about fifty. Not finding the rest they expected, however, they migrated to Altona in 1672, where they were dispersed on the death of the leaders. Small communities also existed in the Rhineland, and a missionary settlement was established in New York.

See H. van Berkum, *De Labadie en de Labadisten*, Sneek, 1851; Goebel, *Gesch. d. Christl. Lebens in der rheinisch-westphälischen Kirche*, Coblentz, 1852; Heppe, *Geschichte des Pietismus*, Leyden, 1879; Ritschl, *Geschichte des Pietismus*, vol. i., Bonn, 1880; and especially Peter Yvon, *Abrégé précis de la vie et de la conduite et des vrais sentiments de feu M. de Labadie*, and Anna Maria v. Schürman, *Eucleria*, Altona, 1673, 1678.

LABARUM, the sacred military standard of the early Christian Roman emperors, was first adopted by Constantine the Great after his miraculous vision in 312, although, according to Gibbon, he did not exhibit it to the army till 323. The name seems to have been known before, and the banner itself was simply a Christianized form of the Roman cavalry standard. Eusebius (*Life of Const.*, i. 31) describes the first labarum minutely as consisting of a long gilded spear, crossed at the top by a bar from which hung a square purple cloth, richly jewelled. At the upper extremity of the spear was fixed a golden wreath encircling the sacred monogram, formed of the first two letters of the name of Christ. In later banners the monogram was sometimes embroidered on the cloth. A special guard of fifty soldiers was appointed to protect the sacred standard. The derivation of the word labarum is disputed; modern scholarship inclines to recognize its etymon in the Basque *labarva*, signifying standard. An illustration of a labarum is given under the heading FLAG (vol. ix. p. 243, fig. 5, A).

LABEO, MARCUS ANTISTIUS (*cir.* 50 B.C.–18 A.D.), was the son of Pacuvius Antistius Labeo, a jurist of minor note, who caused himself to be slain after the defeat of his party at Philippi. A member of the plebeian nobility, and in easy circumstances, the younger Labeo entered early upon public life, and soon rose to the prætorship; but his undisguised antipathy to the new régime, and the somewhat brusque manner in which in the senate he occasionally gave expression to his republican sympathies—what Tacitus (*Ann.* iii. 75) calls his *incorrupta libertas*—proved an obstacle to his advancement, and his rival, Ateius Capito, who had unreservedly given in his adhesion to the ruling powers, was unfairly promoted by Augustus to the consulate, when, in ordinary course, the appointment should have fallen to Labeo; the result was that, smarting under the wrong that was done him, he declined to accept the office when it was offered to him in a subsequent year (Tac., *Ann.* iii. 75; Pompon. in fr. 47, *Dig.* i. 2). From this time he seems to have abandoned politics, and devoted his whole time to jurisprudence, with which his name is much more prominently connected. His training in the science had been derived principally from Trebatius Testa, although he had also diligently attended the public audiences of most of the more eminent lawyers of the later years of the republic. To a profound knowledge of the law as he had received it from them he added a wide general culture, devoting his attention specially to dialectics, philology (*grammatica*), and antiquities, as valuable aids in the exposition, expansion and application of legal doctrine (Gell., xiii. 10). Capito, in a letter preserved by Gellius (xiii. 12), says of him "nihil haberet nisi quod justum sanctumque esse in Romanis antiquitatibus legisset;" and this has sometimes been thought irreconcilable with the statement of Pomponius (fr. 47, *Dig.* i. 2) that in law he was an innovator. But the observations of Capito refer to what he calls Labeo's absurd craze for freedom—his horror of anything out of the old current of constitutional practice (which had led him, as Capito relates, into the ridiculous extreme of indignantly resenting, as unauthorized, the courtesy of a tribune who had ordered an officer simply to summon him to answer to a complaint, instead of apprehending him). In his jurisprudential teaching and advising there was none of this dogged indisposition to deviate from the paths of his predecessors. It was the characteristic of his rival Capito to stand as much as possible within the old lines,—"in his, quæ ei tradita fuerunt, perseverabat" (Pomp. in fr. 47, *Dig.* i. 2); that of Labeo was, with the aid of his dialectics, philology, and antiquities, to dissect a received doctrine so as to reach its innermost *ratio*, and from this to start afresh, and give the doctrine a more accurate expression and a variety of new developments. His success in this new method is attested by the position he took among his contemporaries, and the reputation in which he was held by his successors. Down to the time of Hadrian his was probably the name of greatest authority; and the fact that several of his works were abridged and annotated by later hands testifies to the estimation in which they were held by practitioners. While Capito is hardly ever referred to, the dicta of Labeo are of constant recurrence in the writings of the classical jurists, such as Gaius, Ulpian, and Paul; and no inconsiderable number of them were thought worthy of preservation in Justinian's *Digest.* Labeo gets the credit of being the founder of the Proculian sect or school, while Capito is spoken of as the founder of the rival Sabinian one (Pomponius in fr. 47, *Dig.* i. 2). It is doubtful whether this statement is quite accurate. Labeo certainly taught in some way or other; for it is recorded of him that he devoted six months of the year to giving professional advice and instructing his pupils in Rome, while the other six he spent in literary work at his country seat. But the lecturing *stationes* of which Gellius speaks (xiii. 13) had not by that time been established, and it is probable that the real founders of the two *scholæ* were Proculus and Sabinus, followers respectively of the methods of Labeo and Capito. Such conjunctions (in reference to peculiar doctrines of the schools), as "Proculus et Pegasus," "Sabinus et Cassius," are very frequent; but the name of Labeo or Capito in conjunction with another is of the rarest occurrence. There is not a single case in the texts in which the latter is credited with the introduction of a doctrine of the Sabinians, and only one or two in which Labeo is spoken of as the author of a doctrine of the other school.

Labeo's most important literary work was the *Libri Posteriorum*, so called because published only after his death. So far as can be judged, they contained a systematic exposition of the common law in at least forty books, after the order of the commentaries of Q. Mucius Scævola. They seem to have been epitomized by Javolenus, who was a leader of the Sabinian school; and numerous excerpts from them, some from the original, others from the epitome, are preserved in Justinian's *Digest*. His *Libri ad Edictum*, frequently referred to by Ulpian and Paul, as well as by earlier writers, embraced a commentary, not only on the edicts of the urban and peregrine prætors, but also on that of the curule ædiles. His *Probabilium* (πιθανῶν) *Lib. VIII.*, a collection of definitions and axiomatic legal propositions, seem to have been one of his most characteristic productions; they were abridged and annotated by Paul, and occasionally criticised by him with some severity. Amongst the writings of Labeo which we know only by report were *Commentarii de jure pontificio*, *Commentarii ad XII. Tabulas*, *Libri Epistolarum*, and *Libri Responsorum*. See Van Eck, "De vita, moribus, et studiis M. Ant. Labeonis," Franeker, 1692, in Oelrichs's *Thes. Nov.*, vol. i.; Mascovius, *De Sectis Sabinianor. et Proculianor.*, 1728; Dirksen, "Ueber die Schulen der Röm. Juristen," in his *Beiträge zur Kunde des Röm. Rechts*, 1825; Pernice, *M. Antistius Labeo,—Das Röm. Privatrecht im ersten Jahrhunderte der Kaiserzeit*, 1st and 2d vols., 1873 and 1878.

LABERIUS, DECIMUS (105–43 B.C.), a Roman knight and a prolific writer of *mimi*, or farces, was born about 105 B.C. Of his life we know little; but from the scattered notices of him in the old writers we can gather that he was a man of caustic wit, who wrote his pieces for his own pleasure, and enjoyed some consideration among his contemporaries. In 45 B.C. Julius Cæsar, promising him 500,000 sesterces, ordered him to appear in one of his own mimi in a public contest with the actor Publius or Publilius Syrus. Laberius pronounced a dignified prologue on the degradation thus thrust on his sixty years, and in the course of his acting directed several sharp allusions against the dictator. Cæsar awarded the victory to Syrus, but restored Laberius to his equestrian rank, which he had forfeited by appearing as a mimus. Laberius died at Puteoli in January, 43 B.C. He was the chief of those who introduced the mimus into Latin literature towards the close of the republican period. He seems to have been a man of learning and culture, but his pieces did not escape the coarseness inherent to the class of literature to which they belonged; and Aulus Gellius (xvi. 7, 1) accuses him of extravagance in the coining of new words. The titles of forty-four of his mimi have been preserved; and what fragments remain have been collected by Ribbeck in his *Comicorum Latinorum Reliquiæ*, 1855, 2d ed. 1873.

LABIENUS, TITUS, Julius Cæsar's proprætor in Gaul, first attracted his leader's favor in a civil capacity. In 63 B.C. he appeared at Cæsar's instigation as the prosecutor of Rabirius for perduellio; and in the same year, being tribune of the plebs, he carried a plebiscitum that indirectly secured for Cæsar the dignity of pontifex maximus. The military talent of Labienus was respectable, though not brilliant; but of all the officers trained under Cæsar in his Gallic campaigns he was the most trusted. His chief exploits in Gaul were the defeat of the Treviri under Indutiomarus in 54 B.C., his expedition against Lutetia (Paris) 52 B.C., and his victory over Camologenus and the Ædui in the same year. In 50 B.C. he was left in command of Gallia Cisalpina, while Cæsar returned to the north; but, on the outbreak next year of the civil war between Cæsar and Pompey, Labienus was one of the first to desert Cæsar. His motive is perhaps to be looked for, not so much in a deliberate calculation of chances, as in an overweening sense of his own importance, not adequately recognized by Cæsar. He was rapturously welcomed on the Pompeian side; but he brought no great strength with him. The veterans remained true to Cæsar, and even the town of Cingulum, on which Labienus had lavished much of his wealth, opened its gates to the future dictator. The ill fortune of Labienus under Pompey was as marked as his success had been under Cæsar's auspices. From the defeat at Pharsalia to which he had contributed by affecting to despise his late comrades, he fled to Africa. There, indeed, he was able by mere force of numbers to inflict a slight check upon Cæsar at Ruspina in 45 B.C.; but when the defeat at Thapsus ruined the Pompeian party in Africa, Labienus withdrew to join the younger Pompey in Spain. At Munda, on March 17, 45 B.C., he again met Cæsar, and in the ensuing defeat of his party fell sword in hand.

See the authorities referred to under CÆSAR; and Baron Carra de Vaux, *Expédition de Labienus contre Lutèce*, Paris, 1876.

LABOR AND LABOR LAWS. With some exceptions in the case of labor imposed as a punishment for crime or as a test or condition of aid to the poor under the poor laws, the labor here to be spoken of is labor by freemen,—that is to say, labor by persons having the primary right to choose whether they will labor or not, and to choose the terms on which they will consent to labor, if labor be their choice. Further, although voluntary labor of men is undertaken from various motives,—for their own profit, for self-preservation, for love, from public or private duty apart from the prospect of immediate gain,—the labor now treated of relates especially to that rendered to others for pecuniary reward, for money or money's worth,—in other words, for *wages*. This class of persons consists of all those who serve their employers by hand labor, whether rude or skilled, in any branch of productive industry or manufacture, including agriculture, mining, and the like, as well as the processes by which skilled artisans elaborate raw material to its final destination and use. Purely domestic service and the service of shopmen and clerks, as well as the work of contractors for the service of others, who do not work with their own hands, is excluded from specific notice here. The laborers falling within the class thus popularly described comprise upwards of a moiety of the present adult male population of the British Isles.

Although this article deals with free labor, the present position of the free laborer cannot be rightly understood without a glance at past history, and some attention to the distinction between voluntary and forced labor.

In every age and country, until times comparatively recent, compulsory personal servitude appears to have been the lot of a large, perhaps the greater, portion of mankind.[1] The slave was a man who had been captured in war or procured by purchase, or who had surrendered himself to the dominion of another as the alternative of starvation or in discharge of a debt, and it was his hands that tilled the soil, dug the mine, wove the cloth, and built the walls in ancient Greece and Italy. It has been asserted that in the early state of Rome the proportion of slaves, who were valued as property, was more considerable than that of hired servants, who could be computed only as an expense. It was thought more for the interest of the merchant or manufacturer to purchase than to hire his workmen, and in the country slaves were employed as the cheapest and most laborious instruments of agriculture. On the other hand, it has been inferred from our scanty materials that, as the Roman empire extended, the agricultural laborer and the citizen in Spain, Gaul, and Britain, in Syria and Egypt, maintained himself, as in the present day, by his own labor and that of his household, without the aid of any slave; but this is probably too favorable a picture. In the decline of the Roman empire, Roman captives were taken home by the northern conquerors. The useful craftsmen—smiths, carpenters, workmen in the metals, shoemakers, tailors, dyers, and others—employed their skill for the use or profit of their masters; while those who were destitute of art but capable of labor were condemned, without regard to their former rank, to tend the cattle and cultivate the lands of the victors. This, however, was only turning the tables on the Romans, for capture in war forms one of the principal sources of supply of slaves wherever slavery exists.

The Germans, in their primitive settlements, were accustomed to the notion of slavery, incurred, not only by captivity, but by crimes, by debt, and the wager of personal liberty in gaming. In the glimpses we get of the conditions of labor elsewhere the same essential features are discernible. In the changes of time and of geographical area of observation the harsher word slave may disappear; yet the thing not only survived the introduction of Christianity but was long regarded as not inconsistent with it, and was recognized as a national institution in civilized Europe. Whether under the name of slavery or of serfdom, or without either name, north, south, east, and west, an absolute right, apart from contract, to earnings and to the person of the laborer was accepted, if not openly vindicated. In looking at the present day at the vestiges of man's former and most permanent handiwork, it is instructive to regard them with an eye to the distinctions between periods of forced and voluntary labor. The pyramids of Egypt and the wall of China are monuments of slave labor; and the same is the case with the classic remains at Athens and Rome, so far at least as relates to the labor involved in the quarrying and hewing of stone, and the making of bricks and placing them in position. As regards Britain, our knowledge is too slight, and the conjectures as to the origin and objects of such structures as Stonehenge and Avebury are too varied, to allow of positive assertion; but it seems legitimate to conclude that the labor was forced. British and Roman camps and earthworks for military purposes probably exhibit the result of organized military labor combined with the forced labor of the inhabitants of the district. In this aspect the fortresses and defences destined for use consequent on the campaigns of a Cæsar or a Napoleon, of an Alexander or a Clive, do not materially differ. The remains still to be seen of Agricola's works on the line between the Firths of Clyde and Forth, as well as of the Roman walls and roads throughout England, and the later but ruder gigantic earthwork of the Mercian king between England and Wales, may be regarded as fruits of slave labor. The stupendous aqueducts of Roman brickwork in various parts of Southern Europe are naturally compared with the viaducts of the present age. The comparison may well extend to the accompanying conditions of labor.

Passing over the general effect of serfdom through out Northern Europe, and of the gradual manumission of toilers, as only a minute part of a very large subject, and directing our attention to the conditions of ordinary daily labor in the earliest period of the history of the British islands, we find it necessary to classify labor in relation to its particular application.

At the present day the most obvious natural distinction to be observed in this connection is that between the labor of the husbandman on the one hand and the labor of the mechanic and artisan on the other, a distinction to some extent parallel with a division into rural and urban labor. In an attempted division of labor in this country recorded in writing, which, although not in its present form earlier than the 15th century, and distorted by a fanciful notion of adapting everything to triads, probably gives us a knowledge of a very primitive people, the following divisions of labor are found:—(1) domestic art, with its three primary branches—husbandry or cultivation of land, pastoral cares, and weaving; and (2) mechanical arts—smith craft, carpentry, and stone-masonry (*Ancient Laws, etc., of Wales*, 1841).

The social status of these various laborers is a very difficult question. It seems clear that the heads of departments of labor, although working for the lord or chief, were freemen. The authority just cited expressly says that smiths, stone-masons, and carpenters had equal privileges, and every one following those trades was entitled, besides his maintenance and firing, to a fixed measure of land for cultivation, independently of what he might have by birthright. It is clear that there must have been subdivisions, as in the present day, between craftsmen and laborers engaged in the same trade, as between a mason and his laborer, between a ploughman and the driver of the team, and between the shepherd responsible for the flock and the cowherd who merely drove cattle to and from the pasture; a freeman might perform one branch of duty and an absolute slave or serf another on the same land, and for the same chief or head. It cannot be denied that slavery in the strictest sense was an institution among the Saxons in England, and that in the earliest English laws such slaves are found, but the true slave class was a small one, and it has been doubted whether the labor of an ordinary serf was practically more severe, or the remuneration in one form or another much less, than that of an agricultural laborer in some parts of England at this day. On the other hand, a fully qualified freeman might be a simple husbandman.

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[1] "The simple wish to use the bodily powers of another person as a means of ministering to one's own ease or pleasure is doubtless the foundation of slavery, and as old as human nature" (Maine).

Of the main conditions of labor at an early period in English towns we have no details. With the gradual development of urban populations around the castle of the lord, it is improbable that in any great number of cases the inhabitants long continued in the condition of personal serfage. The city populations of this island had not the habit and use of slavery. Serfs and oppressed laborers from adjacent estates may have been glad to take refuge from taskmasters more than ordinarily severe, but there is no doubt that freemen gradually united with them under the lord's protection, that strangers engaged in trade sojourned among them, and that a race of artisans gradually grew up in which original class feelings were greatly modified. From these and other causes the distinctions between agricultural laborers and mechanics and artisans grew and became permanent.

Proceeding to notice the legislation of England on the subject of labor, we observe, in passing, that the provisions of Magna Charta were not in the interests of labor. The stipulations against the forced building of new bridges and embankments, and for removing all weirs in rivers, were not by way of protest against involuntary labor, but in relief of a higher class. Direct legislation on labor dates as far back as the twenty-third year of the reign of Edward III., when the first Statute of Laborers was passed. The population had been much reduced by pestilence, and the demand for labor naturally led working classes to insist on higher wages, and there were "some rather willing to beg in idleness than by labor to get their living." The statute reciting these facts, and the "lusts especially of ploughmen and such laborers," enacted that "every man and woman of our realm of England, of what condition he be, free or bond, able in body, and within the age of threescore years, not living in merchandise, nor exercising any craft, not having of his own whereof to live, nor land about whose tillage he might employ himself, nor serving any other," should be bound to serve if he is in convenient service, his estate considered, at the wages accustomed to be given in the twentieth year of that reign, or five or six years before. If he refused, he was to be committed to jail till he found surety to enter into the service. No persons were to pay more than the old wages, upon pain of forfeiting double what they paid. If the lords of the towns or manors presumed to infringe the law, they were to be sued for treble the sum paid or promised by them or their servants. Artificers and workmen were put under the same restrictions, upon pain of imprisonment for taking more. This statute is remarkable as the first in which any notice occurs of the free laborer for hire, for the necessity of a statute to force him to work at fixed wages recognizes his otherwise free state.

A statute passed two years later (25 Edward III.), reciting that the earlier ordinance was disobeyed, contained minute regulations as to wages. If laborers or artificers left their work and went into another county, process was to be issued to the sheriff to arrest and bring them back. In 1360 (34 Edward III.) the former Statute of Laborers was confirmed, except that laborers were not to be punished by fine and ransom. Instead thereof, the lords of towns (*seigneurs des villes*) might take and imprison them for fifteen days if they would not do as required by law, and then send them to the next jail, "there to abide without bail till they will do so according to the statute." The statute enacted that "all alliances and covins of masons and carpenters, and congregations, chapters, ordinances, and oaths betwixt them made, or to be made, shall from henceforth be void and wholly annulled, so that every mason and carpenter, of what condition soever he be, shall be compelled by his master to whom he serveth to do every work that to him pertaineth to do, either of free stone or of rough stone, and also every carpenter in his degree. But it shall be lawful to every lord or other to bargain and covenant for their works in gross with such laborers and artificers when it pleaseth them, so that they perform such works well and lawfully, according to the bargain and covenant with them thereof made." A workman absenting himself from his service, and going to another town or county, was to be proceeded against under the previous statute, to outlawry, to be followed by imprisonment till he did as required by law, and made satisfaction to the party; nevertheless he was to be burnt in the forehead with the letter F, "in token of the falsity," if the party aggrieved so required, and if the justices should so advise. Eight years later, in the same reign (1368, 42 Edward III.), the statute and ordinance concerning laborers was confirmed, and commissions directed to justices to hear and determine matters concerning it.

Indubitable records still exist, proving that before the passing of those statutes, and down to the 15th century, workmen of various descriptions were pressed by writs addressed to sheriffs to work for their king at wages, regardless of their will as to the terms and place of work. Diggers and hewers of stone, masons, and carpenters, as well as ordinary laborers, were so impressed, and by services thus obtained the buildings at Windsor for the Knights of the Round Table, on the institution of the order of the Garter, were erected. In this case the sheriffs were commanded to take security from the workmen not to depart from Windsor without the permission of William of Wykeham, the king's surveyor. Notwithstanding these precautions, many workmen, so impressed, secretly left, in order to work for other persons at higher wages, and writs were directed to the sheriffs of London, commanding them to make proclamation prohibiting any person from employing or retaining any of the workmen on pain of forfeiting all their goods, and, as regards the workmen, commanding their arrest and imprisonment.[1]

An Act was passed in the reign of Richard II. (1388, 12 Richard II.) by which no servant or laborer, whether man or woman, could depart out of the hundred to serve elsewhere, unless bearing a letter patent under the king's seal, expressing the cause of going and the time of return. Wages were fixed in a way that shows the classification of agricultural labor. The

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[1] These proceedings were no doubt founded on notions of the royal prerogative, of which the impressment of seamen affords a more recent illustration. This forcing men to work for the king at low wages may be contrasted with proceedings within the present reign. Workmen employed in building the Queen's Palace at Westminster (the Houses of Parliament) struck for wages in the winter of 1841, and, having nothing to do, availed themselves of vacant seats in the Court of Queen's Bench, where her Majesty was constructively present. Here they were seen from day to day enjoying the comfortable temperature, undisturbed by any fear of writs or other compulsory process to force them to return to their work.

"bailiff for husbandry" stands first. The "master hine," the carter, and the shepherd are on an equality; the ploughman follows; after him the oxherd and cowherd, then the swineherd, the dairymaid and other women receiving equal wages, and every other laborer and servant according to his degree; no servant of artificers is to take more than the servants and laborers above named after their estate. The givers and takers forfeited the excess, or double or treble if attainted before; "and, if the taker so attainted have nothing whereof to pay the said excess, he shall have forty days' imprisonment." This was followed by a remarkable clause: "Also it is ordained and assented that he or she which useth to labor at the plough and cart, or other labor or service of husbandry, till they be of the age of twelve years, shall from thenceforth abide at the said labor, without being put to any trade or handicraft; and, if any covenant or bond of apprenticeship be from henceforth made to the contrary, the same shall be holden for none." By a statute of the following year (13 Richard II.), the justices were to settle and proclaim betwen Easter and Michaelmas what should be thè wages of day laborers.

Early in the 15th century we have a glimpse of something beyond this continued legislation interfering with freedom of labor, in a reservation in favor of children being sent to school. An Act of 7 Henry IV., putting a property qualification on apprenticeship and requiring children to be put to such labor as their fathers or mothers are of, or as their estates require, on penalty of one year's imprisonment, fine, and ransom, and of one hundred shillings for receiving such apprentices, has this sentence: "But any person may send their children to school to learn literature." Laborers and artificers are to be sworn to observe the statutes in force or be put in the stocks, and a penalty is imposed on towns neglecting to have stocks. In 1414, by a statute (2 Henry V.) reciting that the servants and laborers of the shires of the realm flee from county to county because they would not conform to the law, and because the law was not put in force in every county, the former Acts were confirmed and directed to be put in force and proclaimed by the sheriff. Justices of the peace were empowered to send writs to the sheriffs for fugitive laborers in like manner as the justices have power to send to every sheriff for the felons or thieves before they are indicted, and to examine all kinds of laborers, servants, and their masters as well as artificers, and to punish them upon confession in accordance with the statutes.

Early in the following reign (2 Henry VI., 1423) further power was given to justices to compel by process an appearance before them of masters as well as servants for examination as to the execution of the statute of Henry V., and to give offenders a month's imprisonment. Four years later (1427) the conclusion was drawn that the statutes of Richard II. were faulty, —that of 12 Richard II. because it was too hard upon the masters, that of 13 Richard II. because no penalty was attached to its breach; and, besides remedying the defects, it was enacted (6 Henry VI. c. 3) that justices should fix and make proclamation of wages. Two years earlier (1425) legislation had been directed against meetings of masons. The statute 3 Henry VI. c. 1 recites that, "by the annual congregations and confederacies made by masons in their general chapters assembled, the good courses and effect of the Statutes of Laborers are publicly violated and broken, in subversion of the law, and grievous damage of all the commonalty"; and such chapters and congregations were forbidden. It was made felony to cause them to be assembled and held, and masons attending them were to be punished by imprisonment and fine. In 1444 (23 Henry VI.) a scale of wages in agriculture and trade was fixed (including freemasons and "rough" masons, master carpenters and mesne carpenters, and master tilers and slaters), and a servant in husbandry was required before departing to give half a year's warning or else to serve his master the year following. Persons refusing to serve or labor were to be committed to jail, there to remain until they found sufficient surety to serve, and masters were entitled to a fixed fine on such.

A statute towards the close of the 15th century (1495, 11 Henry VII.) referring tò previous statutes, especially to the 23 Henry VI., and complaining of their inadequacy or imperfect execution, proceeds to fix the wages of artificers and laborers with great minuteness. This Act contained a remarkable clause against unlawful conspiracy by workmen engaged in building; if such artificers or laborers "make or cause to be made any assembly to assault, harm, or hurt any person assigned to control and oversee them in their working, that he or they so offending have imprisonment for a year without letting to bail or mainprise, and further to make fine at the king's will." It is not surprising that even with so very limited knowledge of principles a short time sufficed to show how ineffectual minute legislation was to control wages. The statute was repealed in the following year, "for divers and many reasonable considerations and causes, the king's highness moving, and for the common wealth of the poor artificers, as freemasons, carpenters, and other persons necessary and convenient for the reparations and buildings, and other laborers and servants of husbandry." But what is surprising is that (although the first legislation of the 16th century was in favor of masters[1]) we find in 1514 a statute regulating wages and hours of work and even the summer day sleep of artificers and laborers, and in fact a re-enactment of the law of 1495.[2] The London workmen could not endure this restriction as to wages, and in the following year were allowed to take the previous rate when working within the city or its liberties; the king's works were, however, excepted.

At this point it is necessary to refer to the provisions made against vagrancy in the 16th century, these being closely connected with compulsory labor. The great social revolution caused by the suppression of the monasteries, and by the consequent withdrawal of the support which those institutions afforded to the indigent, and too often to the idle, had led to the dispersion over the face of the country of a multitude of beggars, many of whom were able to work but preferred idleness, often adding theft and robbery to mendicancy. Under these circumstances harsh and cruel statutes were passed in the reigns of Henry VIII., Edward VI., and Elizabeth.

In 1530 (22 Henry VIII.) any person, being whole and mighty in body and able to labor, found begging or being vagrant, and giving no satisfactory account how he lawfully obtained his living, might be arrested by a constable, and a justice might, in his discretion, cause every such idle person to be taken to the nearest town and there tied to the end of a cart naked, and to be beaten with whips throughout the town "till his body be bloody by reason of such whipping." He was then required to take an oath to return to his home "and put himself to labor as a true man ought to do." The whipping was to be repeated as often as he made default; but five years later the punishment for "rufflers, sturdy vagabonds, and valiant beggars," persisting in not working after a whipping, was increased to having the upper part of the gristle of his right ear clean cut off. If still persistent he was to be tried, and executed as a felon.

On the accession of Edward VI. a law was passed by which a serving man wanting a master, or loitering or wandering, and not applying himself to honest labor, might on conviction be marked with the letter V, and adjudged to be the slave for two years of the person buying him, giving him only bread and water or small

[1] In 1512 (4 Hen. VIII.) the penalties for giving of wages contrary to the statute 12 Rich. II. were repealed so far and only so far as relates to the masters.

[2] Miners and workers for tin, lead, iron, or silver, colliers for sea coal, and glass makers were excepted.

drink, and such refuse of meat as the master should think fit, and causing him to work by beating, chaining, or otherwise. If he ran away he might not only be punished by his master in the same way, but the justices, on conviction, were to have him marked on the forehead or ball of the cheek with an hot iron with the letter S, and adjudge him to be the master's slave for life. If he again ran away, the offence became felony, and he was to suffer the pains of death "as other felons ought to do." Any child of a vagabond, above the age of five and under fourteen, might be adjudged the servant or apprentice of any person willing to take it until the age of twenty-four if a male and twenty if a female, if it ran away slavery followed for life. The master might put a ring of iron about the neck, arm, or leg of his slave to prevent his running away, with a penalty on any person helping him to take it off, and if the slave resisted correction he was to be executed as a felon. The slave might be sold or devised by will as other goods and chattels. This statute was repealed three years after, but it remains on the rolls of parliament, and nothing can obliterate the fact and the consequent disgrace attaching for all time to the parliament that could pass such a law, and to the country that could endure it for a day. This reintroduction of slavery in England by name, and in its worst form, is memorable, and serves to mark the alteration of opinion and feeling that has since taken place, much more than any contrast between freedom of labor and wages in the sense of the political economist.

Early in the reign of Elizabeth (5 Elizabeth, 1562) the statute commonly called "the Statute of Laborers" repealed all former statutes relating to laborers in husbandry and artificers or laborers engaged in particular trades, and consolidated and amended many former provisions. Its chief object was to provide a new rate of wages, and, in addition, to regulate in many respects the terms of employment as between the employer and the employed. This Act admits that the wages laid down by former statutes are in divers places too small in view of the general rise of prices, but approves of the principle and aims of previous legislation, the substance of which it seeks to digest in a single statute. The statute draws a main distinction between artificers and laborers in husbandry. The former may not be hired for a less term than a year, and any unemployed person brought up in a craft or who had practised it for more than three years was bound, on pain of imprisonment, to accept service if required "by any person using the art or mystery wherein he has been exercised," unless he had a farm in tillage, an estate worth 40 shillings a year, or goods to the yearly value of £10. Similar provision was made in respect of service in husbandry. Every person between the ages of twelve and sixty was in like manner bound to serve in husbandry unless possessed of property of specified amount, or employed as a fisherman or mariner, or in mining, or in any of the arts or sciences previously mentioned, or unless born a gentleman, or unless a member of a university or school. Minute regulations were made with reference to the rights and obligations of both master and servant. No person retained in husbandry or trade was to go out of the county or shire where he last served, to serve in any other, without a testimonial. No person leaving his service could be taken into another without showing such testimonial to the authorities of the place in which he was about to serve. If he broke this regulation he was to be imprisoned till he could procure a testimonial, and unless he did so within twenty-one days he was to be whipped. Every person retaining a servant without the latter showing such testimonial forfeited £5. Besides empowering justices in session to make a rate of wages, the statute fixed with great minuteness the hours of labor. In the time of harvest, justices or constables or other head officers might require artificers and persons meet for labor to serve by the day in mowing, reaping, shearing, getting, or turning of corn, grain, or hay, according to the skill and quality of the person, and upon refusal might put him in the stocks for two days and a night. Even single women between the ages of twelve and forty might be compelled to serve in such employment as the justices might direct, under pain of imprisonment. Amended provision was made towards the close of the reign for justices yearly fixing the rate of wages.

It will be seen by the preceding summary how great were the restraints still placed by the legislature on the free action of labor. After this mass of unwholesome legislation it is instructive to notice the state of the laboring classes in England in the 16th century, as recorded by Harrison. After dividing English people into four sorts—gentlemen, citizens or burgesses, yeomen, and artificers and laborers—and describing the first three classes, he says:

> "The fourth and last sort of people in England are day laborers, poor husbandmen, and some retailers (which have no free land), copyholders, and all artificers, as tailors, shoemakers, carpenters, brickmakers, masons, etc. As for slaves and bondmen, we have none; nay, such is the privilege of our country, by the especial grace of God and bounty of our princess, that, if any come hither from other realms, so soon as they set foot on land they become so free of condition as their masters. . . . This fourth and last sort of people have neither voice nor authority in the commonwealth, but are to be ruled, and not to rule others; yet they are not altogether neglected, for in cities and corporate towns, for default of yeomen, they are fain to make up their inquests of such manner of people, and in villages they are commonly made churchwardens, sidemen, ale conners, now and then constables, and many times enjoy the name of headboroughs. Unto this sort also may our great swarms of idle serving-men be referred, of whom there runneth a proverb, Young serving-men, old beggars, because service is none heritage. . . . This, furthermore, among other things I have to say of our husbandmen and artificers, that they were never so excellent in their trades as at this present. But, as the workmanship of the latter sort was never more fine and curious to the eye, so was it never less strong and substantial for continuance and benefit of the buyers. Neither is there anything that hurteth the common sort of our artificers more than haste, and a barbarous or slavish desire to turn the penny, and by ridding their work to make speedy utterance of their wares; which enforceth them to bungle up and despatch many things they care not how so they be out of their hands, whereby the buyer is often sore defrauded, and findeth to his cost that haste maketh waste, according to the proverb. Oh, how many traders and handicrafts are now in England whereof the commonwealth hath no need! How many needful commodities have we which are perfected with great cost, etc., and yet may with far more ease and less cost be provided from other countries if we could use the means! I will not speak of iron, glass, and such like, which spoil much wood, and yet are brought from other countries better cheap than we can make them here at home. I could exemplify also in many others."

Notwithstanding compulsory legislation, and the forcing of labor for the sovereign already noticed, it is evident that the condition of the laborer, even when employed on royal property, was undergoing amelioration. In a remarkable but apparently unpublished letter of Humphrey Mitchell, surveyor of the queen's works at Windsor (and for some time member of parliament for that borough), to Lord Burghley, written in 1575, he says—"At my first entry into this charge I could scarce get workmen by commission; since, with monthly 'payes,' impressing through the mayor those contumacious in work, rewarding the diligent, and thrusting out the evil where I perceived them loitering, I have brought them into such an obedience and a desire to work here that where I have one I can have twenty to serve her Majesty; and when, at the first entry into the works, they had their breakfast at eight of the clock in the morning, and drinking at three in the afternoon, I have taken that idle custom from them, and have only allowed them two hours at noon, and as necessity serveth, sometimes but one, with their contentation; and for that also I would have them they must know their duty, I bring them to the lecture at the college [Windsor] twice every week, losing no hour's work thereby, for those days they rest at twelve. I suffer not a swearer nor filthy talker in the works to my knowledge, by all which means I think her Majesty hath her work done as diligently as any other private man hath."

Light is thrown on the arrangement of hours by a clause in the above-mentioned Statute of Laborers of the fifth year of the Queen's reign. It enacted that—

> "All artificers and laborers being hired for wages by the day or week shall, betwixt the midst of the months of March and September, be and continue at their work at or before five of the clock in the morning, and continue at work and not depart until betwixt seven and eight o'clock at night (except it be in the time of breakfast, dinner, or drinking), the which time at the most shall not exceed above two hours and a half in a day, that is to say, at every drinking one-half hour, for his dinner one hour, and for his sleep when he is allowed to sleep, the which is from the midst of May to the midst of August, half an hour at the most, and at every breakfast one-half hour; and all the said artificers and laborers betwixt the midst of September and the midst of March shall be and continue at their work from the spring of the day in the morning until the night of the same day, except it be in time afore appointed for breakfast and dinner, upon pain to lose and forfeit one penny for every hour's absence, to be deducted and *defaulked* out of his wages that shall so offend."

In the first parliament after the accession of James an attempt made towards the close of the previous reign to enforce the rating of wages and the payment of the rated amounts was renewed. The Act recites, in the same terms as were used only two years before, that the Act of 1562 "hath not, according to the true meaning thereof, been duly put in execution," and, in order to remove a doubt as to the application of the principle of assessing wages, expressly extends it, "to rate wages of any laborers, weavers, spinsters, or workmen whatsoever, either working by the day, week, month, year, or taking any work at any person or persons' hand whatsoever, to be done in great or otherwise." The giving or receiving more or less than the proclaimed price was expressly declared to be an offence.

In Scotland we find complaint in the 16th century by masters of salt-pans of the great rise in wages, and early in the 17th century (1617) justices were directed to fix at quarter sessions the ordinary rate of hire and wages of workmen, laborers, and servants, and to imprison those who refused to serve for the appointed hire. At the same time, "that servants may be the more willing to obey the ordinance," power was given to the justices to compel payment of wages. This law was re-enacted in 1661. Some years previously (1606) any one hiring a collier or salter without a sufficient testimonial from his last master was compelled to deliver him up if demanded; and colliers and salters were empowered to apprehend vagabonds and sturdy beggars and force them to labor. In 1621, in consequence of "the great straits and necessities that the poor laborers of the ground" were driven to by the "fraud and malice" of servants who either refused to be hired without the promise of great wages, or else hired themselves from Martinmas to Whitsunday, then "casting them loose" on purpose to make their gain and advantage by extraordinary works, such as casting and winning peats or turfs, building fold dykes, and shearing in the harvest, hired servants were forbidden to leave unless upon proof to a justice of the peace that they were hired to another. If it was found that a servant was not so hired, his master was empowered to detain him at the previous rate of wages. Power was given to apprehend a servant "who broke loose," and to deliver him to a constable or justice, and a power to all persons to apprehend loose and masterless men and women found within their own bounds; and the justices and constables were empowered to compel them to serve for competent hire and wages. Twenty years later servants in manufactories were compelled to work at reasonable rates, and not to hire without their previous master's consent. Houses of correction were erected for disobedient servants, and in 1672 masters of correction houses were empowered to receive such servants and to force them to work, and to correct them according to their demerits. These latter laws of Scotland were accompanied by others directed against vagrancy.

Passing over legislation which either affected only particular trades (although denoting the growth of manufacturing industry), or related rather to the poor laws than directly to the subject of this article, and arriving at the middle of the 18th century, we find the legislature no longer employed in compelling laborers or artisans to enter into involuntary service, but regulating the summary jurisdiction of justice in the matter of disputes between employers and employed, in relation to contracts and agreements, express or implied, presumed to have been entered into voluntarily on both sides.

The statute 20 Geo. II. c. 19 (passed in 1746) provided that all complaints, differences, and disputes arising between masters and servants in husbandry hired for one year or longer (extended by a subsequent statute of the same reign to those hired for less than a year), or arising between masters and artificers, handicraftsmen, and miners, (applied in 1829 to laborers of every sort), were to be determined by one or more justices, who, upon complaint of the servant, might determine any dispute as to wages and order payment of any sum found to be due, not exceeding £10 in case of a servant in husbandry, and £5 in case of artificers and other laborers, and, in the event of non-payment, might levy the same by distress on the goods of the master. In case of complaint by the master, the authority of the justice was still larger. He had power to entertain a complaint of "any misdemeanour, miscarriage, or ill behaviour of the servant in his or her service or employment," and to hear, examine, and determine the same. If the decision was adverse to the servant, the justice might either abate some part of the wages due to such servant, or discharge him from the service, or he might punish the offender by committing him to the house of correction, "there to be corrected," which term was held to mean correction by whipping and holding to hard labor for a reasonable time, not exceeding a month.

A statute of 1823 (4 Geo. IV. c. 34), the next general statute on this subject, took a somewhat wider scope, dealing with breaches of contract on the part of the servant in not entering into the agreed service at all, as well as in quitting it before the term agreed on had expired, and subjecting these breaches as well as any misdemeanor or misconduct while in the service to the jurisdiction of the justice, who might adjudge the offender to be imprisoned in the house of correction for a term not exceeding three months (but without any power to order corporal punishment), abating a proportional part of his wages in the future, or adjudging him to lose the whole or part of his wages already earned; or, he might dismiss him from the service.

Thus stood the statute law until 1867. In consequence of considerable dissatisfaction on the part of workmen with the adjudication of justices, a select committee of the House of Commons was appointed in the previous year to inquire into the state of the law as regards contracts of service between master and servant, and as to the expediency of amending it. That committee reported—

1. That the law as it then existed was objectionable.
2. That all cases arising under the law of master and servant should be publicly tried in England and Ireland before two or more magistrates, or before a stipendiary magistrate, and in Scotland before two or more magistrates, or the sheriff.
3. That procedure should be by summons in England and Ireland, and warrant to cite in Scotland, and, failing appearance of defendant in answer to summons or citation, the court should have power to grant warrant to apprehend.

4. That punishment should be by fine, and failing payment by distress or imprisonment.

5. That the court should have power when such a course is deemed advisable to order the defendant to fulfil the contract, and also, if necessary, to compel him to find security that he will do so.

6. That in aggravated cases of breach of contract, causing injury to person or property, the magistrate or sheriff should have the power of awarding punishment by imprisonment instead of fine.

7. That the arrest of wages in Scotland in payment of fines should be abolished.

The Master and Servant Act, 1867, sometimes called Lord Elcho's Act, was framed upon the report of the committee, and embodied most of the recommendations. As regards simple breaches of contract, the position of servants was considerably improved. Imprisonment, which, under the former Acts, the magistrate was authorized to impose in the first instance as a punishment for a breach of the contract, was taken away, except as auxiliary to the jurisdiction, as the consequence of disobedience to the order of the court; and wherever imprisonment might, under the former Acts, have been accompanied by hard labor, the power to order hard labor was taken away. Lord Elcho's Act did not, however, remove the dissatisfaction felt on the part of workmen, and the events of a few years rendered it desirable to reconsider the whole law, with reference not only to breaches of contract but to other special legislation of a criminal kind, and to the general law of conspiracy affecting the relation of employer and employed.

Commissioners reported in 1875 recommending, so far as relates to the scope of this article, that the proceedings should be altogether divested of a penal character and assume that of a civil proceeding for specific performance or recovery of damages, and that, to effect the main object, Lord Elcho's Act should be amended or a new Act framed in clearer language. Within a few months of the presentation of the report, Mr. Cross, then secretary of state, introduced two bills, the one an "Employers and Workmen Bill," and the other a "Conspiracy and Protection of Property Bill," and these bills, after undergoing considerable discussion and alteration in their different stages, were passed and came into operation on the 1st of September, 1875. This article only deals with the former Act. While carrying out the recommendation of the commissioners regarding Lord Elcho's Act, and placing all provisions of a penal character in a separate Act ("Conspiracy and Protection of Property"), the legislature thought fit to go further and take away the right of enforcing performance of contracts of labor (although that is a very important branch of civil procedure in relation to various matters of contract), and make it a mere question of recovery of damages, unless both parties agree that security for performance of the contract shall be given instead of damages. Adjudication can be by courts of summary jurisdiction.[1]

Neither this Act nor its predecessor takes away the right of parties to sue in the ordinary civil tribunals of the country; but the Act puts county courts (in Scotland the ordinary sheriff court of the county, in Ireland the civil bill court) practically on the same footing with courts of summary jurisdiction.—the jurisdiction of magistrates being simply because the county courts in most places do not sit sufficiently often for the practical adjudication of these differences. The title of the Act, "to enlarge the powers of county courts in respect of disputes between employers and workmen, and to give other courts a limited civil jurisdiction in respect of such disputes," indicates its general scope, which is borne out by its provisions. It extends to "any dispute between an employer and a workman arising out of or incidental to their relation as such." The expression "workman" does not include a domestic or menial servant, but means any person who, being a laborer, servant in husbandry, journeyman, artificer, handicraftsman, miner, or otherwise engaged in manual labor, whether under the age of twenty-one years or above that age, has entered into our works under a contract with an employer, whether the contract be made before or after the passing of the Act, be express or implied, oral or in writing, and be a contract of service or a contract personally to execute any work or labor. Payment of damages and debts under the Act, as in other cases of judgment debts, is enforceable by imprisonment for a term not exceeding six weeks, only on proof of ability and neglect to pay, whether the proceedings be in the county court or in the court of summary jurisdiction.

Two circumstances show the rapid strides made in a few years in the position of labor in relation to legislation. Lord Elcho's Act in 1867 received the title of "The Master and Servant Act." In eight years that title is silently dropped, and "Employers and Workmen" substituted. In 1867 the prime minister spoke in high terms of eulogy of Lord Elcho's Act as securing valuable rights for workmen. In 1875 the same prime minister, speaking a few weeks after the passing of the Act of that year, remarked that for the first time in the history of the country the employer and employed sat under equal laws.

Although the general tendency of colonial legislation is to follow that of the parent country, where it can be applied, that is not the case in some important British colonies in relation to the enforcement of labor contracts.

In New South Wales, servants, including artificers, journeymen, and handicraftsmen, and all agricultural laborers, as well as domestic servants, are dealt with under a colonial Act of 1857. For not fulfilling a contract, whether by deserting or not entering upon the service, or for other misconduct or ill behavior, justices upon conviction may impose a fine not exceeding £10. In default of distress, imprisonment, not exceeding fourteen days, or forfeiture of wages then due may follow. Obtaining advances of money after entering into a contract and refusing to go to the place of service, or refusing to perform work to the extent of the advance without reasonable cause, is punishable by direct imprisonment with or without hard labor for any term not exceeding three months. Persons knowingly concealing or employing absconding or absenting servants or persuading them to violate agreements are liable to a penalty not exceeding £10, and in default imprisonment for fourteen days. On the other hand wages not exceeding £50 and full costs may be recovered by distress, and in default imprisonment for fourteen days; masters are also liable to a penalty for withholding property of their servants. Independently of these provisions, justices may hear and determine in a summary manner any complaint, difference, or dispute between a servant and his master, and the award may be enforced by cancelling an agreement or imposing a fine, and in default of distress by imprisonment not exceeding fourteen days. The power of imprisonment under the Act does not extend to women.

In South Australia, by an Act of 1878 (following in the main the tenor of Lord Elcho's Act, rather than the legislation of 1875), whenever the employer or employed neglects or refuses to fulfil any contract, or the employed neglects or refuses to enter or continue his service or absents himself, or whenever any dispute arises between the parties, the case may be summarily decided by justices, who may order an abatement of wages due, or direct the fulfilment of the contract, with a direction to the party complained against to find security by recognizance or bond with or without sureties; or the contract may be annulled and the amount of wages or compensation apportioned; or, where pecuniary compensation will not, in the opinion of the justices, meet the circumstances of the case, they may impose a fine not exceeding £20. The neglect or refusal to find security for performance of contract may be enforced by imprisonment not exceeding three months.

The Victorian statutes relating to master and servant were consolidated in 1864. Under that Act all agricultural and other laborers and workmen and artisans, as well as domestic servants, were made liable on summary conviction to imprisonment not exceeding three months, or abatement of wages, for breaches of contract or for disobedience or other misconduct or misdemeanor. The like imprisonment was provided for obtaining advances of wages and refusing to serve and also for wilful or negligent acts involving a destruction of work or materials committed to the workman's charge, in default of payment of damages (limited to £10). Wages and amends for ill-treatment were made recoverable by order.

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[1] In England such courts are a police or stipendiary magistrate, or, where there is no such magistrate, two or more justices sitting at some place appointed for holding petty sessions, or, in the city of London, the lord mayor or an alderman sitting at the Mansion House or Guildhall. In Scotland the court of summary jurisdiction is the small debt court of the sheriff of the county. In Ireland the court is constituted of one or more of the divisional justices of the police district of Dublin metropolis, and elsewhere in Ireland of two or more justices of the peace in petty sessions, sitting at a place appointed for holding petty sessions. These courts are, for the purposes of the Act, civil courts.

It is impossible within the limits of this article to follow the different provisions in various colonies affecting the relation of employer and employed. To render a summary of practical value, local peculiarities and exigencies must be borne in mind. Where native or foreign races form a material part of the industrial population, or where changes have occurred in their condition, the facts must be taken into account; for example, the legislation of Jamaica, although now constituted an ordinary British colony, must be considered in relation to the former existence of slavery and to the intermediate status of apprenticeship before its abolition. So in British Guiana, the large number of emigrants from the East Indies, many of them working on the estates under indentures, must not be lost sight of.

With regard to India, that vast area cannot be dealt with as if the industrial population consisted of Europeans, manufacturing in its cities. Although natives are increasingly sharing in the labor and ownership involved in the production of manufactures, the cultivation of the soil forms the basis of the support of two-thirds of the population. The true view of India is that as a whole it is divided into a vast number of independent self-acting organized groups, cultivating, trading, and manufacturing, governed by law made up to a great extent of local usages and customs, and where caste is often merely a name for trade or occupation, the village communities comprising families who are hereditary weavers, potters, blacksmiths, harness makers, and so forth.

The condition of the law in European states at the present time with regard to the enforcement of labor contracts is this. In France contracts of work and service stand on the same footing as other contracts. The breach of such contracts is regarded as a private matter, as the subject of a claim for damages, but not of the application of the criminal law. The recovery of damages is regulated by the Code Napoléon. The juge de paix decides the amount when the sum claimed is under 200 francs, when above that amount the tribunal of first instance. So in Belgium there is no criminal penalty attaching to the breach of a contract of labor; such a contract entitles the aggrieved party, as a general rule, only to pecuniary damages; and the same is the case in the Netherlands, Austria Hungary, Italy, Portugal, Sweden, Norway, and Russia. In Switzerland there is no criminal liability, provided the dereliction of duty involves no consequences injurious to the public welfare or to the life or health of other persons. The performance of contracts, however, in the larger works in Switzerland is secured by the system of "décompte," or portion of wages retained as security by the employer. In Prussia, although in 1869 all the penal regulations previously existing against breaches of contract and wrongful cessation of work on the part of workmen in mills, mines, and metallurgical establishments and in underground quarries and pits were repealed, police laws are, it seems, still capable of being enforced by way of fine, and in default, by a short imprisonment in some provinces, against agricultural laborers, and against boatmen or workmen engaged in special field or forest work.

Of the United States, the English representative wrote thus to the Foreign Office in 1869:—"There are few countries in which the working man is held in such regard as in the United States of America. The laboring classes may be said to embrace the entire American nation. Every man works for a living, follows a profession, or is engaged either in mercantile or industrial pursuits." As might be expected, it may be said that, as to both parties to a contract for labor and service, they stand upon the mere footing of contract, and such contract is not distinguished from any other contract. The matter does not belong to the province of federal legislation, but to the regulation of each particular State. There has been no legislation, however, making the breach of a contract for labor or services the subject of criminal liability. Contracts of apprenticeship are nevertheless enforced by statutory provisions.

We have hitherto dealt with the mode of enforcing contracts of labor. It remains to speak of the extent to which the contracts themselves are controlled.

With reference to the period of service, there is no law directly limiting it. A right even to perpetual service founded on a contract may not perhaps be illegal and void; for, if a man can contract to serve for one year, there seems to be no reason to prevent his contracting to serve for one hundred years if he should so long live,—though the courts would be inclined to consider it an improvident engagement, and would not be very strict in enforcing it (Christian). No such perpetual contracts, however, exist in actual practice, and where no time is expressly stipulated or implied the contract is generally construed to endure until determined by a reasonable notice on either side, to be construed by the general usage in relation to the particular employment. If a time is expressed or implied, the silent continuing in the service after its expiration draws with it in general a renewal of the same terms as were originally stipulated for. In agriculture the general engagement, express or implied, is for a year. In manufacture it is seldom so long, and in journeyman handicrafts it is sometimes by the hour, but the usage to calculate earnings and the time of payment by the hour or day is often of course quite distinct from the duration of the contract. Payment by measure or quantity (piece work) is very general, and so far as the calculation of earnings is concerned supersedes reference to time. Nevertheless the obligation to serve may be conditional on the employer finding a reasonable quantity of work, or may expressly or implicitly endure until a reasonable notice is given on either side. In the pottery manufacture in North Staffordshire most of the workmen in the different branches of the trade are paid by the quantity according to a price list, the engagements being by usage, from Martinmas to Martinmas; and in this and in most other manufactures where the artisan works on the material and in the manufactory or the workshop of the employer he is subject to the usual hours of work, although only paid by the quantity.

Most workmen of all classes and descriptions of labor are paid weekly, in whatever way their earnings accrue or are calculated. The contracts of infants (see INFANT) for their personal services as necessary for their maintenance are enforceable, for unless they could make such contracts they might starve. As long as these contracts were enforceable by imprisonment the courts looked closely into them, refusing to enforce them unless they were mutual, that is, capable of being enforced against the employer as well as against the servant. If there were an agreement to serve under circumstances which involved no obligation to employ, the courts would not enforce the contract, and young servants were not unfrequently discharged from custody on the ground that no obligation to serve existed by reason of the onesidedness. Contracts of APPRENTICESHIP (*q. v.*) are beyond the limits of this article.

The will of the parties is not interfered with as regards the description of labor or the adequacy of the remuneration agreed upon. In the absence of any verbal or written stipulation, the performance of labor upon an express or implied request in general involves an implied agreement to pay the value of it in the current coin of the realm; and wherever a mutuality of agreement can be implied, that is to say, where it is not onesided, it can be enforced. As the employer and employed are free, they would primarily have a right to stipulate that the remuneration for service should be for something else than money, as for articles of value, or for an exchange of labor; but the primary right of employer and employed to make their own arrangements as to the mode of remuneration is interfered with in England by legislation, especially by the so-called Truck Act, 1 and 2 Will. IV. c. 37, applying to all persons employed in the manufacture of iron from raising the stone to the completion of the making of the products of iron and steel, and the manufacture of all other hardware and cutlery, and the getting of coal, stone and slate, salt and clay, and the manufacture of pottery, and the weaving, preparation, and dyeing of woollen, worsted, cotton cloth, and silk. The object of the statute is to compel payment of wages in money. For this purpose it prohibits agreements for paying wages otherwise, and prohibits paying them in goods or money's worth. To insure obedience, it enables the artificer to repudiate a contract and payment contrary to its provisions, and, however fairly he may have been dealt with, to enforce payment in such case over again. It is obvious that such a provision is open to two most important objections:—(1) it interferes with that freedom of contract and conduct which is universally recognized as of the greatest benefit; (2) it enables an artificer who may have requested and received payment otherwise than in money, and who may have benefited thereby and been most justly and kindly treated, to commit a great dishonesty by enforcing payment again. But, grave as these objections are, the legislature has deemed it necessary to face them, in order to guard against the mischiefs of a system under which the workman may receive directly from his employer, or indirectly, as through "tommyshops" in which the employer has an interest, articles not a real equivalent of the wages; so that but for the statute an employer might engage a man to work for him with a promise of payment in goods, and cheat him by giving him goods of inferior quality or overcharge, or engaging him with a promise of money and then cheating him by a pressure to take goods, or by supplying the man with goods beyond his wages, get him into his debt, and then exercise an injurious control over him. It is in vain to say that the master would cheat in cases where money wages were agreed for, by withholding money agreed to be paid, and that the law would redress the one wrong as readily as the other. The answer is that such a cheat is too barefaced, and would certainly be successfully resisted; while more or less of inferiority in the quality or value of goods might be endured, or, if contested, would give rise to more doubtful inquiries. Whether these mischiefs are worth the remedy, or whether the remedy is the best, is not the question to be discussed or determined in this article.

As servants in husbandry are often remunerated in part in other ways than by money, as by land or its produce, or by house room, and in a variety of ways, the Truck Act especially exempts them. Domestic servants are also specially exempted. Moreover, by express provision, the Act does not prevent any employer of any artificer or agent of such employer from supplying or contracting to supply medicine or medical attendance, or any fuel, or any materials, tools, or implements employed by the artificer in his trade or occupation if employed in mining, or any hay, corn, or other provender for horses or other beasts of burden employed by such artificer in his trade or occupation, nor from letting any tenement at a rental to any artificer, workman, or laborer within the Act, nor from supplying or contracting to supply to any artificer any victuals dressed or prepared under the roof of the employer and there to be consumed by such artificer, nor from making deductions or stoppages, or advancing money for any of these purposes, provided that only the real value is charged, and that the agreement for any such stoppage or deduction is in writing. Employers are not prevented from advancing money to an artificer for his contributions to a friendly society or to a savings bank, or for his relief in sickness, or for the education of his children, or from making deductions for such education, if the agreement for such deduction is in writing. The interpretation of the Truck Act has exercised the most subtle intellects. It has been determined by the majority of judges that the obligation to render services personally is necessary to make the Act applicable. The circumstances under which stoppages and deductions may be made, and other exceptions from the operation of the prohibitory clauses of the Act, have also been the subject of divergent opinions. A custom having prevailed among the employers of artificers in the hosiery manufactures of letting out frames and machinery to the artificers employed by them, in 1874 contracts to stop wages for frames were declared illegal, and the stoppage of wages made unlawful. By a provision of the Employers and Workmen Act, 1875, forfeitures on the ground of absence or leaving work cannot, in the case of a child, young person, or woman subject to the provisions of the Factory Acts, be deducted from or set off against a claim for wages or other sum due for work done before such absence or leaving work, except to the amount of the damage (if any) which the employer sustained by reason of such absence or leaving work.

Great evils having arisen in Scotland through the arrestment of wages for debts of laborers, manufacturers, artificers, and other work people, the power to arrest wages earned there not exceeding twenty shillings a-week was in 1870 taken away, and limited in amount where the wages are above that sum. A provision of a statute of the reign of George II., "to prevent oppression of the laborers and workmen employed in any respect in or about making or manufacturing of gloves, breeches, boots, shoes, slippers, wares or goods of that sort," requires the true weight, quantity, or tale to be declared of goods and materials delivered out to be wrought up in those manufactures.

The system of the "livret" (still the law in some European states, although fallen into disuse as no longer in harmony with the direction of modern views), by which it is a condition precedent to a workman entering into a contract, or being engaged by a fresh employer, to produce a document certifying that he has fulfilled his previous engagements, is unknown now in England. The former system of rules stood much on the same footing, and there is something closely resembling it introduced into the rules regulating the employment of drivers of public vehicles in the metropolis. It is only in relation to domestic service that a new employer concerns himself with the antecedents of a servant or with anything beyond the capacity to work; and the former employer in whose interests "livrets" were imposed does not in general deem it worth while, with the present abundance of labor in every field of work, to impose any restraint on the departure of a dissatisfied workman. The practical ground of complaint is not so much a workman exchanging employers, as a neglect of work while remaining in service.

The legal remedies at present in existence for breaches of contract have been necessarily stated in the outline of the last statute on the subject of employer and employed. The weak point is the absence in England of any mode by which the performance of contracts of labor can be enforced, as contracts of other kinds can be where damages do not afford a remedy. Lord Elcho's Act of 1867 purposely gave a remedy in the nature of specific performance, and where carefully applied was found to work very well. The commission of 1875 expressly recommended the retention of this power as quite distinct from criminal punishment. Provision for compelling the performance of a contract exists in many countries where any application of criminal law is repudiated. Nevertheless, not so much from any objection on the part of the framers to compulsory performance as from fear of its abuse by the heavy hand (the bane of administrative legislation as of inventive genius), the power is gone. The result is undoubted hardship to employers, particularly to those (and there are many of them) who are themselves workers and entirely dependent on the due performance of contracts by their fellow-workers. That home legislation is defective in this respect may be inferred from the fact that subsequent colonial legislation has given the means of getting labor contracts performed without trenching on the domain of criminal law. As, however, there is little probability of an amendment of home law in the direction indicated, it is to be hoped that compensation for diminished legal remedy will be found in an increased sense of moral responsibility.

Arbitration is frequently employed to settle differences between masters and workmen.

The institution of "conseils de prud'hommes" is known by name as in force in most of the manufacturing districts of France and Belgium and other Continental countries. The council is a recognized tribunal consisting of equal numbers of employers and employed. All disputes between master and workmen, whether as to quality of work or rate of wages, are first submitted to a committee, which sits privately, to endeavor to settle the question amicably and at a nominal expense; failing this, the case is referred to the council, which sits in public once a month, or oftener if required. Though the right of appeal to the regular courts exists, it is seldom resorted to.

In Austria a law of 1869 instituted arbitration courts of this description in every important manufacturing town and district, to settle all disputes respecting wages, continuance of work, fulfilment of contracts, and claims on benefit clubs and relief funds and matters of that kind. Each court of arbitration must be composed of at least twelve and at most twenty-four members,—one half of them employers elected by employers, and the other half workmen elected by workmen, each class voting separately. Workmen sitting on cases judged by these courts are paid by the commune for every day's sitting. In the case of the minor trades, which cannot maintain regular arbitration courts, the trade laws assign the adjudication of all disputes between masters and men in the first instance to the representatives of the trade in which such disputes arise, and, in places where the necessary quorum for that purpose cannot be made up by the local representatives of any particular trade, the deficiency is supplied by a certain number of workmen temporarily appointed by the municipal authorities from amongst the most respectable and intelligent members of their class to act as arbitrators in such cases. Disputes which cannot be settled in this way must be decided by the common law courts; and it is only a court of law which can take cognizance of a claim raised thirty days after the expiration of a contract to which it refers.

In England no such compulsory legislation exists. The old guilds acted as arbitration courts, and, although their decision was practically binding, the guilds were only adapted to deal with small craftsmen acting singly. In modern times the law has been very reluctant to give effect even to voluntary agreements for referring disputes to arbitration, on a notion that to take away the jurisdiction of the ordinary tribunals and to set up another was contrary to settled principles. There are now several statutes, however, for giving legal effect to the awards of arbitrators in trade disputes voluntarily referred to arbitration and sitting in the way pointed out. The most successful arbitrations between employers and employed appear to be under voluntary submissions, in accordance with rules previously agreed to by employers and employed, in particular manufactures, the decisions being acted upon independently of any legislative aid.

Applied to the one pre-eminently important—probably the only great—question, the rate of wages, reference to arbitration is full of difficulties. The difference relates to the future, not to the past. It is an erroneous notion that strikes and lock-outs involve any breach of contract. In former days it may have been that employer and employed refused to carry out a contract on the ground that the other side had first failed in the performance of some condition precedent to the right to call on the other to perform work or to pay for it, as the case might be; but in the present day the disturbance of the previous relationship of employer and employed generally occurs without any such allegation on one side or the other. Thus, in a strike terminated while this article is in the press, the contracts between employers and employed in the pottery trade of North Staffordshire were previously at an end by lapse of time. The question in such cases is on what terms the parties will agree for the future relationship of employer and employed, there being no such relationship when the strike began, and of course none while it is pending. This goes to the root of the whole matter, although it may seem a technical mode of looking at it. But if no such obstacle existed, there are difficulties of another kind. In such cases a board of conciliation is inevitably equally divided, and reference to an umpire becomes necessary. To give confidence, he must not be an employer or employed in the trade. In general, therefore, he must know nothing previously of the subject he had undertaken to settle. He must deal with it on such imperfect knowledge as he can acquire in the arbitration, and apply such general principles as may occur to him. Nevertheless much good has been done by a good-tempered calm inquiry in which both sides learn perhaps for the first time the grounds on which the demand is made or resisted.

A recent important Act of Parliament, the Employers' Liability Act, 1880, must be noticed. To render its provisions intelligible, it is necessary to state the general law on the subject of civil liability for negligence. A person who causes injury to the person or property of another is liable in damages to that person, and if the injury has resulted in death, the right of action is extended to the representatives, on behalf of the widow or children, independently of any criminal liability incurred by the negligence. If the person who committed the negligent act is in the service of another, and the negligent act was committed in the course of the discharge of his duty, the civil liability extends to the master. This liability of the master is important to the injured person, because the servant is in most cases a much poorer person than the master. If they were equally able to pay damages, nothing would be gained by resorting to the master. But the liability of the latter was not, before 1880, extended to make the master responsible in damages if the person injured and the negligent servant were both in his service and both were performing the same kind of duty, a "common employment," as it has been termed, and if the master, so far from being guilty of any actual negligence himself, had employed a generally competent person, and had provided him with the means of properly performing his duty. No vindication of the then law seems necessary, for, whether the liability of an employer to strangers is just or not, there is an obvious distinction between such a liability and responsibility where all parties are "rowing in the same boat," to adopt an expression used in one case, whether the injured person be a servant or guest of the master. Both are volunteers, and both know that the master will not personally intervene. There does not appear to be any injustice in such a case in confining the liability to that of the servant personally guilty of the negligence, although a poor man. However, some apparently hard cases, especially arising out of accidents on railways, where, while a passenger could sue the company for negligence, an engine-driver or a guard's remedy was limited to the person actually guilty of the negligence, led to the attention of parliament being called to the subject. In 1877 a committee of the House of Commons, pointing out that the development of modern industry has created large numbers of employing bodies, such as corporations and public companies, to whom it is not possible to bring home personal default, and that there are other cases in which masters leave the whole conduct of their business to agents and managers, themselves taking no personal part whatever either in the supply of materials or in the choice of subordinate servants, reported thus:

"Your committee are of opinion that in cases such as

> these, that is, where the actual employers cannot personally discharge the duties of masters, or where they deliberately abdicate their functions and delegate them to agents, the acts or defaults of the agents who thus discharge the duties and fulfil the functions of masters should be considered as the personal acts or defaults of the principals and employers, and should impose the same liability on such principals and employers as they would have been subject to had they been acting personally in the conduct of their business, notwithstanding that such agents are technically in the employment of the principals. The fact of such a delegation of authority would have to be established in each case, but this would not be a matter of difficulty. Your committee are further of opinion that the doctrine of common employment has been carried too far when workmen employed by a contractor and workmen employed by a person or company who has employed such contractor are considered as being in the same common employment."

Three years afterwards the Act in question was passed. By sect. 1, where personal injury is caused to a workman—

> "(1.) By reason of any defect in the condition of the ways, works, machinery, or plant connected with or used in the business of the employer; or (2) by reason of the negligence of any person in the service of the employer, who has any superintendence entrusted to him, whilst in the exercise of such superintendence; or (3) by reason of the negligence of any person in the service of the employer to whose orders or directions the workmen at the time of the injury was bound to conform and did conform, where such injury resulted from his having so conformed; or (4) by reason of the act or omission of any person in the service of the employer done or made in obedience to the rules or by-laws of the employer, or in obedience to particular instructions given by any person delegated with the authority of the employer in that behalf; or (5) by reason of the negligence of any person in the service of the employer who has the charge or control of any signal, points, locomotive engine, or train upon a railway,—the workman, or, in case the injury results in death, the legal personal representatives of the workman, and any persons entitled in case of death, shall have the same right of compensation and remedies against the employer as if the workman had not been a workman of nor in the service of the employer, nor engaged in his work."

Section 2 provides that a workman shall not be entitled under the Act to any right of compensation or remedy against the employer in any of the following cases:

> "(1) Under subsection 1 of section 1, unless the defect therein mentioned arose from, or had not been discovered or remedied owing to, the negligence of the employer, or of some person in the service of the employer, and entrusted by him with the duty of seeing that the ways, works, machinery, or plant were in proper condition; (2) under subsection 4 of section 1, unless the injury resulted from some impropriety or defects in the rules, by-laws, or instructions therein mentioned; provided that, when a rule or by-law has been approved or has been accepted as a proper rule or by-law by one of her Majesty's principal secretaries of state, or by the Board of Trade, or any other department of the Government, under or by virtue of any Act of Parliament, it shall not be deemed for the purposes of this Act to be an improper or defective rule or by-law; (3) in any case where the workman knew of the defect or negligence which caused his injury and failed within a reasonable time to give, or cause to be given, information thereof to the employer or some person superior to himself in the service of the employer, unless he was aware that the employer or such superior knew of the said defect or negligence."

Compensation under this Act (which extends to a railway servant and any person to whom the Employers and Workmen Act, 1875, already noticed, applies) is enforced by action in the county court (in Scotland the sheriff's court, in Ireland the civil bill court) after notice within six weeks of the nature and particulars of the claim (unless there was reasonable excuse for the want of notice in the case of death). The compensation is limited to three years' earnings, and the action must be commenced within six months from the occurrence of the accident, or in case of death within twelve months from the time of death.

Neither in the United Kingdom nor abroad does the right to damages for breach of contracts override the general law as to offences, so that, if any of the parties do anything amounting to a criminal offence, a prosecution may follow although a breach of contract is involved for which breach damages may be recovered. There are moreover a variety of Acts of Parliament from the reign of Anne still in force for securing employers from the frauds of workmen employed in various trades in working up materials, not only as regards the misappropriation of property entrusted to them, but also in relation to fraudulent contrivances for misrepresenting the amount of work done. For such offences fine or imprisonment may be inflicted.

Apart from the legislation already mentioned, there are a great number of Acts of parliament directly or indirectly affecting labor. The general direction of all such legislation is to ameliorate the condition of workmen.

The legislation regulating the hours of labor of young persons, originating in the benevolent exertions of the earl of Shaftesbury, and extended by Lord Aberdare as secretary of state for the home department and others, is most important (see FACTORY ACTS). The indirect effects of those provisions in causing better order in the conduct of manufacturing industries cannot be overlooked. The Agricultural Gangs Act, 1867, arising out of the practice in the east of England of persons known as gang masters hiring children, young persons, and women, with a view to contracting with farmers and others for agricultural work, is a recent illustration of the direct objects of such legislation. The fencing of machinery, the careful working of coal and metalliferous mines, and the like, have been the subject of minute legislative provisions, which, as well as the Explosives Act, 1875, intimately affect the well-being of the laboring community and the general safety.

The wants of servants are considered in the preference shown to claims for wages in the case of death and bankruptcy, and the general need of all classes of workmen is kept in view in the provisions relating to workmen's dwellings, and the obligation of railway companies to afford facilities for their conveyance at a low rate. Less directly they are considered in the legislation relating to friendly and provident societies; of equivocal effect was the legislation respecting small loans, intended to facilitate the purchase of tools, but taken advantage of to form loan societies of doubtful general benefit to the community. We cannot notice here the effect of the laws regulating the land and sea forces on contracts relating to labor by persons entering the army or navy. (J. E. D.)

LABRADOR, in the widest acceptation of the word, is the peninsular portion of North America bounded on three sides by the Gulf of St. Lawrence, the North Atlantic, Hudson's Straits, and Hudson's Bay, and vaguely defined towards the southwest by Rupert's river, the Mistassini river, and the Bersiamits river. It extends from about 49° to 63° N. lat., and from the 55th to the 79th meridian. Its greatest length from the Straits of Belle Isle, which separate it from Newfoundland, to Cape Wolstenholme, its most northern extremity, is 1100 miles; its greatest breadth is about 700 miles. The area is approximately 420,000 square miles, equal to the united areas of the British Isles, France, and Prussia. As a permanent abode of civilized man, Labrador is on the whole one of the most uninviting regions on the face of the earth. The Atlantic coast is the edge of a vast solitude of rocky hills, split and blasted by frosts and beaten by the waves. A vast table-land, in one region 2240 feet above the sea-level, occupies much of the interior. "This plateau," says Professor Hind, "is pre-eminently sterile, and, where the country is not burned, caribou moss covers the rocks, with stunted spruce, birch, and aspen in the hollows and deep ravines. The whole of the table-land is strewed with an infinite number of boulders, sometimes three and four deep; these singular erratics are perched on the summit of every mountain and hill, often on the edges of cliffs, and they vary in size from 1 foot to 20 feet in diameter. Language fails to paint the awful desolation of the table-land of the Labrador peninsula."

The interior of Labrador has been but very partially explored, and even the course of the main rivers is largely matter of conjecture. The largest is probably the Ashwanipi or Hamilton river, which rises in the rear of the Seven Islands, drains a portion of the vast table-land, and falls into Hamilton Inlet, on the Atlantic coast. At its mouth it is nearly a mile and a half in width. One hundred miles from its mouth are the great falls and rapids, which extend over 20 miles, and involve fifteen portages. The valley of this river is well wooded, some of the trees, which are chiefly spruce, white birch, and poplar, being of considerable size, and tracts of loamy soil being found at intervals along its banks. The Kenamou and the Nasquapee or Northwest river also fall into Hamilton Inlet. The Eagle river, the West and East rivers, all famous for salmon and trout, discharge their waters into Sandwich Bay. Of the rivers falling into Ungava Bay the largest is Koksoak or South river, which is 3 miles wide at its mouth, and has its source in Lake Kaniapuscaw, 70 miles long and 20 broad, which occupies the very centre of the peninsula, being equidistant from the St. Lawrence, Ungava, and Hamilton Inlet, and 350 miles from each. George's river and Whale river also fall into Ungava Bay. The aspect of the country drained by these rivers is forbidding in the extreme, bleak and barren rocks, with a few stunted trees at the mouths of the rivers or around the lakes, being the most marked features. In a few sheltered spots, however, on the margins of the rivers, timber of fair size is to be found. The rivers discharging into Hudson's Bay are Rupert's river, East Main, and Great and Little Whale rivers. The Moisie river, 250 miles in length, the Mingan, and the Ounaneme fall into the Gulf of St. Lawrence. The St. Augustine falls into a fine bay of the same name, and has its source in the lakes and marshes of the table-land. The country through which these rivers flow is rugged and mountainous, swamps and innumerable lakes occupying the lower grounds.

By far the most important portion of Labrador is the Atlantic seaboard. The coast itself is rugged, but is deeply indented with bays and inlets, and has many fine harbors. The scenery is grand and impressive. Dark and yellow headlands towering over the waters are ever in sight, some grim and naked, others clad in the pale green of mosses and dwarf shrubbery. With miles on miles of rocky precipices alternate lengthened sea slopes, tame and monotonous, or fantastic and picturesque in form, with stony vales winding alway among the blue hills of the interior. Battle Harbor at the northern extremity of the straits of Belle Isle, is a busy fishing settlement with a narrow sheltered roadstead about half a mile in length between Battle Islands and Great Caribou Island. The water is of great depth in this neighborhood, and is noted for its wonderful ground swell, which at times rolls in without wind from the eastward into St. Louis Sound, "bursting," as Admiral Bayfield describes it, "with fury over islets 30 feet high, or sending sheets of foam and spray sparkling in the sunbeams 50 feet up the sides of precipices." By far the greatest of the numerous inlets which indent the coast is Eskimo Bay or Ivuktoke or Hamilton Inlet, 250 miles north of the straits of Belle Isle. This inlet is 30 miles wide at the entrance, but at Port Rigolette, 50 miles from the sea, it narrows to a mile. On both sides of these narrows hills tower to the height of 1000 feet, wooded with spruce from base to summit. At the termination of this gorge the inlet again expands and forms Lake Melville, 30 miles in length and 20 in breadth. After narrowing again it forms another lake (Goose Bay) 7 miles wide and 20 long, and at its extremity the head of the great inlet is reached, 150 miles from the sea. The scenery along the shores of Hamilton Inlet is wild and rugged, and above Rigolette becomes very grand. Along the south shore of Melville lake are the volcanic peaks of the Mealy Mountains, 1500 feet in height. This range commences 100 miles to the south of Hamilton Inlet, running nearly parallel to the coast; and after skirting Lake Melville it strikes westerly and is lost in the hilly regions of the interior.

Northern Labrador, from Cape Webeck to Cape Chudleigh, is the proper home of the Eskimo of this region, who are now about 1400 in number.[1] By the labors of the Moravian Brethren, commenced in 1770, nearly the whole of them have been brought under Christian training. The Brethren have four stations—Hopedale (55° 25′ N. lat.), Nain (56° 25′), Okkak (57° 33′), and Hebron (58° 50′). Each station has a church, store, dwelling-house for the missionaries, and workshops for the native tradesmen. The missionaries number about twenty.

The white inhabitants of the St. Lawrence coast of Labrador are chiefly of Acadian or Canadian origin, with a few settled fishermen from France. On the Atlantic coast of Labrador many of the white inhabitants are British sailors and their descendants. Salmon and cod-fishing are their main occupations; and the products of their industries are exchanged with traders on the spot for such commodities as they require. The winter is passed in trapping fur-bearing animals. There are nine places of worship—four of the Church of England, three of the Church of Rome, and two Wesleyan. During the fishing season a steamer carrying mails and passengers plies fortnightly on the coast, connecting with the Newfoundland coastal steamer at Battle Harbor.

The Indians inhabiting the interior of Labrador are now greatly reduced in numbers. The returns of the Hudson's Bay Company show that about four thousand of these Indians frequent the company's posts throughout the whole of Labrador; and this account probably includes nearly their whole strength. Nineteen-twentieths of them are nominally Roman Catholics. The early Jesuit missions in Canada extended to Labrador; and of late years Roman Catholic missions have been resumed and are now systematically carried on. Game of all kinds is every year becoming scarcer, and in many parts has almost disappeared. Fires have destroyed the forests, berry-bearing shrubs, mosses, and lichens, and converted whole districts into hopeless deserts. The savage tribes wander over a vast extent of country, and have established routes along certain rivers and lakes, by which periodically they make their way to the sea-coast, to exchange the products of the chase for firearms, clothing, and other necessaries.

It is only in the interior valleys of the rivers, at some distance from the coast, that any extent of forest appears; but there sufficient timber for fuel and building purposes can almost always be found. The trees are chiefly larch, birch, aspen, silver fir, black, white, and red spruce, willow, cherry, and mountain ash. Among the wild animals may be enumerated reindeer, black and white bears, wolves, foxes, martens, lynxes, otters, minks, beavers, muskrats, hares, rabbits, moles. The birds are represented by the hawk, falcon, eagle, owl, raven, ptarmigan, spruce partridge, curlew, gray plover, sandpipers and other waders, geese, ducks, gulls, divers, swallows, martins, snipe, pigeons. Berry-bearing plants abound in many regions—whortleberries, raspberries, cranberries, partridge berries, bake appleberries, wild currants, and wild gooseberries. In summer, where there are sheltered spots, mosses of every hue, wild flowers of the most delicate colors, ferns, and tall grasses diversify the scene.

Though Labrador is detached from Arctic lands, and though much of it lies between the same parallels of latitude as Great Britain, the climate is rigorous in the extreme, owing mainly to the ice-laden Arctic current which washes its shores. Snow lies from September or October till June. In winter the whole coast is blockaded by ice-fields drifting from Baffin's Bay and other outlets of the Arctic Ocean; while in summer icebergs, stranded or floating, impart a stern grandeur to the frowning shores. At Nain the mean annual temperature is 22.52° Fahr., at Okkak, 27.86°, and at Hopedale, 27.82°. In summer the thermometer sometimes reaches 75°; spirits freeze in the intense cold of winter, and 30° below zero is not uncommon but, owing to the dryness of the air and the absence of high winds, such a temperature is not felt as uncomfortable.

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[1] The dialect of the Labrador Eskimo is treated of in Kleinschmidt, *Gram. d. grönland. Sprache*, Berlin, 1851.

The winter is one continued stretch of cold dry frosty weather, and is felt to be bracing by those accustomed to it. Travelling is performed by sledges drawn by dogs, sometimes at the rate of 100 miles a day, over the frozen snow.

The total permanent population of Labrador is about 12,500, and is distributed as follows:

On the St. Lawrence coast from Port Nuef to Blanc Sablon	4,411
On the Atlantic coast—white population	2,416
" " Eskimo	1,700
Indians of the interior	4,000
Total	12,527

Tourists in search of the picturesque, invalids, sportsmen, and anglers are finding their way, of late years, in increasing numbers to Labrador during its brief but lovely summer; and in the fishing season from the end of June to the first or second week of October the migratory population from Newfoundland, Nova Scotia, Canada, and the United States numbers between 20,000 and 25,000.

But little is known of the geology of Labrador. It has been ascertained, however, that the Laurentian formation constitutes the great framework of the peninsula, and that Lower Silurian beds, principally Potsdam, rest on the Laurentian at various points along the coast. On the north side of the Straits of Belle Isle there is a large development of Lower Silurian rocks, corresponding to those on the Newfoundland side opposite. The Potsdam rocks here are gray and reddish sandstones, 230 feet in thickness, overlaid by 140 feet of limestone, with some shale. These limestones and sandstones extend about 80 miles along the coast, and about ten miles back from the shore. All over the country gneiss ranges of mountains and hills and gneiss boulders in countless multitudes are everywhere met with. "The rocks of this formation," says Sir William Logan, "are the most ancient known on the American continent, and correspond probably to the oldest gneiss of Finland and Scandinavia, and to some similar rocks in the north of Scotland." The system is made up of crystallized rocks, and may be considered as an alternation of crystalline schists, quartzites, limestones, and serpentines. Copper ore has been discovered at various points along the coast; also silver, lead, and mica, as well as gold.

The southern portion of the Labrador coast, as far north as Sandwich Bay, has been frequented as a fishing ground for more than a century. Since about 1850 large numbers of fishermen have extended their operations as far north as Cape Harrison or Webeck. From about 1870 Newfoundland cod-fishers have ventured as far north as Cape Mugford; and the probability is that they will soon be attracted still farther, to Cape Chudleigh, at the entrance of Hudson's Straits, by the reports of the amazing quantity of fish. From Cape Harrison to Cape Mugford the coast, like that of Norway, is deeply serrated by a succession of narrow fiords stretching from 30 to 50 miles into the interior. As far as Freestone Point, 120 miles north of Cape Harrison, the heads of many of these fiords contain timber fit for the construction of fishing craft and all ordinary building purposes. The climate and soil of these sheltered spots also permit the cultivation of potatoes and garden vegetables. According to Professor Hind, "it is fringed with a vast multitude of islands forming a continuous archipelago from Cape Aillik to Cape Mugford, averaging 20 miles in depth seawards. Outside these islands, and about 15 miles seawards from them, are numerous banks and shoals which form the summer feeding ground of large cod, and a second range of banks, outside the shoals, which are probably their winter feeding grounds." This island-studded area, exclusive of the banks and shoals, from Cape Harrison to Cape Mugford, he estimates at 5200 square miles, furnishing a boat fishing ground for cod (which as yet has hardly been touched) nearly as large as the combined areas of the English and French boat fishing ground on the coasts of Newfoundland. The Arctic current which washes the coast of Labrador exerts a most important influence on the fish life of those regions, as well as on that of the seas around Newfoundland, Canada, and the United States, forming, in many places, "a living mass, a vast ocean of living slime;" and this slime "accumulates on the banks of Northern Labrador, and renders the existence possible of all those forms of marine life which contribute to the support of the great shoals of cod which also find their home there" (Hind). The same current which brings the slime and multitudes of minute crustaceans also carries on its bosom innumerable cod ova, and distributes them far and wide.

The principal fisheries are those of cod, herrings, salmon, and seals. The following table is compiled from the Newfoundland customs returns for the year ending July 31, 1880:

Exported by Newfoundland Houses from Labrador direct.	
393,436 quintals dried codfish	$1,180,308
144 quintals green codfish	144
1,096 seal skins	1,096
50 tons seal oil	6,400
76 do cod oil	10,032
1 do other oils	108
17 do blubber	236
592 tierces pickled salmon	8,288
16,970 barrels pickled herrings	50,910
14 barrels pickled trout	98
459 barrels pickled mackerel	1,376
58 barrels dried capelin	29
	$1,259,025

Exported by Houses not connected with Newfoundland.	
14,000 quintals dried codfish	$42,000
110 seal skins	110
14 tons seal oil	1,792
55 do cod oil	7,260
2 do refuse	28
15 do blubber	210
400 tierces pickled salmon	5,600
80,000 lb salmon in tins	8,000
700 barrels pickled herrings	2,100
40 barrels pickled trout	280
200 barrels pickled mackerel	600
180 barrels dried capelin	80
	$63,060

The estimated value of exports by traders being £19,950, this gives for the total exports $1,342,035, or £279,590 sterling.

To these direct exportations must be added the fish of various kinds taken at Labrador and sent to Newfoundland for shipment, amounting to about a third of the whole; also the quantities taken by American and Canadian fishermen of which no returns can be obtained, but which are estimated to be about an eighth of the quantities taken by Newfoundland fishermen. These last can work the fisheries more successfully than those coming from a distance, and are gradually absorbing the trade. The total catch by Newfoundlanders, Canadians, Americans, and Eskimo on the Atlantic and St. Lawrence coasts of Labrador may be valued at £1,000,000 sterling per annum, and is increasing steadily. The number of vessels employed annually is estimated at from 1100 to 1200.

Labrador as well as Newfoundland was discovered by John Cabot in 1497; the recent discovery of a map made by or under the direction of Sebastian Cabot proves that it must surrender the honor of being his "Prima tierra vista" to the present island of Cape Breton. Cabot does not appear to have given any name to Labrador; tradition has it that a Basque whaler, called "Labrador," penetrated as far as Labrador Bay (now Bradore Bay), and that, as this bay was in process of time much frequented by Basque fishermen, the name was extended to the whole coast. The Basques were the successors of the Norsemen. After them, about the year 1520, came the Bretons, who founded the town of Brest in Bradore Bay, about 3 miles from Blanc Sablon harbor, which at one time contained upwards of one thousand permanent residents. The ruins and terraces of this old town are still visible. For a lengthened period extensive fisheries (to which they attached the greatest importance) were carried on by the French on the Labrador coast, near the Straits of Belle Isle. After the British conquest of Canada the whole fisheries along the southern and eastern shores of Labrador were placed under the government of Quebec, and they continued so till 1763, when the Atlantic coast was annexed to the government of Newfoundland, the boundary between the two jurisdictions being fixed at Blanc Sablon. In 1773, owing to difficulties arising out of grants made to a few persons, under French rule, the eastern coast was restored to the government of Quebec; but since 1809 it has been again attached to Newfoundland. In 1824 the governor of Newfoundland was empowered to institute a court of civil jurisdiction on the coast of Labrador. At present the civil and criminal court of Labrador is presided over by one judge appointed by the governor in council. All goods landed are subjected to the duties imposed on like goods in any part of the island of Newfoundland. The extent of the jurisdiction of the government of Newfoundland in Labrador is thus defined (Letters-Patent, 28th March, 1876): "All the coast of Labrador from the entrance of Hudson's Straits to a line to be drawn due north and south from Anse Sablon on the said coast to the fifty-second degree of north latitude, and all the islands adjacent to that part of the said coast of Labrador." The northwestern portion, or that which drains into Hudson's Bay and Hudson's Straits, now forms the Northeast Territory of the Dominion of Canada, and the southern portion, draining into the Gulf of St. Lawrence, is incorporated with the province of Quebec. An undefined area of what is now the Northeast Territory was formerly known as East Main.

See Cartwright, *Sixteen Years on the Coast of Labrador*, Newark, 1792; Hind, *Explorations of the Labrador Peninsula*, 1863; Chimmo, in *Journ. Roy. Geog. Soc.*, 1868; Bell, in *Report of the Geol. Survey of Canada*, 1879. (M. H.)

LA BRUYÈRE, JEAN DE (1645–1696), essayist and moralist, was born at Paris in August, 1645, and not, as has more commonly been asserted, at Dourdan (Seine-et-Oise) in 1639. His family was of the middle class, and his reference to a certain Geoffroy de la Bruyère, a crusader, is only a satirical illustration of a method of self-ennoblement common in France as in some other countries. Indeed he himself always signed the name Delabruyère in one word, thus avowing his *roture*. His progenitors, however, were of respectable position, and he could trace them back at least as far as his great-grandfather, who had been a strong Leaguer. La Bruyère's own father held a municipal appointment in the capital, and seems as well as his son to have been in easy circumstances. The son was educated by the Oratorians, and at the university of Orleans; he was called to the bar, and in 1673 bought a post in the revenue department at Caen, which gave the status of noblesse and a certain income. He afterwards in 1687 sold this office. His predecessor in it was a relation of Bossuet, and it is thought that the transaction was the cause of La Bruyère's introduction to the great orator. Bossuet, who from the date of his own preceptorship of the dauphin, was a kind of agent-general for tutorships in the royal family, introduced him in 1683 or 1684 to the household of the great Condé, whose grandson Henri Jules de Bourbon he was charged to educate. The rest of his life was passed in the household of the prince or else at court, and he seems to have profited by the inclination which all the Condé family had for the society of men of letters without suffering from the capricious and tyrannical temper which was also one of the characteristics of the house. Very little is known of the events of this part or indeed of any part of his life. Although he certainly mixed freely in society at a time when more gossip was committed to paper than at almost any other, the notices of him are very few, though they are almost always favorable. The impression derived from them is of a silent, observant but somewhat awkward man, resembling in manners our own Addison, whose master in literature La Bruyère undoubtedly was. Yet despite the numerous enemies which his book raised up for him, most of the few personal notices we have are, as has been said, favorable—notably that of St. Simon, an acute judge and one bitterly prejudiced against roturiers generally. There is a curious passage in a letter from Boileau to Racine in which he regrets that "nature has not made La Bruyère as agreeable as he would like to be," which, as he at the same time calls him a "fort honnête homme," and says that he would lack nothing were it not for the conduct of nature in this respect, can only refer to the want of manner just noticed. His *Caractères* appeared in 1688, and at once, as Malezieu had predicted, brought him "bien des lecteurs et bien des ennemis." At the head of these were Thomas Corneille, Fontenelle, and Benserade, who were pretty clearly aimed at in the book, as well as innumerable other persons, men and women of letters as well as of society, on whom the cap of La Bruyère's fancy-portraits was fitted by manuscript "keys" which were at once compiled by the scribblers of the day. The friendship of Bossuet and still more the protection of the Condés defended the author quite sufficiently, and he continued to insert fresh portraits of his contemporaries in each new edition of his book. Those, however, whom he had attacked were powerful in the Academy, and numerous defeats awaited La Bruyère before he could make his way into that guarded hold. He was defeated thrice in 1691, and on one memorable occasion he had but seven votes, five of which were those of Bossuet, Boileau, Racine, Pelisson, and Bussy-Rabutin. It was not till 1695 that he was elected, and even then an epigram, which, considering his admitted insignificance in conversation, was not of the worst, *hæsit lateri*:

> "Quand la Bruyère se présente
> Pourquoi faut il crier haro?
> Pour faire un nombre de quarante
> Ne falloit il pas un zéro?"

His unpopularity was, however, chiefly confined to the subjects of his sarcastic portraiture, and to the hack writers of the time, of whom he was wont to speak with a disdain only surpassed by that of Pope. His description of the leading newspaper of the day as "immédiatement au dessous du rien" is the best remembered specimen of those unwise attacks which, both in France and England, retarded the establishment of an independent profession of letters for many years. La Bruyère's discourse of admission at the Academy was, like his admission itself, severely criticised, yet it is certainly one of the best of its kind. With the *Caractères*, the translation of Theophrastus, and a few letters, it completes the list of his literary work, with the exception of a curious and much-disputed posthumous treatise. La Bruyère died very suddenly, and not long after his admission to the Academy. He is said to have become suddenly deaf in an assembly of his friends, and, being carried home to the Hôtel de Condé, to have expired of apoplexy a day or two afterwards. It is not surprising that, considering the recent panic about poisoning, the bitter personal enmities which he had excited, and the peculiar circumstances of his death, suspicions of foul play should have been entertained, but there seems to be no foundation for them. Two years after his death appeared certain *Dialogues sur le Quiétisme*, alleged to have been found among his papers incomplete, and to have been completed by the editor. As these dialogues are far inferior in literary merit to La Bruyère's other works, their genuineness has been denied. But the straightforward and circumstantial account of their appearance given by their editor, the Abbé Dupin, a man of acknowledged probity, the intimacy of La Bruyère with Bossuet, whose views in his contest with Fénelon these dialogues are designed to further, and the entire absence at so short a time after the alleged author's death of the least protest on the part of his friends and representatives, seem to be decisive in their favor.

Although for reasons to be given shortly it is permissible to doubt whether the value of the *Caractères* has not been somewhat exaggerated by traditional French criticism, they deserve beyond all question a high place among the great works of French literature. The plan of the book is thoroughly original, if that term may be accorded to a novel and skilful combination of existing elements. That the little treatise of Theophrastus may have furnished the first idea of it is doubtless true, but only a very small part of the Frenchman's work is due to the Greek. With the ethical generalizations and social Dutch painting of Theophrastus La Bruyère combined the peculiarities of the Montaigne essay of the *Pensées* and *Maximes* of which Pascal and La Rochefoucauld are the masters respectively, and lastly of that peculiar 17th century product, the portrait or elaborate literary picture of the personal and mental characteristics of an individual. The result was quite unlike anything that had been before seen, and it has not been exactly reproduced since, though the essay of Addison and Steele resembles it very closely, especially in the introduction of fancy portraits. In the titles of his work and in its extreme desultoriness, La Bruyère reminds the reader of Montaigne, but he aimed too much at sententiousness to attempt even the apparent continuity of the great essayist. The short paragraphs of which his chapters consist are made up of maxims proper, of criticisms literary and ethical, and above all of the celebrated sketches of individuals baptized with names taken from the plays and romances of the time. These last are undoubtedly the great feature of the work, and that which gave it its immediate if not its enduring popularity. They are wonderfully piquant, extraordinarily life-like in a certain sense, and must have given great pleasure or more frequently exquisite pain to the originals, who were in many cases unmistakable and in most recognizable by a society which held to the full Madame de Sévigné's views of the usefulness of "le prochain" as a butt for satirical observation. But there is something wanting in them. The criticism of Charpentier, who received La Bruyère at the Academy, and who was of the opposite faction, has usually been dismissed as one-sided, but it is in fact fully justified as far as it goes. La Bruyère literally "est [trop] descendu dans le particulier." He has neither like Molière embodied abstract peculiarities in a single life-like type, nor has he like Shakespeare made the individual pass *sub speciem æternitatis*, and serve as a type while retaining his individuality. He is a photographer rather than an artist in his portraiture. So too his maxims, admirably as they are expressed, and exact as their truth often is, are on a lower level than those of La Rochefoucauld, which, rather unwisely, they sometimes follow very closely. Beside the sculpturesque precision, the Roman brevity, the profoundness of ethical intuition "piercing to the accepted hells beneath," of the great Frondeur, La Bruyère has the air of a literary *petit-maître* dressing up superficial observation in the finery of *esprit*. It is indeed only by comparison that he loses, but then it is by comparison that he is usually praised. There is no doubt that his abundant wit and his personal "malice" have done much to give him his rank in French literature, but much must also be allowed to his purely literary merits. With Racine and Massillon he is probably the very best writer of what is somewhat arbitrarily styled classical French. He is hardly ever incorrect—the highest merit in the eyes of a French academic critic. He is always well-bred, never obscure, rarely though sometimes "precious" in the turns and niceties of language in which he delights to indulge, in his avowed design of attracting readers by form now that in point of matter "tout est dit." It ought to be added to his credit that he was sensible of the folly of impoverishing French by ejecting old words. His chapter on "Les ouvrages de l'esprit" contains much good criticism, though it shows that, like most of his contemporaries except Fénelon, he was lamentably ignorant of the literature of his own tongue.

The editions of La Bruyère, both partial and complete, have been extremely numerous. *Les Caractères de Théophraste traduits du Grec, avec les Caractères et les Mœurs de ce Siècle*, appeared for the first time in 1688, being published by Michallet, to whose little daughter, according to tradition, La Bruyère gave the profits of the book. Two other editions, little altered, were published in the same year. In the following year, and in each year until 1694, with the exception of 1693, a fresh édition appeared, and in all these five, additions, omissions, and alterations were largely made. A ninth edition, not much altered, was put forth in the year of the author's death. The Academy speech appeared in the eighth edition. The Quietist dialogues were published in 1698; most of the letters, including those addressed to Condé, not till 1867. In the last thirty or forty years numerous editions of the complete works have appeared, notably those of Walckenaer (1845), Servois (1867), Asselineau (a scholarly reprint of the last original edition, 1872), and finally Chassang (1876); the last is one of the most generally useful, as the editor has collected almost everything of value in his predecessors. The literature of "keys" to La Bruyère is extensive and apocryphal. Almost everything that can be done in this direction and in that of general illustration was done by the late M. Edouard Fournier in his learned and amusing *Comédie de La Bruyère*. (G. SA.)

LABUAN, or **LABUHAN**, an island of the East Indian Archipelago, which has been a British possession since 1846. It lies about 6 miles off the northwest coast of Borneo, opposite the northern end of the great bay of Brunei. Rudely triangular in shape, it measures about 7 miles across the base, and has a length of 11 miles from north to south. The general flatness of the surface is broken by a number of undulating hills, none of which, however, exceed 90 feet in height. At the time of the first settlement most of the ground was occupied by virgin forest in which camphor trees of noble proportions were conspicuous; but nearly the whole of this has been destroyed either by human effort or by jungle fires. The soil is very poor, except in the valleys of the larger streams. Of the total area, estimated at over 45 square miles, or 29,350 acres, 21,000 acres are supposed to be capable of cultivation; but of this not more than 1500 acres are sown with rice, the only crop attempted on a large scale in the island. The cocoanut flourishes to no small profit on the little island of Daat; and the African oil palm promises well. At the time of its occupation a brilliant future was prophesied for Labuan; its harbor was to make it a second Singapore, and its coal beds were to prove an unfailing source of wealth. Such anticipations are far from having been realized. Though the workable coal in the island has been estimated at no less than 400,000,000 tons, the mines have commercially proved an utter failure. The Scottish Oriental Coal Company—the fourth of its kind—came to an untimely end in 1880; from 1868 it had raised 53,741 tons of clean coal, each ton costing about 72s. and selling for not more than 25s. or 30s. The want of machinery strong enough to keep the workings dry is assigned as one of the chief reasons of the collapse. The coal, which appears to be of Tertiary formation, is of good quality; the mines are on the north end of the island near the village of Lubok Tamiang. The general trade of Labuan consists mainly of the importation and re-exportation of Bornean produce; and most of the Labuan merchants are from Singapore houses. There are several factories for the preparation of sago flour. The total burden of the vessels entering the port in 1879 was only 10,787 tons, of which 8516 was due to steamships. The population, which in 1861 was 2328 (1627 males, 701 females), was 5731 (3414 males, 2317 females) in 1881. It includes Chinese, Klings, chiefly from Karikal in French India, Malay fishermen, and Kudayans and Tutongs from Borneo. Port Victoria, the principal settlement, has no municipal government.

The colony is now self-supporting. The Chinese have schools for their own children; and Sir Henry Bulwer established in 1873 a school for the teaching of Malay and English. The temporary diocese of Labuan includes, not only Sarawak in Borneo, but also Singapore (which is 770 miles distant); and the church of St. Andrews in that city is the cathedral of the see. Convicts have been sent to Labuan from the Straits settlements since 1866.

See Keppel, *Visit to Indian Archipelago*, London, 1858; Mundy, *Narrative of Events in Borneo*, London, 1848; Burbidge, *Gardens of the Sun*, London, 1880.

LABURNUM is the specific name of a familiar tree of the genus *Cytisus*, Dec., of the pea family or *Leguminosæ*. It is a native of the mountains of France, Switzerland, Southern Germany, Northern Italy, etc., has long been cultivated as an ornamental tree throughout Europe, and was introduced into Northeast America by the European colonists. Gerard records it as growing in his garden in 1596 under the names of anagyris, laburnum, or beane trefoyle (*Historie of Plants*, p. 1239), but the date of its introduction into England appears to be unknown. In France it is called l'aubour—a corruption from laburnum according to Du Hamel—as also arbois, *i. e.*, arc-bois, "the wood having been used by the ancient Gauls for bows. It is still so employed in some parts of the Mâconnois, where the bows are found to preserve their strength and elasticity for half a century" (Loudon, *Arboretum*, ii. p. 590).

Several varieties of this well-known tree are cultivated, differing in the size of the flowers, in the form of the foliage, etc., such as the "oak-leafed" (*quercifolium*), *pendulum*, *crispum*, etc. One of the most remarkable forms is *C. Adami*, Poir. (*C. purpurascens*, Hort.), which bears three kinds of blossoms, viz., racemes of pure yellow flowers, others of a purple color, and others of an intermediate brick-red tint—all three kinds being borne by one and the same tree. The last are hybrid blossoms, and are sterile, with malformed ovules, though, curiously enough, the pollen appears to be good. The yellow and purple "reversions" are fertile. It originated in Paris in 1828 by M. Adam, who inserted a "shield" of the bark of *C. purpureus*, Scop., into a stock of *C. Laburnum*, L. A vigorous shoot from this bud was subsequently propagated. Hence it would appear that the two distinct species mentioned above became united by their cambium layers, and the trees propagated therefrom subsequently reverted to their respective parentages in bearing both yellow and purple flowers, but produce as well blossoms of an intermediate or hybrid character. Such a result, Mr. Darwin observes, may be called a "graft-hybrid." For full details see Darwin's *Animals and Plants under Domestication*.

The laburnum has highly poisonous properties. A case is recorded of nearly fatal results to several boys who masticated the roots on finding they tasted like liquorice, which is a member of the same family as the laburnum. It has proved fatal to cattle, though hares and rabbits eat the bark of it with avidity (*Gardener's Chronicle*, 1881, vol. xvi. p. 666). The seeds also are highly poisonous, possessing emetic as well as narcotico-acrid principles, especially in a green state. Gerard (*loc. cit.*) alludes to the powerful effect produced on the system by taking the bruised leaves medicinally. Pliny records that bees will not visit the flowers (*N. H.*, xvi. 31), but this may be an error, for Mr. Darwin found by experiment that insects play an important part in the fertilization of the laburnum.

The heartwood of the laburnum is of a dark reddish-brown color, hard and durable, and takes a good polish. Hence it is much prized by turners, and used with other colored woods for inlaying purposes.

The laburnum has been called false ebony from this character of its wood.

The roots are subject to a peculiar disease, not at all uncommon in other members of the *Leguminosæ*, the fine rootlets swelling into minute club-shaped processes called exostoses, resembling coral-branches in shape. Large masses of such, one or two inches in diameter, may be found at the extremities of the roots of old laburnum trees. They are apparently caused by a fungus which appears to be ubiquitous, as the disease is rarely, if ever, known to be absent, though it does not seem to cause much if any injury to the health of the plants it attacks. See *Studier öfver Leguminosernas rotknölär*, 1874, by Dr. Jacob Erikssen; also *Gardener's Chronicle*, 1879, xi. p. 209, and xii. p. 112.

LABYRINTH. I. The legendary labyrinth is one of the clearest examples of the close relation between mythology and the early stages of the industrial arts. The word λαβύρινθος is derived from the λαῦραι or passages of a mine; the digamma before the ρ has become in the latter a vowel, while in the former it retains its consonantal value. The mines of Greece, like those of Thrace and the Ægean Islands, were probably first worked by the Phœnician traders; and the simple-minded natives regarded the strange holes in the ground with wonder and awe. To the natural fear of darkness was added the invariable tendency of the uneducated to regard as supernatural the power conferred by superior knowledge; moreover, the god of the riches of the lower world was also the god of death and the dead. Their fear expressed itself in tales of the extraordinary ramifications of the dark passages and of the danger to which any heedless intruder into them was exposed. The maze of passages was called a labyrinth; the word became a proper name and gained a life and meaning of its own in legend, quite unconnected with its original application. It retained a more antique form, as proper names frequently do, whereas the mining term λαύρα lost the older character of the digamma. It must have been comparatively late before the word labyrinth acquired this new independence and connotation. The best-known instance of its mythic character is found in the legends of Crete. It was interwoven with the tales, partly founded on historical events and partly derived from ancient religion, which clustered round the name of Minos. The skilful workman, Dædalus, who sums up all the legendary conceptions of skill in handicraft, made for King Minos a labyrinth, in the centre of which the Minotaur was placed. No one who entered this labyrinth could find his way out again; he became the prey of the monster. The seven youths and seven maidens sent regularly by the Athenians as tribute were thus devoured, until Theseus slew the Minotaur, and escaped out of the labyrinth by the help of the clue which Ariadne had given him.

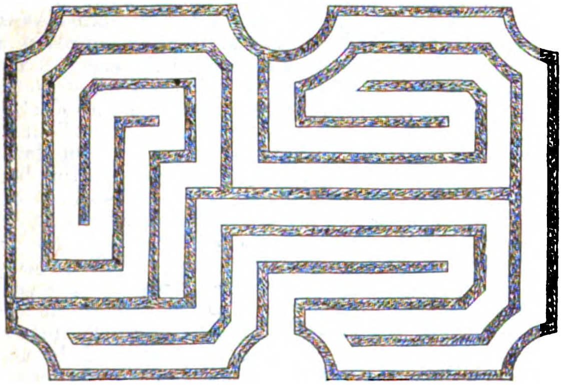
FIG. 1.—Labyrinth of London and Wise.

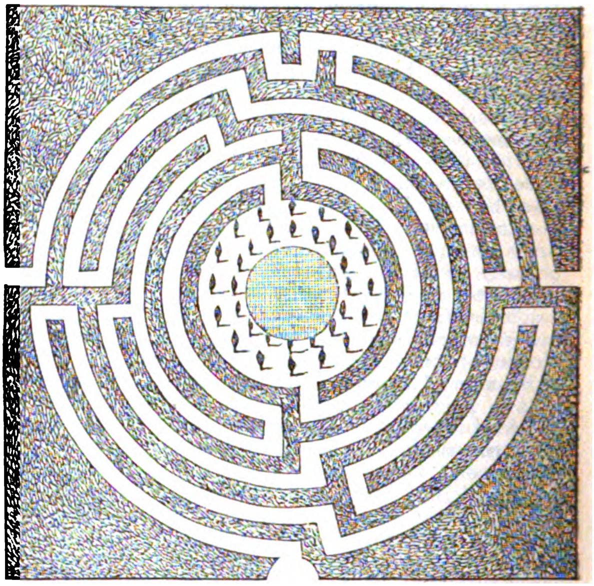
FIG. 2.—Labyrinth of Batty Langley.

Pliny says that there had been in Crete a building called the labyrinth, of which no remains existed in his time; but Hoek has proved quite certainly from the discrepancies and contradictions in accounts and in representations on coins that it had never a real existence. The rocks of Crete are full of winding caves, and these gave the first hint of the legendary labyrinth. This labyrinth is, by the older writers, placed beside Cnossus, and is figured on coins of that city. Late writers, such as Claudian, represent it as being beside Gortyna, and there is a wonderful set of winding passages and chambers in the rocks near that place, which is still pointed out as the labyrinth. When the name had once acquired this meaning, it was applied to several real buildings, of which the following are the most famous. 1. The Egyptian labyrinth, beside the town of Arsinoe or Crocodilopolis, was in two stories, one of them underground, and contained three thousand rooms. Strabo thinks it was built as a common place of meeting for the people of the various nomes; Herodotus and Diodorus say that it was the burial-place of the twelve kings who ruled Egypt about 700 B.C. Müller (*Hist. Greek Art*, § 50–2) also thinks the object of such buildings must have been sepulchral. 2. The Samian labyrinth was built by Theodorus, one of the Samian school of sculptors, for the tyrant Polycrates. It had a hundred and fifty columns, and Pliny says that some scanty remains of it existed in his time. 3. The Lemnian labyrinth, mentioned by Pliny, seems to be a confusion with the Samian (*cf.* Pliny, xxxvi. 19, 3 with 83). 4. The Italian labyrinth was a series of chambers in the lower part of the grave of Porsenna at Clusium. Some maintain that this tomb has been found in the mound named Poggio Gajella near Chiusi.

See Herod. ii. 148; Str. p. 811; Plin. xxxvi. 13 and 19; Müller, *Etrusker*; Dennis, *Cities and Cemeteries of Etruria*; Hoek, *Kreta*. Cockerell (*Travels*), and Prokesch (*Denkwurdigkeiten*) describe the so-called labyrinth of Gortyna.

II. In gardening, a labyrinth or maze means an intricate network of pathways inclosed by hedges or plantations, so that those who enter become bewildered in their efforts to find the centre or make their exit. It is a remnant of the old geometrical style of gardening, but is yet occasionally introduced into pleasure grounds. There are two methods of forming it. That which is perhaps the more common consists of walks, or alleys as they were formerly called, laid out and kept to an equal width or nearly so by parallel hedges, which should be kept so close and thick that the eye cannot readily penetrate through them. The task is to get to the centre, which is often raised, and generally contains a covered seat, a fountain, a statue, or even a small group of trees. After reaching this point the next thing is to return to the entrance, when it is found that egress is as difficult as ingress. To every design of this sort there should be a key, but even those who know the key are apt to be perplexed. Sometimes the design consists of alleys only, as in fig. 1, published in 1706 by London and Wise. In such a case, when the further end is reached, there only remains to travel back again. Of a more pretentious character was a design published by Switzer, in 1742. This is of octagonal form, with very numerous parallel hedges and paths, and "six different entrances, whereof there is but one that leads to the centre, and that is attended with some difficulties and a great many stops." Some of the older designs for labyrinths, on the other hand, avoid this close parallelism of the alleys, which, though equally involved and intricate in their windings, are carried through blocks of thick planting, as shown in fig. 2, from a design published in 1728 by Batty Langley. These blocks of shrubbery have been called wildernesses. To this latter class belongs the celebrated labyrinth at Versailles (fig. 3), of which Switzer observes, that it "is allowed by all to be the noblest of its kind in the world."

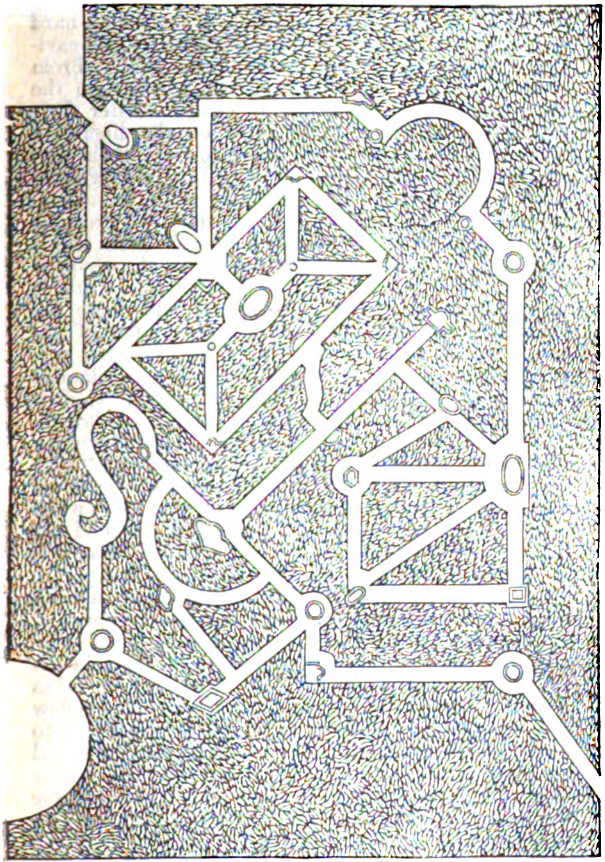

FIG. 3.—Labyrinth at Versailles.

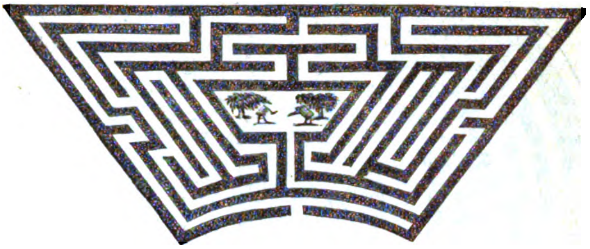

FIG. 4.—Maze at Hampton Court.

Whatever style be adopted, it is essential that there should be a thick healthy growth of the hedges or shrubberies that confine the wanderer. The trees used should be impenetrable to the eye, and so tall that no one can look over them; and the paths should be of gravel and well kept. The trees chiefly used for the hedges, and the best for the purpose, are the hornbeam among deciduous trees, or the yew among evergreens. The beech might be used instead of the hornbeam on suitable soil. The green holly might be planted as an evergreen with very good results, and so might the American arbor vitæ if the natural soil presented no obstacle. The ground must be well prepared, so as to give the trees a good start, and a mulching of manure during the early years of their growth would be of much advantage to them. They must be kept trimmed in or clipped, especially in their earlier stages; trimming with the knife is much to be preferred to clipping with shears. It is not advisable to allow the hedge to run up too quickly or irregularly, so that any plants getting much in advance of the rest should be topped, and the whole kept to some 4 feet or 5 feet in height until the lower parts are well thickened, when it may be allowed to acquire the allotted height by moderate annual increments. In cutting, the hedge (as indeed all hedges) should be kept broadest at the base and narrowed upwards, which prevents it from getting thin and bare below by the stronger growth being drawn to the tops.

The maze in the gardens at Hampton Court Palace (fig. 4), is considered to be one of the finest examples in England. It was planted in the early part of the reign of William III., though it has been supposed that a maze had existed there since the time of Henry VIII. It is constructed on the hedge and alley system, and was, we believe, originally planted with hornbeam, but many of the plants have died out, and been replaced by hollies, yews, etc., so that the vegetation is mixed. The walks are about half a mile in length, and the extent of ground occupied is a little over a quarter of an acre. The centre contains two large trees, with a seat beneath each. The key to reach this resting-place is to keep the right hand continuously in contact with the hedge from first to last, going round all the stops.

The maze in the gardens at Somerleyton Hall, near Lowestoft (fig. 5), was designed by Mr. John Thomas. The hedges are of English yew, and are in very fine condition, without a break or flaw. They are about 6½ feet high, and have been planted a little over thirty years. In the centre is a grass mound, which is raised to the height of the hedges, and on this mound is erected a pagoda, which is approached by a curved grass path. At the two corners on the western side are banks of laurels some 15 or 16 feet high, which are kept trimmed with the knife. On each side of the hedges throughout the labyrinth is a small strip of grass.

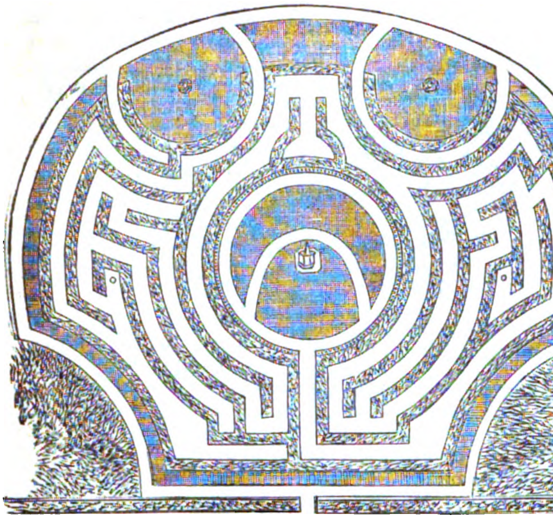

FIG. 5.

There was also a labyrinth at Theobald's Park, near Cheshunt, when this place passed from the earl of Salisbury into the possession of James I. Another is said to have existed at Wimbledon House, the seat of Earl Spencer, which was probably laid out by Brown in the last century. There is an interesting labyrinth, somewhat after the plan of fig. 2, at Mistley Place, Manningtree, the seat of the Rev. C. F. Norman.

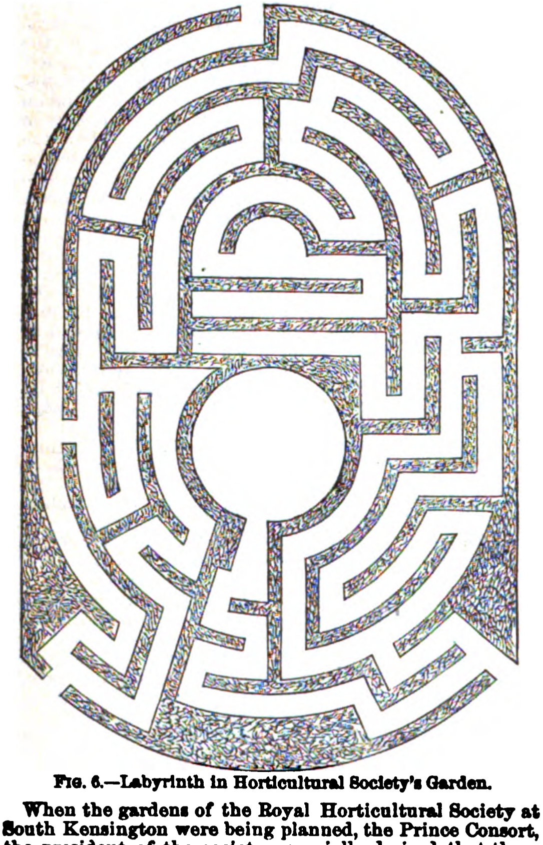

FIG. 6.—Labyrinth in Horticultural Society's Garden.

When the gardens of the Royal Horticultural Society at South Kensington were being planned, the Prince Consort, the president of the society, especially desired that there should be a maze formed in the ante-garden, which was made in the form shown in fig. 6. This labyrinth, which was designed by the late Lieut. W. A. Nesfield, was for many years the chief point of attraction to the younger class of visitors to the gardens; but at last it was allowed to go to ruin, and had to be destroyed. (T. MO.)

LAC is a compound resinous and tinctorial incrustation formed on the twigs and young branches of various trees by an insect, *Coccus lacca* (*Carteria lacca* of Signoret), which infests them. The species of trees upon which it is principally obtained include *Urostigma religiosa*, *U. indica*, *Croton laccifera*, *C. sanguifera*, *Aleurites laccifera*, *Carissa spinarum*, *Mimosa cinerea*, *Erythrina indica*, *Inga dulcis*, *Butea frondosa*, *Zizyphus Jujuba*, *Vismia laccifera*, *Feronia elephantum*, and *Vatica laccifera*. Lac is a product of the East Indies, coming especially from Bengal, Pegu, Siam, and Assam. The insect which yields it is closely allied to the cochineal insect, *Coccus cacti*, kermes, *C. ilicis*, and Polish grains, *C. polonicus*, all of which, like the lac insect, yield a red dye color. The term lac (*Laksha*, Sanskrit; *Lakh*, Hindi) is the same as the numeral lakh—a hundred thousand—and is indicative of the countless hosts of insects which make their appearance with every successive generation. Two evolutions of the young of the lac coccus make their appearance annually, one about the beginning of July and the other early in December. As soon as the minute larval insects make their appearance they fasten in myriads on the young shoots, and, inserting their long proboscides into the bark, draw their nutriment from the sap of the plant. The insects begin at once to exude the resinous secretion over their entire bodies, which forms in effect a cocoon, and, the separate exudations coalescing, a continuous hard resinous layer regularly honeycombed with small cavities is deposited over and around the twig. From this living tomb the female insects, which form the great bulk of the whole, never escape. After their impregnation, which takes place on the liberation of the males, about three months from their first appearance, the females develop into a singularly amorphous-like organism consisting in its main features of a large smooth shining crimson-colored sac—the ovary—with a beak stuck into the bark, and a few papillary processes projected above the resinous surface. The red fluid in the ovary is the substance which forms the lac dye of commerce, and, when the young are allowed to hatch out, the greater part of this coloring matter is lost, and only a dead resinous substance remains on the twig. To obtain the largest amount of both resin and dye-stuff, therefore, it is necessary to gather the twigs with their living inhabitants in or near June and November. Lac incrusting the twigs as gathered is known in commerce as "stick lac;" the resin crushed to small fragments and washed free from coloring matter constitutes "seed lac;" when melted, strained through thick canvas, and spread out into thin layers, this is known as "shell lac," and it is in this last form that the resin is usually brought to European markets. Shell lac, which varies in color from a dark amber to an almost pure black appearance, may be bleached by dissolving in a boiling lye of caustic potash and passing chlorine through the solution till all the resin is precipitated. Bleached lac takes light delicate shades of color, and dyed a golden yellow it is much used in the East Indies for working into chain ornaments for the head and for other personal adornments. Lac is a principal ingredient in sealing wax, and forms the basis of some of the most valuable varnishes, besides being used in various cements, etc. (see LACQUER). Average stick lac contains about 68 per cent. of resin, 10 of lac dye, and 6 of a waxy substance. The resin of lac is a composite body, whose constituents behave differently in presence of chemical reagents.

Lac dye, which is separated by washing stick lac in hot or cold water or in a weak alkaline solution, and dried either by exposure over a fire or in the sun, comes into commerce in the form of small square cakes. It is in many respects similar to, although not identical with, cochineal, and will dye less brilliant shades than that color. It contains about 50 per cent. of coloring matter, with 25 per cent. of resin and 22 per cent of earthy admixture, etc. It is used for dyeing silk and wool, for which purposes it is dissolved in dilute sulphuric acid or somewhat stronger hydrochloric acid; and the substance to be dyed is prepared with a mordant of strong lac spirit, which consists of a solution of stannous chloride. Lac dye has been used from time immemorial in the East, but the knowledge of the substance in the West is comparatively recent. It was first brought to Europe by the East India Company as a substitute for cochineal. The best lac dye comes from Calcutta. Lac lake is an alumina lake containing about 50 per cent. of coloring matter, 40 per cent. of resin, and 9 or 10 per cent. of alumina.

LACAILLE, Nicolas Louis de (1713–1762), a zealous and successful astronomer, was born at Rumigny, near Rheims, March 15, 1713. Left destitute by the death of his father, who held a post in the household of the duchess of Vendôme, his theological studies at the Collége de Lisieux in Paris were prosecuted at the expense of the duke of Bourbon. After he had taken deacon's orders, however, he devoted himself exclusively to science, and, through the patronage of Cassini, obtained employment first in surveying the coast from Nantes to Bayonne, then, in 1739, in remeasuring the French arc of the meridian. The success of this difficult operation, which occupied two years, and achieved the correction of the anomalous result obtained by the elder Cassini in 1684, was mainly due to Lacaille's industry and skill. He was rewarded by admission to the Academy, and the appointment of mathematical professor in Mazarin college, where he worked diligently for some years in a small observatory fitted up for his use. His desire to observe the southern heavens led him to propose, in 1750, an astronomical expedition to the Cape of Good Hope, which was officially sanctioned, and fortunately executed (see Astronomy, vol. ii. p. 661). On his return in 1754 he was distressed to find himself an object of public attention, and withdrew to his former retreat in Mazarin college, where he died, March 21, 1762, of an attack of gout aggravated by unremitting toil. Lalande said of him that, during a comparatively short life, he had made more observations and calculations than all the astronomers of his time put together. And, his carefulness equalling his rapidity, the quality of his work rivalled its quantity. The rectitude of his moral character earned him universal respect, and his career ranks, if not amongst the most brilliant, amongst the most useful and honorable in the annals of science.

His principal works are—*Astronomiæ Fundamenta*, 1757; *Tabulæ Solares*, 1758, giving, for the first time, corrections for planetary perturbations; *Cœlum australe stelliferum*, 1763, a catalogue of 10,035 southern stars; *Observations sur 515 étoiles du Zodiaque*, 1763; *Leçons élémentaires de Mathématiques*, 1741, frequently reprinted; ditto *de Mécanique*, 1743, etc.; ditto *d'Astronomie*, 1746, 4th edition augmented by Lalande, 1779; ditto *d'Optique*, 1750, etc. Calculations by him of eclipses for eighteen hundred years were inserted in *L'art de vérifier les dates*, 1750; he communicated to the Academy in 1755 a classed catalogue of forty-two southern nebulæ, and gave in vol. ii. of his *Éphémérides*, 1754, practical rules for the employment of the lunar method of longitudes, proposing in his additions to Bouguer's *Traité de Navigation*, 1760, the model of a nautical almanac.

LA CALLE, or **La Cala**, a seaport town of Algeria, in the province of Constantine, the centre of the Algerian and Tunisian coral fisheries. It lies 40 miles east of Bone and 10 miles from the Tunisian frontiers. The harbor is small and inconvenient, but it is proposed to construct a military port and harbor of refuge a little to the west. La Calle proper, or the old fortified town, is built on a ridge of rocks about 400 yards long, connected with the main land by a bank of sand; but a new town has grown up along the coast. Besides the coral fisheries the curing of sardines is largely carried on. The population, without the garrison, was 3308 in 1871.

La Calle is mentioned as Mersa el Kharez by El Bekri (see *Journ. Asiat.*, 1859), and was even then the residence of coral merchants. In the early part of the 18th century it was the seat of an English trading factory, but on the failure of the company the French African Company moved their factory from Bastion de la France to La Calle. The company was suppressed in 1794. In 1806 Mr. Blanckley, British consul-general at Algiers, obtained the right of occupying Bone and La Calle for an annual rent of £11,000; but though the money was paid for several years no practical effect was given to the agreement. The French regained possession in 1817, were expelled during the wars of 1827, but returned and rebuilt the place in 1836.

See Abbé Poiret, *Voyage en Barbarie*, Paris, 1787; Broughton, *Six Years in Algeria;* and Playfair, *Travels in the Footsteps of Bruce.*

LACCADIVES, a group of coral reefs and islands in the Indian Ocean, lying between 10° and 12° 20′ N. lat. and 71° 40′ and 74° E. long. The name Laccadives (*laksha dwipa*, the "hundred thousand isles") is that given by the people of the continent, and was probably meant to include the myriad Maldives; they are called by the natives simply *Divi*, "islands," or *Amendivi*, from the chief island. There are about nineteen separate reefs, containing, however, only thirteen islands, and of these only eight are inhabited. The islands have in nearly all cases emerged from the eastern and protected side of the reef, and have gradually extended towards the west over the shallow lagoon of which the rest of the space within the barrier-reef consists. The islands are small, none exceeding a mile in breadth, and lie so low that they would be hardly discernible but for the cocoa-nut groves with which they are thickly covered. The soil is light coral sand, beneath which a few feet down, lies a stratum of coral stretching over the whole of the island. This coral, which is generally a foot to a foot and a half in thickness, has been in the principal islands wholly excavated, whereby the underlying damp sand is rendered available for cereals. These excavations—a work of vast labor—were made at a remote period, and according to the native tradition by giants. In these spaces [*totam* ="garden"] are cultivated coarse grain, pulse, bananas, and vegetables; cocoa-nuts grow abundantly everywhere, and for rice the natives depend upon the mainland.

Population and Trade.—Of the eight Laccadive islands, four are directly under British rule and form part of the South Kanara collectorate in the Madras presidency. The other four (together with Minicoy, noticed below) form part of the estate of the bibi of Cannanore. The following are the names of the islands, with population in 1881:

British Islands.		*Cannanore Islands.*	
Amini,	2060	Agathi,	1376
Chetlat,	577	Kawrati,	2127
Kadamat,	245	Androt,	2896
Kiltan,	790	Kalpéni,	1216
Total,	3672	Total,	7615

making a total for all the islands of 11,287, a dense population for so small an area. Amini, Kalpeni, Androt, and Kawrati are the principal or *tarwat* islands, and in them only do the high caste natives reside. The others are called *melacheri*, or low caste islands. The people are Moplas, *i. e.*, of mixed Hindu and Arab descent, and are Mohammedans. Their manners and customs are similar to those of the coast Moplas; but they maintain their own ancient caste distinctions. The language spoken is Malayala, but it is written in the Arabic character. Reading and writing are common accomplishments among the men. The chief industries are the manufactures of coir and jaggery, the Laccadive coir being esteemed the best in India; the various processes are intrusted to the women. The men employ themselves with boat-building and in conveying the island produce to the coast—in the case of the English islands to Mangalore, and in that of the bibi's islands to Cannanore. In each case the coir is taken by the ruling Government at lower than market rates, and the natives are not subject to any other taxation. At Mangalore they are paid partly in money and partly in rice, and the rates are not altered for many years. On the other hand the varying and oppressive tariff imposed upon the Cannanore islands has led to a diminished and inferior manufacture of coir, and to frequent complaints. This monopoly system, however fairly worked by the British Government, interferes with the trading capabilities of the natives, and puts them at considerable disadvantage with their rivals of Minicoy and the Maldives. The exports from the Laccadives are of the annual value of £17,000.

History and Government.—No data exist for determining at what period the Laccadives were first colonized. The earliest mention of them as distinguished from the Maldives seems to be by Albírúní (*circ.* 1030), who divides the whole archipelago (Díbaját) into the *Dívah Kúzah* or Cowrie Islands (the Maldives), and the *Dívah Kanbar* or Coir Islands (the Laccadives). See *Journ. Asiat.*, September, 1844, p. 265. According to native tradition, the islands were first occupied about a thousand years ago. The early polity, according to Mr. Robinson, was patriarchal, conducted by a *modalal*, or chief inhabitant, and the heads of the principal families. Each island was independent. This kind of internal economy seems to have lasted until the advent of the Portuguese. During their independence the islanders were converted to Islam by an Arab apostle named Mumba Mulyaka, whose grave at Androt still imparts a peculiar sanctity to that island. The kazee of Androt was in 1847 still a member of his family, and was said to be the twenty-second who had held the office in direct line from the saint. This gives color to the tradition that the conversion took place about 1250. It is also further corroborated by the story given by Ibn Batuta of the conversion of the Maldives, which occurred, as he heard, four generations (say one hundred and twenty years) before his visit to these islands in 1342. The Portuguese discovered the Laccadives in 1499, and built forts upon them, but about 1545 the natives rose upon their oppressors, and with the aid of the raja of Cherical exterminated them. For this aid the raja obtained the suzerainty of the group, but he afterwards conferred them upon the head of the Cannanore moplas for an annual tribute. The Cannanore raja ceased to pay this tribute about the middle of the 18th century. In 1784 the Amini islands threw off the yoke, and put themselves under the protection of Tippoo, from whom, at the fall of Seringapatam in 1799, they passed to the East India Company. The remaining islands had already in 1791 fallen into the power of the Company by the storming of Cannanore, but by the peace of Seringapatam (1792) were permitted to remain under the management of the bibi at a yearly tribute. This has been often in arrear, and on this account these islands have been sequestrated by the British Government since 1877, to the general satisfaction of the inhabitants. See Mr. Robinson's *Report*, Madras, 1874; Mr. Hume in *Stray Feathers*, vol. iv., 1876, Calcutta.

Minicoy (called *Máliku* by the natives), a small island 5 miles in length, 108 miles south of Kalpéni and 68 miles north of the Maldives, belongs politically to the Laccadives in so far as it forms part of the estate of the bibi of Cannanore. The natives, however, are of the same race and speak the same language as the Maldivians. The population in 1881 was 3915. The people are well behaved, but of a very independent character; they are active and enterprising sailors, and lazy cultivators. They are divided into four classes, viz., *málikans*, the aristocracy, *malumnies*, the pilots and mates of vessels, *klasies*, smaller landed proprietors and sailors, *melacheries*, toddy drawers. Minicoy anciently formed part of the Maldive realm, but, probably in the 16th century, was given by a Maldive sultan to his brother. In 1607, when it was visited by Pyrard, it was governed by a lady who for greater security held it of the raja of Cannanore (Pyrard's *Voyage*, chap. xxiii.). The island has never been restored to the Maldive kings.

LACE [1] is the name applied to an ornamental open work of threads of flax, cotton, silk, gold, or silver, and occasionally of mohair or aloe fibre. Such threads may be either looped, or plaited or twisted together in one of three ways:—(1) with a needle, when the work is distinctively known as "needlepoint lace;" (2) with bobbins, pins, and a pillow or cushion, when the work is known as "pillow lace;" and (3) by machinery, when imitations of both needlepoint and pillow lace patterns are produced.

History.—Special patterns for needlepoint and pillow laces date from the beginning of the 16th century. Before that period such works as might now be classified as laces consisted of small cords of plaited and twisted threads fastened in loops (or "purls") along the edges of costumes, of darning work done upon a net ground, and of drawn and cut embroidery. From these classes of earlier work lace is descended. Pillow lace can be distinctly traced up to the "merletti a piombini" of the 16th century. At a very early period embroidery of geometrical patterns in colored silk, etc., on a network of small square meshes, was known and made throughout Europe. This in the 13th and 14th centuries was known in ecclesiastical circles as "opus filatorium" or "opus araneum" (spider work), and examples dating from the 13th century still exist in public collections. The productions of this art, which has some analogy to weaving, in the early part of the 16th century came to be known as "punto a maglia quadra" in Italy, and as "lacis" in France—the patterns, stiff and geometrical, being sometimes cut out of linen or separately sewed and applied to the meshed surface; but more frequently they were darned in, the stitches being counted as in tapestry, and hence it was known as "point conté" or darned netting. With the development of the renaissance of art, free-flowing patterns and figure subjects were introduced and worked in lacis.

Drawn and cut works were ancient forms of embroidery which directly developed into point lace. The methods of producing them were various. A common way was to fasten on a light frame a reticulation of threads, under which was fastened, by gum or otherwise, a piece of fine lawn. Then along these threads the pattern to be formed was stitched to the lawn background in button-hole stitching, and the superfluous parts of the lawn were afterwards drawn or cut away,—whence the names "punto a reticella" and "punto tagliato." In other cases no cloth at all was used, and the pattern, consisting of an interlacing framework of threads, was simply sewed over with buttonhole stitches. This was "punto in aria." The early geometrical patterns of the "punto a reticella" or "punto tagliato" and "punto in aria" were probably derived from the Ionian Islands and Greece, and the cutwork itself was indeed also known as Greek lace. The close connection of the proud and powerful Venetian republic with Greece and the eastern islands, and its commercial relations with the East, sufficiently explain the early transplanting of these arts into Venice. Once fairly established, they quickly grew in beauty and variety of pattern, complexity of stitch, and delicacy of execution, until Venetian lace attained an artistic grace and perfection which baffle all description. The making of the principal and most important variety of Venetian needlepoint lace, the "punto in aria," began to be practised in the middle of the 16th century.[2]

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[1] Italian, *merletto*, *trina;* Genoese, *pizzo;* German, *Spitzen;* French, *dentelle;* Dutch, *kanten;* Spanish, *encaje*. The English word is the Fr. *lassis* or *lacis*, connected with the Latin *laqueus*. Early French laces were also called *passements* ("insertions").

[2] The prevalence of fashion in the above-mentioned sorts of embroidery during the 16th century is marked by the number of pattern-books then published. In Venice an early work of this class was issued by Alessandro Pagannino in 1527; another of a similar nature, printed by Pierre Quinty, appeared in the same year at Cologne; and *La fleur de la science de pourtraicture et patrons de broderie, façon arabicque et ytalique*, was published at Paris in 1530. From these early dates until the beginning of the 17th century pattern-books for embroidery in Italy, France, Germany, and England were produced and published in great abundance. The designs contained in many of those dating from the early 16th century were to be worked for costumes and hangings and consisted of scrolls, arabesques, birds, animals, flowers, foliage, herbs, and grasses. So far, however, as their reproduction as laces might be concerned, the execution of complicated work was involved which none but practised lace-workers, such as those who arose a century later, could be expected to overcome.

It is a noteworthy circumstance that the two widely distant regions of Europe where pictorial art first flourished and attained a high perfection, North Italy and Flanders, were precisely the localities where lacemaking first took root and became an industry of importance both from an artistic and from a commercial point of view. The invention of pillow lace is generally credited to the Flemings; but there is no distinct trace of the time or the locality. In a picture said to exist in the church of St. Gammar, at Lierre, and sometimes attributed to Quentin Matsys (1495), is introduced a girl working lace with pillow, bobbins, etc., which are somewhat similar to the implements in use in more recent times.[1] From the very infancy of Flemish art an active intercourse was maintained between the Low Countries and the great centres of Italian art; and it is therefore only what might be expected that the wonderful examples of the art and handiwork of Venice in lace-making should soon have come to be known to and rivalled among the equally industrious, thriving, and artistic Flemings. And so we find that, at the end of the 16th century, lacis and needlepoint lace were also known and made in Flanders, and pattern-books were issued having the same general character as those published for the instruction of the Venetians and other Italians. In Italy, under the name of "merletti a piombini," the art of twisting and plaiting threads by means of bobbins or *fuzii* was early practised; and in later times fine scrolls in great widths for altar frontals were made in Italy on the pillow.

France and England were not far behind Venice and Flanders in adopting lace. Henry III. of France (1574–1589) appointed a Venetian, Frederic Vinciolo, to be pattern-maker for varieties of linen needle works and laces to his court. Through the influence of this fertile designer the seeds of a taste for lace in France were principally sown. But the event which *par excellence* would seem to have fostered the art of lace making there was the aid and patronage officially given it in the following century by Louis XIV., acting on the advice of his minister Colbert. Intrigue and diplomacy were put into action to secure the services of Venetian lace-workers; and by an edict dated 1665 lacemaking centres were founded at Alençon, Quesnoy, Arras, Rheims, Sedan, Château Thierry, Loudun, and elsewhere. The state made a contribution of 36,000 francs in aid of a company to carry out the organization of these establishments; and at the same time the importation of Venetian, Flemish, and other laces was strictly forbidden.[2] The edict contained instructions that the lace-makers should produce all sorts of thread work, such as those done on a pillow or cushion and with the needle, in the style of the laces made at Venice, Genoa, Ragusa, and other places; these French imitations were to be called "points de France." By 1671 the Italian ambassador at Paris writes, "Gallantly is the minister Colbert on his way to bring the 'lavoria d'aria' to perfection." Six years later, an Italian, Domenigo Contarini, alludes to the "punto in aria," "which the French can now do to admiration." The styles of design which emanated from the chief of the French lace centres, Alençon, were more fanciful and floral than the Venetian, and it is quite evident that the Flemish lace-makers adopted many of these French patterns for their own use. The importance of these French designs, which owe so much to the state patronage they enjoyed, was noticed early in the 18th century by Bishop Berkeley. "How," he asks, "could France and Flanders have drawn so much money from other countries for figured silk, lace, and tapestry, if they had not had their academies of design?"

The humble endeavors of peasantry in England (which could boast of no schools of design), Germany, Sweden, Russia, and Spain could not result in work of high artistic pretension. Lacemaking is said to have been promoted in Russia through the patronage of the court there, after the visit of Peter the Great to Paris in the early days of the 18th century. In Germany, Barbara Uttmann, a native of Nuremberg, instructed peasants of the Erz mountains to twist and plait threads in 1561. She was assisted in this by certain refugees from Flanders. A sort of "purling" or imitation of the Italian "merletti a piombini" was the style of work produced here. It did not develop in any important way, nor have German laces acquired great artistic reputation. Spain has been considered to have been a lace-making country, and no doubt a good deal of lace, having, however, no distinctive character, was made in Spanish conventual establishments. The "point d'Espagne," however, appears to have been a commercial name given by French manufacturers of a class of lace greatly esteemed by Spaniards in the 17th century. No lace pattern books have been found to have been published in Spain. The point laces which came out of Spanish monasteries in 1830, when these institutions were dissolved, were not distinguishable from similar Venetian needle-made laces. The lace vestments preserved at the cathedral at Granada, hitherto presumed to be of Spanish work, are Flemish of the 17th century. The industry is not alluded to in Spanish ordinances of the 15th, 16th, or 17th centuries. Much Flemish lace was imported into Spain from Spanish Flanders. The black and white silk pillow laces, or "blondes," date from the 18th century. They were made in considerable quantity in the neighborhood of Chantilly, and imported by Spain for mantillas. Although after the 18th century the making of silk laces has more or less ceased at Chantilly and the neighborhood, the craft is now carried on in Normandy—at Bayeux and Caen—as well as in Auvergne. Silk pillow lace making is carried on in Spain, especially at Barcelona. The patterns are almost entirely imitations from the French. Malta is noted for producing a thick pillow lace of black, white, and red threads, chiefly of geometric pattern, in which circles, wheels, and radiations of shapes resembling grains of wheat are a principal feature. This characteristic of design, appearing in laces of similar make which have been identified as Genoese pillow laces of the early 17th century, reappears in Spanish and Paraguayan work. Pillow lace in imitation of Maltese, Buckinghamshire, and Devonshire laces is made in Ceylon, and in different parts of India where attempts have been made to introduce European arts to native labor.

At present the chief sources of hand-made lace are Belgium, England, and France, but a successful effort has also been made to re-establish the industry in the island of Burano near Venice, and much fine work of good design is now (1882) made there. Russian peasants in the districts of Vologda, Balakhua (Nijni Novgorod), Bieleff (Tula), and Mzensk (Orel) make pillow laces of simple patterns. But by far the greatest amount of lace now made is that which issues from machines in England and France.[3] The total number of persons employed in the lace industry in England in 1871 was 49,370; and according to official returns of the year 1873, 240,000 women were similarly employed in France.

The early history of the lace-making machine coincides with that of the stocking-frame, that machine having been adapted about the year 1768 for producing open-looped stitches, which had a net-like appearance. In the years 1808 and 1809 John Heathcoat of Nottingham obtained patents for machines for making bobbin net, which form the real foundation of machine making of lace. These machines were improved on in 1813 by John Leavers, whose lace-making machines are in use at the present time. The application of the celebrated Jacquard apparatus to these net machines has enabled manufacturers to produce all sorts of patterns in thread work in imitation of the patterns for hand-made lace. The latest improvement in machinery for lacemaking has resulted in a French machine called the "dentellière" (see *La Nature* for 3d March, 1881). The work produced by this machine is plaited. That produced by the English and by other French machines is of twisted threads. At present, however, the expense attending the production of plaited lace by the "dentellière" is as great as that of pillow lace made by the hand.

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[1] The picture, however, as Seguin has pointed out, was probably painted some thirty years later, by Jean Matsys.

[2] See the poetical skit *Revolte des Passements et Broderies*, written by Mademoiselle de la Tousse, cousin of Madame de Sévigné, in the middle of the 17th century, which marks the favor which foreign laces at that time commanded amongst the leaders of French fashion. It is fairly evident too that the French laces themselves, known as "bisette," "gueuse," "campane," and "mignonette," were small and comparatively insignificant works, without pretence to design.

[3] See Felkin's *Machine-wrought Hosiery and Lace Manufactures.*

Before considering technical details in processes of making lace, the principal parts of a piece of lace may be named. A prominent feature is the ornament or pattern. This may be so designed that the different parts may touch one another, and so be fastened together, no ground-work of any sort being required. Ground-works are useful to set off the pattern, and either consist of links or tyes, which give an open effect to the pattern, or else of a series of meshes like net. Sometimes the pattern is outlined with a thread or cord line, or more strongly marked by means of a raised edge of button-hole stitched or plaited work. Fanciful devices are sometimes inserted into various portions of the pattern. In some of the heavy laces, which resemble delicate carving in ivory, little clusters of small loops are distributed about the pattern. French terms are frequently used in speaking of details in laces. Thus the pattern is called the *toilé* or gimp, the links or tyes are called *brides*, the meshed grounds are called *réseaux* (retiola), the outline to the edges of a pattern is called *cordonnet*, the insertions of fanciful devices *modes*, the little loops *picots*. These terms are applicable to the various portions of all laces made with the needle, on the pillow, or by the machine.

The history of patterns in lace is roughly as follows. From about 1540 to 1590 the forms were geometric, chiefly common, without *brides* or *réseaux*. From 1590 to 1630 may be dated the introduction of floral and human forms and slender scrolls held together by *brides*. At this time lace-makers enriched their works with insertions of *modes*. To the period extending from 1620 to 1670 belongs the development of scrolls and elaboration of details like the *cordonnet* with massings of *picots*. Much heavy raised lace enriched with fillings in of *modes* was made at this time. About 1660 *réseaux* came into use. From 1650 to 1720 the scroll patterns gave way to arrangements of detached ornamental details which were frequently filled in with elaborate *modes*. A closer imitation of all sorts of subjects was attempted in lace patterns. Pictorial representations of figures, incidents, persons, arose. The purely conventional scrolls were succeeded by naturalistic renderings of garlands, flowers, birds, and such like. The use of meshed grounds extended, and grounds composed entirely of varieties of *modes* were made. From 1720 to 1780 small details of bouquets, sprays of flowers, single flowers, leaves, buds, spots, and such like were adopted, and sprinkled over meshed grounds. Since that time down to the present day all these styles of pattern have been used as fashion has required.

Needlepoint Lace.—The way in which the early Venetian "punto in aria," as already described, was made appears to correspond precisely with the elementary principles upon which needlepoint lace is now worked. The pattern is first drawn upon a piece of parchment. The parchment is then stitched to a stout bit of linen. Upon the leading lines drawn on the parchment threads are laid, which are here and there fastened through the parchment and linen by means of stitches.

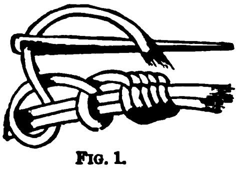
Fig. 1.

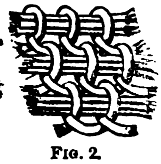
Fig. 2.

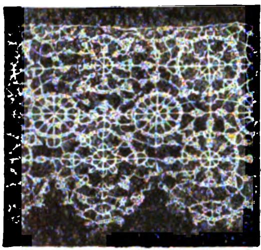
Fig. 3.—Part of a Border of Needlepoint Lace, geometric design. About 1550.

When the skeleton thread pattern is completed, a compact covering of thread in button-hole stitches is cast upon it (fig. 1). The portions which may be required to be represented as close linen work or *toilé* are worked as indicated in the enlarged diagram (fig. 2). Between the leading lines of the pattern may be inserted tyes (links) or meshes, so that the pattern is held together. When all is finished, a knife is passed between the parchment and the stout linen, cutting the stitches which have passed through the parchment and linen, and so releasing the lace itself from its pattern parchment. For about sixty years the laces thus made were chiefly geometric in pattern (fig. 3). They were used both for insertions between seams and for borders. Following closely upon these geometric laces came laces of a freer style of design, and towards the end of the 16th century designs for scrolls with the introduction of all kinds of odd figures and leaves and blossoms were produced (fig. 4). Links or tyes—*brides*—came to be interspersed between the various details of the patterns (fig. 5). The work was of a flat character. Some large and elaborate specimens of this flat point lace were made at this time. The lace workers occasionally used gold thread with the white thread. The nomenclature of these earlier needle-made laces is somewhat modern. At the present time the different sorts of early Venetian point laces are called "flat Venetian point," "rose (raised) point," "caterpillar point," "bone point," etc.; and works of bold design done in relief are called "gros point de Venise." Lace of this latter class (figs. 6, 7) was used for altar cloths, flounces, and heavily trimmed *jabots* or neckcloths which hung beneath the chin over the breast. *Tabliers* and ladies' aprons were also made of such lace. The laces which have hitherto been referred to are laces in which no regular ground was used. All sorts of

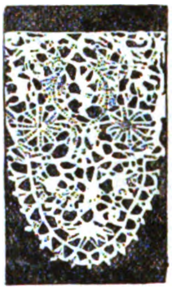
Fig. 4.—Italian Needlepoint Scallop.

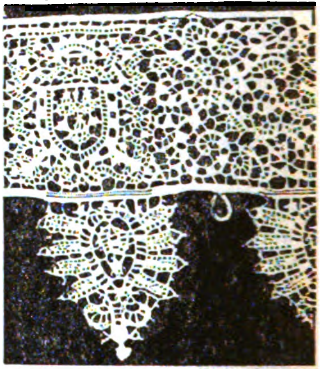
Fig. 5.—Needlepoint Lace, showing use of tyes or "brides."

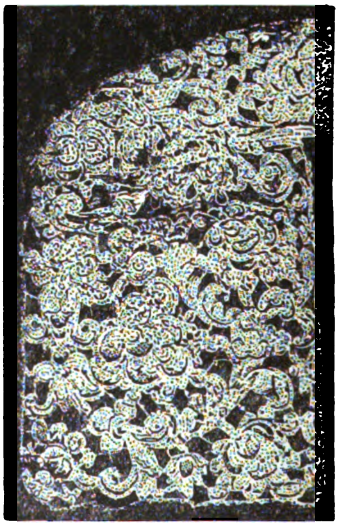
Fig. 6.—Venetian Needlepoint Lace.

minute embellishments, like little knots, stars, and loops or *picots*, were worked on to the irregularly arranged *brides* or tyes holding the main patterns together, and these devices as a rule gave a rich effect to the lace work. Following this style of treatment came laces with ground works; and grounds of *brides* or tyes arranged in a honeycomb pattern were, it appears, first used early in the 17th century (fig. 8). To them succeeded a lighter sort of lace, one in which the rich and compact relief gave place to much flatter work with a ground of meshes. The needle-made meshes were sometimes of single and sometimes of double threads. A diagram is given of an ordinary method of making such meshes (fig. 9). The delicate Venetian point lace made with a ground of meshes is usually known as "point de Venise à réseau." It was contemporary with the famed needle-made French laces of Alençon and Argentan. "Point d'Argentan" has been thought to be especially distinguished on account of its ground of hexagonally arranged *brides*. But this has been noticed as a peculiarity in certain Venetian point laces of earlier date.[1] Often intermixed with this stiff hexagonal *brides* ground is the fine-meshed ground or *reseaux*, which has been held to be distinctive of "point d'Alençon" (fig. 10). But, apart from the assumedly distinctive grounds, the styles of patterns and the methods of working them, with rich variety of insertions or *modes*, with raised button-hole-stitched edgings or *cordonnets*, are precisely alike in the two classes of Argentan and Alençon needle-made laces. Besides the hexagonal *brides* ground and the ground of meshes there was another variety of grounding used in the Alençon laces, which was extensively used and forms a third class. This ground consisted of button-hole-stitched skeleton hexagons, within each of which was worked a small solid hexagon connected with the outer surrounding hexagon by means of six little tyes or *brides* (see fig. 11). Lace with this particular ground has been called "Argentella," and some writers on lace have thought that it was a specialty of Genoese or Venetian work. The character of the work and the style of the floral patterns worked upon such grounds are those of Alençon laces. and specimens of this "Argentella" often contain insertions of the Argentan *brides* and the Alençon fine meshes.

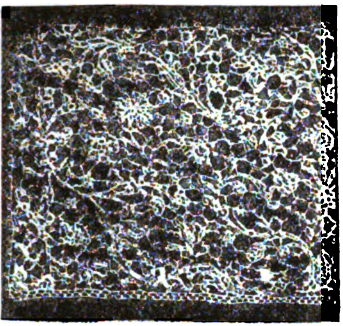
FIG. 7.—Venetian Needlepoint Lace.

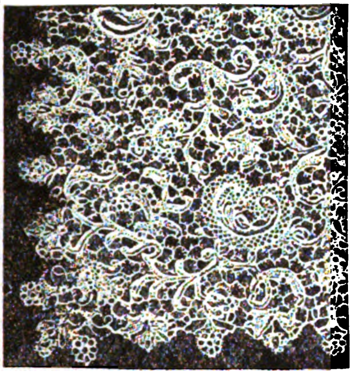
FIG. 8.—Venetian Needlepoint Lace.

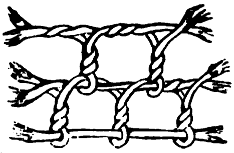
FIG. 9.

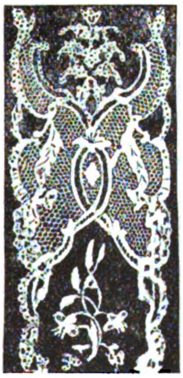
FIG. 10.—French Needlepoint Lace.

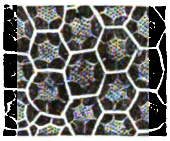
FIG. 11.

There are very slight indications respecting the establishment of a lace manufactory at Argentan, whereas those regarding Alençon are numerous. A family of thread and linen dealers, inhabitants of Alençon, by name Monthuley, are credited with the establishment of a branch manufactory or *succursale* for lace at Argentan. In the course of business, the Monthuleys assisted the interchange of lace patterns between Argentan and Alençon, which are distant one from another about 10 miles. Thus if a piece of lace was produced at Alençon it was called "point d'Alençon," and if at Argentan "point d'Argentan," though both works might have been made from one design. From about 1670 to 1780 a great deal of point lace was made at Alençon and in the neighboring villages. The styles of patterns varied, as has been stated. Point d'Alençon is still made.

In Belgium, Brussels has acquired some celebrity for needle-made laces. These, however, are chiefly in imitation of those made at Alençon. Brussels needlepoint lace is often worked into meshed grounds made on a pillow. The Brussels needle-lace workers used a plain thread as a *cardonnet* for their patterns instead of a thread overcast with button-hole stitches as in the Venetian and French needlepoint laces.

This kind of lace has also been produced in England. Whilst the character of English design in needlepoint laces of the early 17th century (fig. 12) is simpler than that of the contemporary Italian, the method of workmanship is virtually the same. Specimens of needle-made work done by English school children may be met with in samplers of the 17th and 18th centuries. Point lace is successfully made in Irish convents. In all great towns like London, Paris, Brussels, Vienna, lace dealers undertake to supply demands for finely executed modern imitations of old needle-made lace. At Burano the lace-making school lately established there produces hand-made laces which are, to a great extent, careful reproductions of the more celebrated classes of point laces, such as "punto in aria," "rose point de Venise," "point de Venise à réseau," "point d'Alençon," "point d'Argentan," and others. A weaving of threads with a needle into a foundation of net—very distinctive, and different from the "punto a maglia" or "lacis"—has been done for a long time in Spain. Its leading characteristic is the pattern of repeated squares, filled up with star figures. When fine

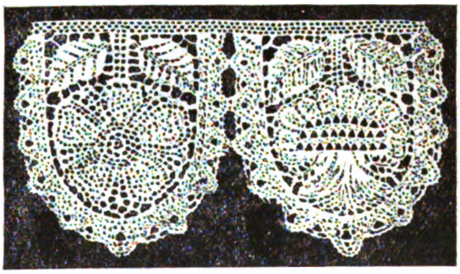
FIG. 12.—English Point Lace.

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[1] The lace-workers at Alençon and its neighborhood produced work of a daintier kind than that chiefly made by the Venetians. As a rule the hexagonal *bride* grounds of Alençon laces are smaller than similar details in Venetian laces. The average size of a diagonal taken from angle to angle in an Alençon (or so-called Argentan) hexagon was about one-sixth of an inch, and each side of the hexagon was about one-tenth of an inch. An idea of the minuteness of the work can be formed from the fact that a side of a hexagon would be overcast with some nine or ten button-hole stitches.

thread is used the effect of heavy cobwebs is produced. Work of this description has been made in Paraguay, where a coarse "torchon" pillow lace is also produced.

Pillow-made Lace.—Pillow-made lace is built upon no substructure, like a skeleton thread pattern, such as is used for needlepoint lace. It is the representation of a pattern obtained by twisting and plaiting threads. The only pre-existing analogue of pillow laces is to be found in the primitive twistings and plaitings of fibres and threads. The English word "lace" in the 15th century was employed to describe fine cords and braids. In a Harleian MS. of the time of Henry VI. and Edward IV., about 1471, directions are given for the making of "lace Bascon, lace indented, lace bordered, lace covert, a brode lace, a round lace, a thynne lace, an open lace, lace for hattys," etc. The MS. opens with an illuminated capital letter, in which is the figure of a woman making these articles. Her implements are not those with which pillow lace of ornamental quality from the middle of the 16th century and onwards has been made. The MS. supplies a clear description how threads in combinations of twos, threes, fours, fives, to tens and fifteens, were to be twisted and plaited together. Instead of the pillow, bobbins, and pins with which pillow lace is made, the hands were used. Each finger of a hand served as a peg. The writer of the MS. says that it shall be understood that the first finger next the thumb shall be called A, the next B, and so on. According to the sort of twisted cord or braid which had to be made, so each of the four fingers A, B, C, D might be called upon to act like a reel, and to hold a "bowys" or "bow," or little ball of thread. Each ball might be of different color from the other. A "thynne lace" might be made with three threads, and then only fingers A, B, C would be required. A "round" lace, stouter than the "thynne" lace, might require the service of four or more fingers. By occasionally dropping the use of threads from certain fingers a sort of indented lace or braid might be made. But when laces of more importance were wanted, such as a broad lace for "hattys," the hands of assistants were required.

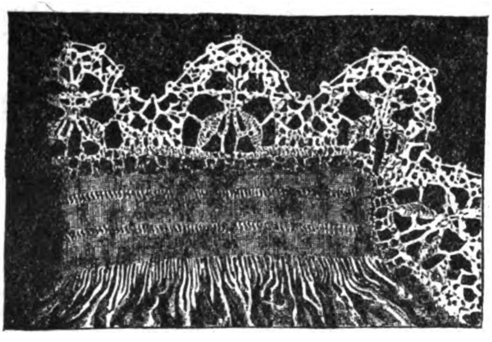


Fig. 13.—Cuff trimmed with Plaited and Twisted Thread Work in Points, or Scallops. Late 16th century.

Pillow lace making was never so strictly confined to geometric patterns as point lace making. Curved forms, almost at its outset, seem to have been found easy of execution (fig. 13). One reason for this no doubt is that the twisted and plaited work was not constrained by a foundation of any sort. The plaitings and twistings gave the workers a greater freedom in reproducing designs. At the same time, little specialty of pattern seems to have been produced for the pillow lace workers, and so laces worked on the pillow, particularly those of higher pretence to artistic design, were similar in pattern to those worked with the needle. The early wiry-looking twisted and plaited thread laces were soon succeeded by laces in which flattened and broader lines occupy a prominent position (fig. 14). Tape was also sometimes used for the broad lines. The weaving of tape appears to have been begun in Flanders about the end of the 16th or the beginning of the 17th century In England it dates no farther back than 1747, when two Dutchmen of the name of Lanfort were invited by an English firm to set up tape looms in Manchester and give instructions in the method of weaving tape.

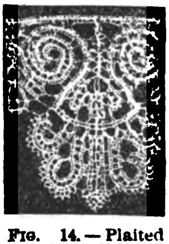


Fig. 14.—Plaited and Twisted Thread Work known as "Merletti a Piombini." About 1560.

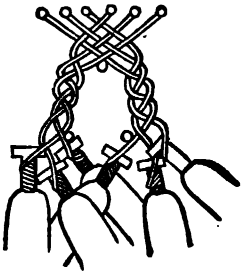


Fig. 15.—Diagram showing six Bobbins in use.

The process by which lace has been made on the pillow from about the middle of the 17th century is very roughly and briefly as follows. A pattern is first drawn upon a piece of paper or parchment. It is then pricked with holes by a skilled "pattern pricker," who determines where the principal pins shall be stuck for guiding the threads. This pricked pattern is then fastened to the pillow. The pillow or cushion varies in shape in different countries. Some lace-makers use a circular pad, backed with a flat board, in order that it may be placed upon a table and easily moved as the worker may wish. Other lace-workers use a well-stuffed round pillow or short bolster, flattened at the two ends, so that they may hold it between their knees. On the upper part of the pattern are fastened the ends of the threads from the bobbins. The bobbins thus hang across the pattern. Fig. 15 shows the commencement of a double set of three-thread plaitings. The compact portion in a pillow lace has a woven appearance (fig. 16).

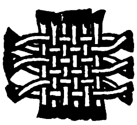


Fig. 16.

In the 17th century pillow lace in imitation of the scroll patterns of point lace was made. This sort of work, produced chiefly in Flanders, went under the name of "point d'Angleterre" (fig. 17). Into Spain and France much lace from Venice and Flanders was imported as well as into England, where from the 16th century the manufacture of "bone lace" by peasants in the midland and southern counties was carried on. This bone lace consisted chiefly of borders done in imitation of the Venetian "merletti a piombini." In Charles II.'s time its manufacture was of sufficient importance to demand parliamentary attention. The trade was threatened with extinction by the more artistic and finer Flemish laces. The importation of the latter was prohibited. Flemish lace-workers sought to evade the prohibitions by calling certain of their laces "point d'Angleterre." But the difficulties which attended the smuggling into England of these "points d'Angleterre" appear to have stimulated English dealers in lace anxious to supply the demands of fashion to obtain the services of Flemish lace-makers and to induce them to settle in England. It is from some such cause that English pillow lace closely resembles in character of design pillow laces of Brussels, Mechlin, and Valenciennes.

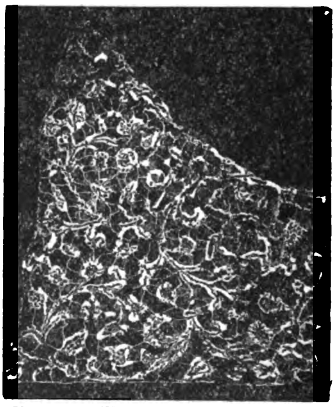


Fig. 17.—Pillow-made Lace "à brides." Flemish. 17th century. Sometimes called "Point d'Angleterre."

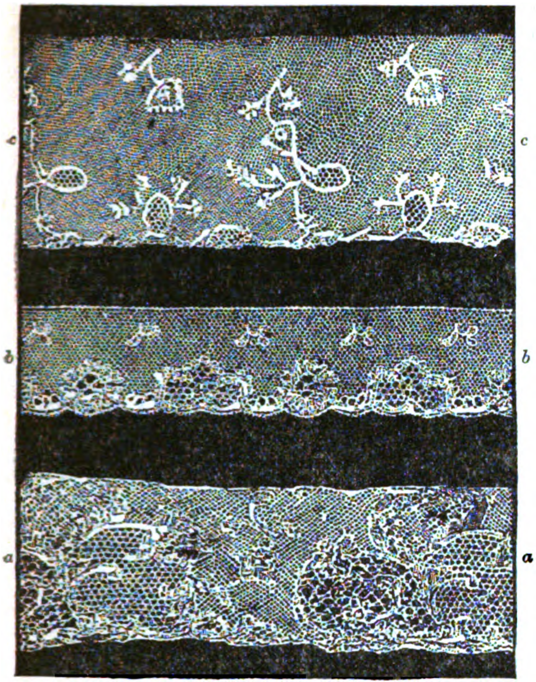


Fig. 18.—English Pillow Laces. 18th century.

Fig. 18 gives three sorts of Buckinghamshire pillow laces, the patterns of which have been in use since the middle of the 18th century. In (*a*) is a variety of fillings-in, which give the name of "trolly" to such specimens. It is an adaptation of Mechlin "trolle kant" or sampler lace, sent round to dealers and purchasers to show the variety of patterns which the lace-makers happened to be at work upon. Specimens (*b*) and (*c*) are both in the style of certain 18th century Mechlin laces, (*c*) being also like laces made at Lille and Arras.

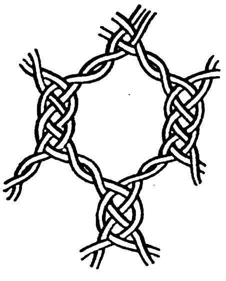


Fig. 19.—Mechlin Mesh.

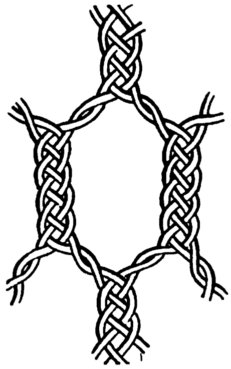


Fig. 20.—Enlargement of Mesh of Brussels ground, showing the four-twisted and two-plaited sides in each mesh.

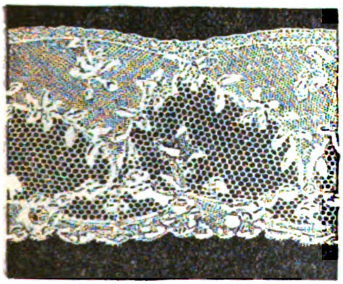


Fig. 21.—Pillow Lace. Brussels. 18th century.

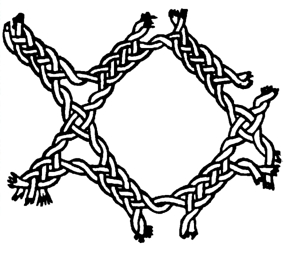


Fig. 22.

As skill in making lace developed, patterns and particularly plaitings came to be identified with certain localities. Mechlin enjoyed a high reputation for her production, which was in the 17th century poetically styled the "queen of laces." The chief features of this pillow lace are the plaiting of the meshes, and the outlining of the pattern or *toilé* with a thread. The ordinary Mechlin mesh is hexagonal in shape. Four of the sides are of double twisted threads, two are of four threads plaited three times (fig. 19). The mesh of Brussels pillow lace is also hexagonal. Four of the sides are of double-twisted threads, two are of four threads plaited four times (fig. 20). The finer specimens of Brussels lace are remarkable for the fidelity and grace with which floral compositions are rendered. Many of these compositions are either reproductions or adaptations of designs for point d'Alençon, and in such patterns the soft quality of fine pillow-made lace contrasts with the harder and more crisp appearance of needlepoint lace. In the Brussels pillow lace (fig. 21) much realistic effect is obtained by the delicate modelling imparted to the flowers by means of a bone instrument used to give concave shapes to petals and leaves, the edges of which are often marked by a flattened and slightly raised *cordonnet* of plaited work. Honiton pillow lace resembles Brussels lace. As a rule it is made with a coarser thread, and the designs lack the careful drawing and composition which may be seen in Brussels pillow laces. In Valenciennes lace there are no twisted sides to the mesh; all are closely plaited (fig. 22), and as a rule the shape of the mesh is diamond. No outline or *cordonnet* is used in Valenciennes lace. Besides these distinctive classes of pillow-like laces, there are others in which equal ingenuity is displayed, though the character of the design remains primitive, as for instance in peasant laces from Crete (fig. 23), Russia, and Germany. Pillow lace

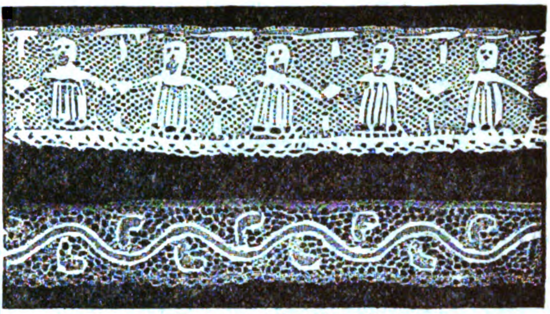


Fig. 23.—Peasant Lace from Crete.

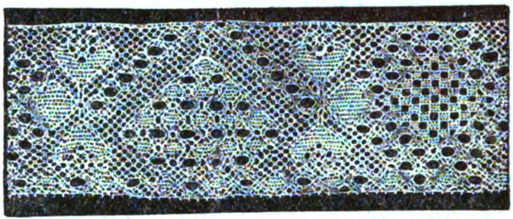


Fig. 24.—German Pillow-made Lace. 18th century.

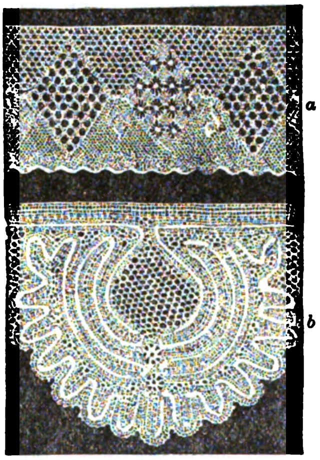


Fig. 25.—Russian Pillow Laces. 19th century.

making in Crete would seem to have arisen in consequence of Venetian intercourse with the island. The art is now said to be extinct. The laces were chiefly made of silk. The patterns in many specimens are outlined with one, two, or three bright-colored silken threads. As a rule the motives of the Cretan lace patterns are traceable to orderly arrangement and balance of simple symmetrical and geometrical details, such as diamonds, triangles, and odd polygonal figures. Uniformity in character of design may be observed in many of the German and Russian laces, especially in respect of patterns like that shown in fig. 24 and fig. 25 *a*. This sort of pattern is used in peasant laces of Sweden, in common French "torchon" laces, and in a lace made at Ripon in Yorkshire. The meshed grounds (*réseaux*) of the Chantilly silk laces were generally simple in character, as shown in fig. 26.

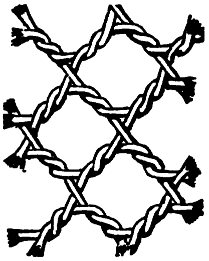


FIG. 26.

Guipure.—This name, often applied to needlepoint and pillow laces, properly designates a kind of lace or "passement" made with "cartisane" and twisted silk. "Cartisane" is a little strip of thin parchment or vellum, which was covered with silk, gold, or silver thread. Guipure is also made with fine wires whipped round with silk, and with cotton thread similarly treated. These stiff threads, formed into a pattern, were held together by stitches worked with the needle. Such work, which is very much dependent upon the ductile characteristics of the materials employed, is now called gimp work. Gold and silver thread laces were usually made on the pillow.

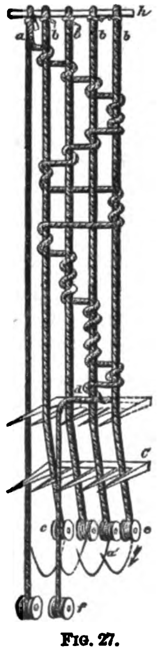


FIG. 27.

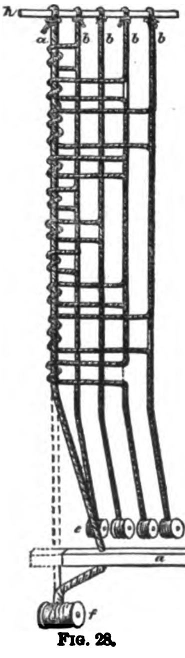


FIG. 28.

Machine-made Lace.—We have already seen that a technical peculiarity in making needlepoint lace is that a single thread and needle are alone used to form the pattern, and that the button-hole stitch and other loopings which can be worked by means of a needle and thread mark a distinction between lace made in this manner and lace made on the pillow. For the process of pillow lace making a series of threads are in constant employment, plaited and twisted the one with another. A button-hole stitch is not producible by it. The machine does not attempt to make either a button-hole stitch or a regular plait. Up to the present, however ingenious may be the counterfeits of design of all sorts of lace produced by the machine, an essential principle of the machine-made work is that the threads are merely twisted together. The only exception which could be made to this statement would be as regards the plaited lace made by the "dentellière" already mentioned. The Leavers lace machine is that which is generally in use at Nottingham and Calais. French ingenuity has developed improvements, in this machine whereby laces of delicate thread are made; but as fast as France makes an improvement England follows with another, and both countries virtually maintain an equal position in this branch of industry. The number of threads brought into operation in a Leavers machine is regulated by the pattern to be produced, the threads being of two sorts, beam or warp threads and bobbin or weft threads. Upwards of 8880 are sometimes used, sixty pieces of lace being made simultaneously, each piece requiring 148 threads—100 beam threads and 48 bobbin threads. The ends of both sets of threads are fixed to a cylinder upon which as the manufacture proceeds the lace becomes wound. The supply of the beam or warp threads is held upon reels, and that of the bobbins or weft threads is held in bobbins. The beam or warp thread reels are arranged in frames or trays beneath the stage, above which and between it and the cylinder the twisting of the bobbin or weft with beam or warp threads takes place. The bobbins containing the bobbin or weft threads are flattened in shape so as to pass conveniently between the stretched beam or warp threads. Each bobbin can contain about 120 yards of thread. By most ingenious mechanism varying degrees of tension can be imparted to warp and weft threads as required. The bobbins of the weft threads as they pass like pendulums between the warp threads are made to oscillate, and through this oscillation the threads twist themselves or become twisted with the warp threads.

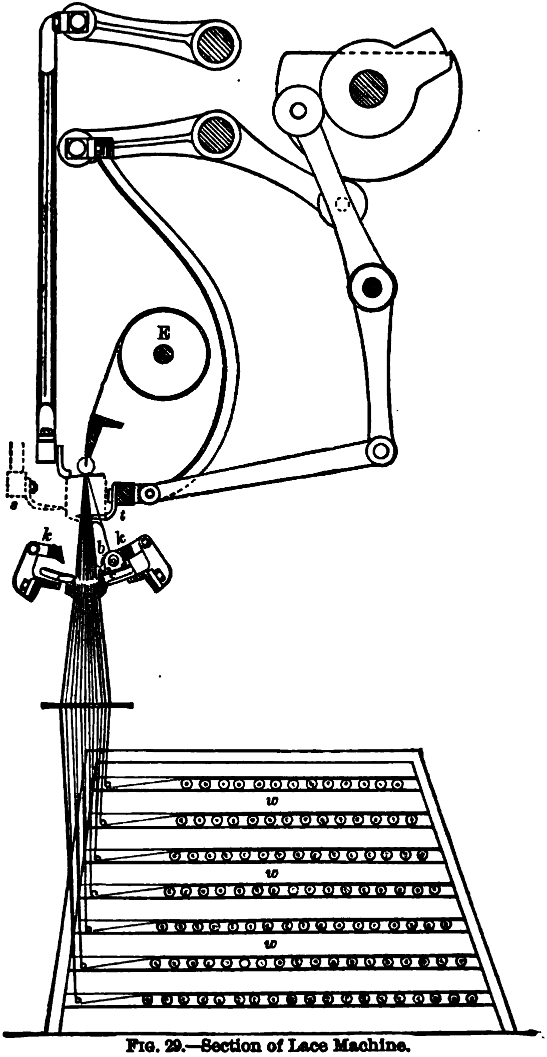


FIG. 29.—Section of Lace Machine.

As the twistings take place, combs passing through both warp and weft threads compress the twistings. Thus the usual machine-made lace may generally be detected by its compressed twisted threads. Figs. 27 and 28 are intended to show effects obtained by varying the tensions of weft and warp threads. For instance, if the weft, as threads *b*, *b*, *b*, *b* in fig. 27, be tight and the warp thread slack, the warp thread *a* will be twisted upon the weft threads. But if the warp thread *a* be tight and the weft threads *b*, *b*, *b*, *b* be slack, as in fig. 28, then the weft threads will be twisted on the warp thread. At the same time the twisting in both these cases arises from the conjunction of movements given to the two sets of threads, namely, a movement from side to side of the beam or warp threads, and the swinging or pendulum-like oscillations of the bobbin or weft threads between the warp threads. Fig. 29 represents a section of part of a lace machine. E is the cylinder or beam upon which the lace is rolled as made, and upon which the ends of both warp and weft threads are fastened at starting. Beneath are *w*, *w*, *w*, a series of trays or beams, one above the other, containing the reels of the supplies of warp threads; *c*, *c* represents the slide bars for the passage of the bobbin *b* with its thread from *k* to *k*, the landing bars, one on each side of the rank of warp threads; *s*, *t* are the combs which take it in turns to press together the twistings as they are made. The combs are so regulated that they come away clear from the threads as soon as they have pressed them together and fall into positions ready to perform their pressing operations again. The contrivances for giving each thread a particular tension and movement at a certain time are connected with an adaptation of the Jacquard system of pierced cards.

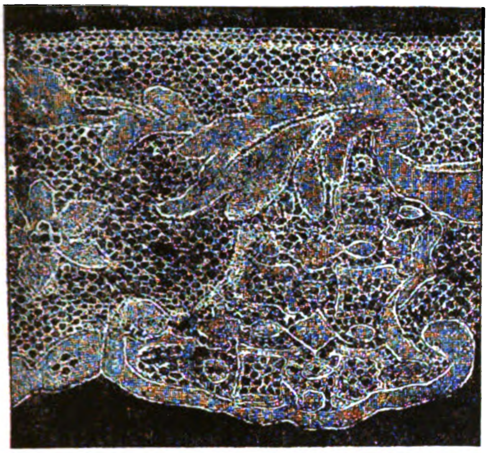


FIG. 30.—Pillow-made Lace. Mechlin. Early 18th century.

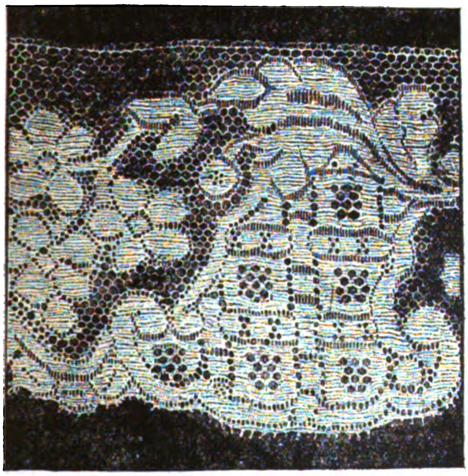


FIG. 31.—Machine-made Imitation of Mechlin Pillow Lace.

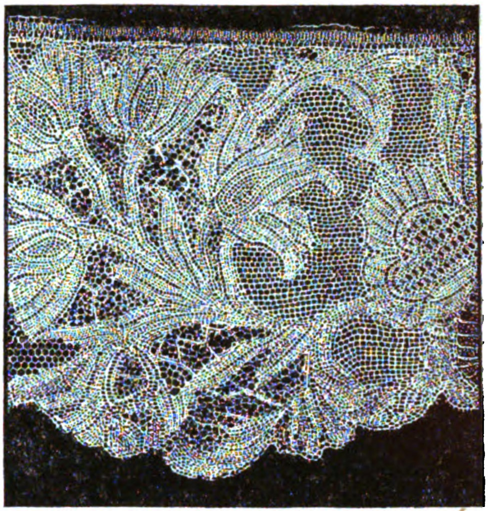


FIG. 32.—Venetian Point Lace, à réseau. 17th century.

The machine lace pattern drafter has to calculate how many holes shall be punched in a card, and to determine the position of such holes. Each hole regulates the mechanism for giving movement to a thread. Fig. 30 is a specimen of a Flemish pillow lace of the early 18th century. The meshes of the ground are variegated in appearance. A thread outlines the pattern. In fig. 31 it will be seen that the manufacturer has merely attempted to reproduce the pattern of the foregoing. His meshes are regular. No outlining thread marks the pattern, which, instead of being filmy, like cambric, is ribbed. This specimen, recently made at Calais with a Leavers machine, is produced at a cost of 1s 2d. a yard, whilst the value of the original hand-made pillow lace is at least £1 5s. a yard. Fig. 32 is taken from a piece of fine needle-made lace (point de Venise à réseau). The flat and even appearance in the close portions (the *toilé*) of the pattern, the slight thread (*cordonnet*) outlining the pattern, and the delicate fillings-in or *modes* of tracery work may be noted for comparison with corresponding details in the machine-made imitation (fig. 33). In

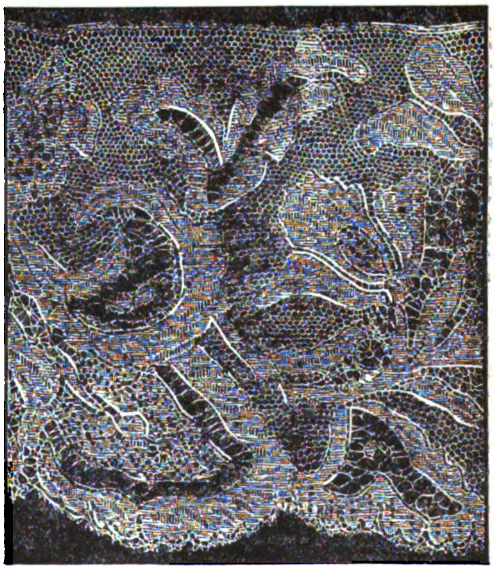


FIG. 33.—Machine-made Imitation of Venetian Point Lace, à réseau.

this the close portions are ribbed, the *cordonnet* is stouter and stands in relief, and the tracery *modes* are simpler in composition.

Literature.—The literature of the art of lace making is considerable. The series of 16th and 17th century lace pattern-books, of which the more important are perhaps those by F. Vinciolo (Paris, 1587), Cesare Vecellio (Venice, 1592), and Isabetta Catanea Parasole (Venice, 1600), not to mention several kindred works of earlier and later date published in Germany and the Netherlands, supplies a large field for exploration. Recently Signor Ongania of Venice has published a limited number of facsimiles of the majority of such works. M. Alvin of Brussels issued a brochure in 1863 upon these patterns, and in the same year the Marquis Girolamo d'Adda contributed two bibliographical essays upon the same subject to the *Gazette des Beaux Arts* (vol. xv. p. 342 *sq.*, and vol. xvii. p. 421 *sq.*). In 1864 Cavaliere A. Merli wrote a pamphlet (with illustrations) entitled *Origine ed uso delle Trine a filo di refe;* Mons. F. de Fertiault compiled a brief and rather fanciful *Histoire de la Dentelle* in 1843, in which he reproduced statements to be found in Diderot's *Encyclopédie*, subsequently quoted by Roland de la Platière. The first *Report of the Department of Practical Art*, 1853, contains a "Report on Cotton Print Works and Lace Making" by Octavius Hudson, and in the first *Report of the Department of Science and Art* are some "Observations on Lace," with magnified representations of details showing stitches and plaits used in various laces. Mr. Hudson delivered two lectures "On Lace made by Hand" in 1853. Reports upon the International Exhibitions of 1851 (London) and 1867 (Paris), by M. Aubry, Mrs. Palliser, and others, contain information concerning lace making. But the most important work first issued upon the history of lace making is that by the late Mrs. Bury Palliser (*History of Lace*, 1869; latest edition, 1875). In this work the history is treated rather from an antiquarian than a technical point of view; and wardrobe accounts, inventories, state papers, fashionable journals, diaries, plays, poems, have been laid under contribution with surprising diligence. *The Queen Lace Book*, an historical and descriptive account of the hand-made laces of all countries, published in London in 1874, relies for much of its data upon Mrs. Palliser's book, and contains some illustrations of excellent specimens of work. In 1875 the Arundel Society brought out a folio volume of permanently printed photographs taken from some of the finest specimens of ancient lace which were collected for the International Exhibition of 1874. These were accompanied by a brief history of lace, written from the technical aspect of the art, by Mr. Alan S. Cole. At the same time appeared a bulky imperial 4to volume by M. Seguin, entitled *La Dentelle*, which is illustrated with woodcuts and fifty phototypographical plates. M. Seguin divides his work into four sections. The first of these is devoted to a sketch of the origin of lacis; the second deals with pillow laces, bibliography of lace, and a review of sumptuary edicts; the third relates to needle-made lace; and the fourth contains an account of places where lace has been and is made, remarks upon commerce in lace, and upon the industry of lacemakers. This method of treating the subject entails the repetition of numerous facts and observations. Without sufficient conclusive evidence, M. Seguin accords to France the palm for having excelled in producing the richer sorts of laces, which both before and since the publication of his otherwise valuable work have been identified as being Italian in origin. Descriptive catalogues are issued of the lace collections at South Kensington Museum, at the Science and Art Museum, Dublin, and at the Industrial Museum, Nuremberg. In 1881 a series of four Cantor Lectures on the art of lace making were delivered before the Society of Arts by Mr. Alan S. Cole, and have since been extracted from the journal of the society, and published in pamphlet form, with illustrations. The latest work on the subject is a *Technical History of the Manufacture of Venetian Laces*, by G. M. Urbani de Gheltof, with plates, translated by Lady Layard, and published at Venice by Signor Ongania. The *History of Machine-wrought Hosiery and Lace Manufacture* (London, 1867), by Felkin, has already been referred to. There is also a technological essay upon lace made by machinery, with diagrams of lace stitches and patterns (*Technologische Studien im Sächsischen Erzgebirge*, Leipsic, 1878), by Hugo Fischer. (A. S. C.)

LACEDÆMON. See LACONIA and SPARTA.

LACÉPÈDE, BERNARD GERMAIN ÉTIENNE DE LA VILLE, COMTE DE (1756–1825), French naturalist, was born at Agen in Guyenne, December 26, 1756. His education was carefully conducted by his father, and the early perusal of Buffon's *Natural History* awakened an interest in that branch of study, which for the remainder of his life absorbed his chief attention. His leisure he devoted to music, in which, besides becoming a good performer on the piano and organ, he acquired considerable mastery of composition, two of his operas, which, however, were never published, meeting with the high approval of Gluck; and in 1781–85 he also brought out in two volumes his *Poëtique de la Musique.* Meantime he wrote two treatises, *Essai sur l'Électricité* (1781) and *Physique générale et particulière* (1782–84), which gained him the friendship of Buffon, who in 1785 appointed him sub-demonstrator in the Jardin du Roi, and proposed to him to become the continuator of his *Histoire Naturelle.* This continuation was published under the titles *Histoire des Quadrupèdes ovipares et des Serpents* (2 vols., 1788–89) and *Histoire Naturelle des Reptiles* (1789). After the Revolution Lacépède became a member of the legislative assembly, but during the Reign of Terror he deemed it advisable to leave Paris, his life having become endangered by his disapproval of the massacres. When the Jardin du Roi was reorganized as the Jardin des Plantes Lacépède was appointed to the chair set apart to the history of reptiles and fishes, which he conducted with such success that in 1796 he was chosen a member of the Institute. Two years afterwards he published the first volume of *Histoire Naturelle des Poissons*, the 5th volume appearing in 1803; and in 1804 appeared *Histoire des Cétacés.* From this period till his death the part he took in politics prevented him from making any further contribution of importance to science. In 1799 he became a senator, in 1801 president of the senate, in 1803 grand chancellor of the legion of honor, in 1804 minister of state, and at the Restoration, in 1819 he was created a peer of France. He died at Épinay, October 6, 1825. During the latter period of his life he wrote *Histoire générale physique et civile de l'Europe*, which was published posthumously in 18 vols., 1826. A collected edition of his works on natural history was published in the same year, and has been frequently reprinted. See ICHTHYOLOGY, vol. xii. p. 669.

LA CHALOTAIS, LOUIS RENÉ DE CARADEUC DE (1701–1785), representative of the French provincial parliaments in their struggles with Louis XV., was born at Rennes in Brittany, March 6, 1701. He entered with keen vigor into the question of the suppression of the Jesuits, which began to be most openly mooted after the affair of Martinique; and as procureur général of the parliament of Brittany he submitted to the parliament in 1761 and 1762—the very heat of the conflict—two *Comptes Rendus des Constitutions des Jésuites*, which dealt the society some of the most powerful blows it had received since Pascal, and undoubtedly contributed largely to secure the edict of suppression in 1764. In the friends of the Jesuits La Chalotais had thus prepared for himself bitter enemies, and he was to feel their power in the events of the quarrel between the court and the parliaments. The breach between the estates of Brittany and the king, in which La Chalotais was more immediately concerned, originated in an order passed by Government that the voices of two of the three estates should bind the other, that is, that the clergy and citizens should control the landed proprietors. To this order, designed to secure the registration of certain fiscal edicts in spite of the proprietors, who formed a majority in the estates, and upon whom the taxes would fall most heavily, the opposition was marked by all the obstinacy of the Breton character. La Chalotais endeavored to carry through a compromise, but at the same time animadverted somewhat acrimoniously upon the coercive efforts of the Duc d'Aiguillon, governor of Brittany, who already, as a supporter of the Jesuits, regarded the procureur with animosity. When the estates, therefore, absolutely refused to register the edicts, the court chose to regard La Chalotais as the moving spirit in the opposition; and in November, 1765, he was arrested on a charge of having written certain anonymous and seditious letters to the king. No attention was paid to his protestations of innocence; and, when the parliament of Rennes tried to force matters to a crisis by resigning in a body, Louis merely appointed commissioners to sit as a new parliament and to try La Chalotais, with his son and some other magistrates who had been arrested at the same time. But the question had spread beyond Brittany; other provincial parliaments, and even the parliament of Paris, took it up; and the strife began to assume the ominous significance of one between the people and the crown. No lower tribunal ventured to pass sentence upon La Chalotais, and in 1769 the king, calling the case before himself in council, attempted to settle it in his own autocratic way: silence was imposed as to the future, oblivion as to the past; the innocence of the accused was acknowledged, but they were exiled from their province. Such a decision was no settlement. The parliament, now restored, accused the Duc d'Aiguillon of having suborned witnesses against La Chalotais, and, when he published memoirs retorting the charge, caused them to be burned by the hand of the common hangman. Maupeou, minister of the king, after vainly endeavoring to enforce the royal edict of silence, summoned the case before the parliament of Paris in 1770. That body, however, gave such unequivocal signs of favor to La Chalotais, that the king interfered and quashed the whole proceedings by a "bed of justice." The entire matter thus lay over so far as it affected the procureur, till the death of the king in 1774 allowed him to return to his official duties. La Chalotais died at Rennes, July 12, 1785.

Besides the *Comptes Rendus* and the *Exposé Justificatif* (three parts, 1766–67), written in prison, La Chalotais was the author of an *Essai d'Education Nationale* (1763), a work extravagantly praised by Voltaire. It was written in view of the disorganization in matters educational that would follow the expected expulsion of the Jesuits from France.

LACHISH (לָכִישׁ), a town in the low country of Judah (Josh. xv. 39), and one of the strong fortresses that offered an obstinate resistance to Nebuchadnezzar (Jer. xxxiv. 7). It was to Lachish that Amaziah fled from the conspiracy raised against him at Jerusalem, and there he was killed (2 Kings xiv. 19). From an obscure allusion in Micah i. 13 it would appear that the place was a chariot city. For this it was doubtless recommended by its position in the rich low country, and the same reason, together with the fact that it commanded the line of advance from Egypt, is sufficient to explain why it was the headquarters of Sennacherib during part of his Judæan campaign (2 Kings xviii. 14; Isa. xxxvii. 8). The name of Lachish occurs on the monuments of Sennacherib, and a bas-relief now in the British Museum, representing the king receiving its spoils, is given in G. Smith's *History of Sennacherib* (1878). Lachish was reoccupied by the Jews after the captivity (Neh. xi. 30), and the *Onomastica* place it 7 miles from Eleutheropolis on the southern road. The site has not been identified. Umm Lákis does not agree with the statement of the *Onomastica*, and the name ("Mother of Itch") has no connection with the Hebrew, while El Ḥasy, suggested by Conder, has still less to recommend it. As the cities in this district were built of brick, the ruins may probably have all but disappeared.

LACHMANN, Karl Konrad Friedrich Wilhelm (1793–1851), a highly distinguished philologist and critic, was born March 4, 1793, at Brunswick, where his father held an appointment as preacher in the Andreas Kirche. In his eighth year he entered the Katharineum of his native town, where the strong bent of his vigorous mind towards philology and literature soon made itself unmistakably evident. In 1809 he passed to the university of Leipsic as a student of philology and theology; in the same year he transferred himself to Göttingen, where under the influence of Heyne, his enthusiasm for philological pursuits almost completely extinguished his interest in theology; the pagan classics and particularly the Roman poets became his absorbing study. Stronger even than that of Heyne was the influence of Dissen over the young and rising scholar, who found additional intellectual stimulus in the companionship of such fellow-students as C. K. J. Bunsen, Ernst Schulze, and C. A. Brandis. Under G. F. Benecke he also devoted himself to Italian and English, and ultimately to Old German. In 1815 he was led by the stirring political events of the day to interrupt his studious life and join the Prussian army as a volunteer chasseur; in this capacity he accompanied his detachment to Paris, but to his great regret never encountered the enemy. The regiment being disbanded he went to Berlin, where he became an assistant master in the Friedrich Werder gymnasium, and in the spring of 1816 he "habilitated" at the university. His thesis was published immediately afterwards, the subject being "The original form of the *Nibelungennoth*." Almost simultaneously appeared his edition of Propertius. The same summer he became one of the principal masters in the Fredericianum of Königsberg, where he assisted his colleague Karl Köpke with his edition of Rudolf von Monfort's *Barlaam und Josaphat* (1818), and also took part in the researches of his friend towards an edition of the works of Walther von der Vogelweide. In January, 1818, he became professor extraordinarius of classical philology in the university of Königsberg, where Lobeck also was; he at the same time began to lecture on Old German grammar and the Middle High German poets. In connection with this task he devoted himself during the following seven years to an extraordinarily minute study of all that could be found, whether in print or in manuscript, relating to these subjects, and in the summer of 1824 he obtained leave of absence in order that he might search the libraries of Middle and South Germany for further materials. In February, 1825, Lachmann was nominated extraordinary professor of classical and German philology in the university of Berlin; in June, 1827, he was promoted to the ordinary professorship in the same department; and in 1830 he was admitted a member of the Academy of Sciences. The remainder of his laborious and fruitful life as an author and a teacher presents no episode requiring special record. In January, 1851, he was seized with an inflammatory affection of the left foot, to which he ultimately succumbed on March 13, 1851. See Hertz, *Karl Lachmann, eine Biographie* (Berlin, 1851).

Lachmann, who was the translator of the first volume of P. E. Müller's *Sagaenbibliothek des Skandinavischen Alterthums*, published at Berlin in 1816, is a figure of considerable importance in the history of German philology (see Rudolf von Raumer, *Gesch. d. germanischen Philologie*, 1870). In his "habilitationsschrift" on the *Nibelungennoth*, and still more in his review of Hagen's *Nibelungen* and Benecke's *Bonerius*, contributed in 1817 to the *Jenaische Literaturzeitung*, he had already laid down the rules of text criticism and elucidated the phonetic and metrical principles of Middle High German in a manner which marked a very distinct advance in that branch of learned investigation. The rigidly scientific character of his method becomes increasingly apparent in the *Auswahl aus den Hochdeutschen Dichtern des dreizehnten Jahrhunderts* (dedicated to Benecke, 1820), in the edition of Hartmann's *Iwein* (the text being Lachmann's special care, while the explanatory notes are by Benecke, 1827), in those of Walther von der Vogelweide (1827) and Wolfram von Eschenbach (1833), in the papers "Ueber das Hildebrandslied," "Ueber althochdeutsche Betonung und Verskunst," "Ueber den Eingang des Parzivals," and "Ueber drei Bruchstücke niederrheinischer Gedichte," published in the *Abhandlungen* of the Berlin Academy, and in *Der Nibelungen Not mit der Klage in der ältesten Gestalt mit den Abweichungen der gemeinen Lesart* (1826), which was followed by a critical commentary in 1836. Lachmann's "Betrachtungen über die Ilias," first published in the *Abhandlungen* of the Berlin Academy in 1837 and 1841, in which he sought to show that the *Iliad* consists of sixteen independent "lays" variously enlarged and interpolated, have had considerable influence on modern Homeric criticism. See Homer. His smaller edition of the

New Testament appeared in 1831, 3d ed. 1846; the larger, in two volumes, in 1842–50 (*Novum Testamentum Græce et Latine: Carolus Lachmannus recensuit, Philippus Buttmannus Græcæ lectiones auctoritates apposuit*). The plan of Lachmann's edition, which has been explained by himself in the *Stud. u. Krit.* of 1830, is a modification of the unaccomplished project of Bentley. It seeks to restore the most ancient reading current in Eastern MSS., using the consent of the Latin authorities (Old Latin and Greek Western Uncials) as the main proof of antiquity of a reading where the oldest Eastern authorities differ. Besides Propertius, Lachmann edited Catullus, 1829; Tibullus, 1829; Genesius; 1834; Terentianus Maurus, 1836; Babrius, 1845; Avianus, 1845; Gaius, 1841–42; the Agrimensores Romani, 1848–52; and Lucretius, 1850. The last, which was the main occupation of the closing years of his life, from 1845, was perhaps his greatest achievement, and has been characterized by Munro as "a work which will be a landmark for scholars as long as the Latin language continues to be studied."

LA CONDAMINE, Charles Marie de (1701–1774), French geographer and mathematician, born at Paris, January 28, 1701, was trained for the military profession, but turned his attention to science and geographical exploration. He was a member with Godin and Bouguer of the expedition sent to Peru in 1735 to determine the length of a degree of the meridian in the neighborhood of the equator (see vol. vii. 517), and on his homeward route made the first scientific exploration of the river Amazon. He returned to Paris in 1745, and published the results of his measurements and travels with a map of the Amazon in *Mém. de l'Académie des Sciences*, 1745 (English translation 1745–47). La Condamine continued to interest himself in metrical problems, and on a visit to Rome made careful measurements of the ancient buildings with a view to a precise determination of the length of the Roman foot. The journal of his voyage to the equator was published at Paris in 1751. He also wrote in favor of inoculation. He died February 4, 1774.

LACONIA, the Greek Λακωνική, is the name generally applied in modern times to the country which occupied the southeastern corner of the Peloponnesus, often called Lacedæmon, Λακεδαίμων, which is the only name used in Homer. The history of the district has already been given (see Greece), and it only remains to give a slight sketch of its physical features. These are very peculiar, and had great influence in producing the marked and distinctive character of the section of the Dorian race which occupied Laconia throughout the historical period. The country is a deep valley almost completely surrounded by mountains, and it is the general opinion that both names, Laconia and Lacedæmon, refer to this hollow sunken character, being connected with *lacus*, λάκκος, etc. The mountains of Arcadia shut in this valley on the north, and from them two parallel chains of mountains stretch due south bounding the valley on the east and on the west. The eastern chain bore in ancient times the name Taygetus, the western, Parnon; both ridges stretch far out into the sea, forming respectively the promontories of Taenarus and Malea. Taygetus, now called Pentedaktylon, is a splendid unbroken chain of lofty peaks, well deserving its Homeric epithet περιμήκετος; the highest point is the ancient Taleton, now St. Elias, 7900 feet high. Mount Parnon is not such a fine ridge, but still forms a strong barrier along the sea-coast. Through the whole length of the valley from north to south flows the river Eurotas, which has only one tributary of any consequence, the Oenus. The soil was not remarkably fertile, except in the low ground towards the sea; but the sides of Taygetus were covered with dense forests, which afforded excellent sport to the inhabitants of the plain. The people were thus inured to the hardy life of mountaineers; they were so securely defended by nature against invasion that the victorious Epaminondas hesitated to attack the country; while with command of the passes they could at any time invade the neighboring countries. Over Mount Taygetus there was hardly any pass practicable for an army; from Arcadia there were only two entrances, both easily defended, one by the course of the Oenus, the other by the Eurotas. Mount Parnon stretched along the east coast, which offered no harbor, hardly even a landing-place, for foreign ships. While adding to the security of the country, the same causes isolated it greatly from intercourse with other peoples, tended to keep the inhabitants backward and to prevent education, and led to that jealous and exclusive character which distinguished the Lacedæmonians.

LACORDAIRE, Jean Baptiste Henri (1802–1861), French orator, was born at Recey-sur-Ource, Côte d'Or, 12th March, 1802. He was the second of a family of four, the eldest of whom travelled a great deal in his youth, and subsequently occupied the chair of comparative anatomy at Liége, from which he contributed some valuable treatises on entomology. For several years Lacordaire studied at Dijon, showing a marked talent for rhetoric; this naturally led him to the pursuit of law, and in the local debates of the advocates he attained a high celebrity. At Paris he for a time thought of going on the stage, but was induced to finish the course, and, having done so with credit, applied himself for eighteen months with much success to the consideration of briefs. Meanwhile a great change was passing over his convictions. Lamennais had published his *Essai sur l'Indifférence*,—a passionate vindication of belief as against the tolerant contempt of a generation which regarded truth and falsehood in every department of life with equal complaisance, a demonstration of the weakness of individual reason and an assertion of the rightful supremacy of a central religious authority. Lacordaire read and was convinced. His ardent and believing nature was weary of the theological negations of the Encyclopedists. He was impelled toward a deistical explanation of the universe, from which in turn he went on to Catholicism as the only faith calculated to keep society from disintegration. In 1823 he became a theological student at the seminary of St. Sulpice; four years later he was ordained and became almoner of the college of Henry IV. He was called from it to co-operate with Lamennais in the editorship of *L'Avenir*, a journal established for the purpose of advocating the union of the democratic principle with ultramontanism. To be a Catholic was to be a royalist in the popular definition; Lacordaire strove to show that Catholicism was not bound up with the idea of dynasty, and definitely allied it with a well-defined liberty, equality, and fraternity. But the new propagandism was denounced from Rome in an encyclical. In the meantime Lacordaire and Montalembert, believing that, under the charter of 1830, they were entitled to liberty of instruction, opened an independent free school and began to teach in it. It was closed in two days, and the teachers fined before the court of peers. These reverses Lacordaire accepted with quiet dignity; but brought his relationship with Lamennais to a close. He now began the course of Christian *conférences* at the Collége Stanislas, which attracted the art and intellect of Paris; thence he went to Notre Dame, and for two years his sermons were the delight of the capital. His presence was dignified, his voice capable of indefinite modulation, and his gestures animated and attractive. He still preached the gospel of the people's sovereignty in civil life and the pope's supremacy in religion, but brought to his propagandism the full resources of a mind familiar with philosophy, history, and literature, and indeed led the reaction against Voltairean skepticism. He was asked to edit the *Univers*, to take a chair in the university of Louvain, but declined both appointments, and in 1836 set out for Rome, revolving a great scheme for Christianizing France by restoring the old order of St. Dominic. At Rome he prepared himself for the life of the new brotherhood, donning the habit of the preaching friar and joining the monastery of Minerva. His *Mémoire pour le rétablissement en France de l'ordre des frères* *prêcheurs* was then prepared and dedicated to his country; at the same time he collected the materials for the life of his avowed master, St. Dominic. But he did not return to France until 1841, when he resumed his preaching at Notre Dame, and was successful in re-establishing the order of which he ever afterwards called himself monk. His funeral orations are the most notable in their kind of any delivered during his time, those devoted to the death of Drouot and O'Connell being especially predominant in the qualities of point and clearness. He next thought that his presence in the Assembly would be of use to his cause; but he remained there only a short while, finding the true field of his influence to be the pulpit. Many popular movements he advocated with the fervor of high conviction. In 1850 he went back to Rome and was made provincial of the order, and for four years labored to make the Dominicans a religious power. In 1854 he retired to Sorèze to become director of a private lyceum, and remained there in self-chosen obscurity until he died, 22d November, 1861.

LACQUER, or Lacker, in general terms may be said to be colored and frequently opaque varnishes applied to certain metallic objects and to wood. The term is derived from resin lac, which substance is the basis of lacquers, properly so called. Technically, among Western nations, lacquering is restricted to the coating of polished metals or metallic surfaces, such as brass, pewter, and tin, with prepared varnishes which will give them a golden, bronze-like, or other lustre as desired. Of the numerous recipes for the preparation of the various lacquers, the following for a gold lacquer for brass work may be taken as a sample:—shell-lac 8 oz., sandarach 2 oz., turmeric 8 oz., arnotto 2 oz., dragon's blood ½ oz., dissolved in 1 gallon of rectified spirit. Throughout the East Indies the lacquering of wooden surfaces is universally practised, large articles of household furniture, as well as small boxes, trays, toys, and papier mâché objects, being decorated with bright-colored and variegated lacquer. The lacquer used in the East is, in general, variously colored sealing-wax, applied, smoothed, and polished in a heated condition; and by various devices intricate marbled, streaked and mottled designs are produced. Quite distinct from these, and from all other forms of lacquer, is the lacquer work of Japan. The source and nature of the raw material of Japanese lacquer has been referred to under Japanning, and there also will be found some allusion to its extraordinary durability and resistance to all ordinary solvents. Not less extraordinary is the manipulative skill shown by the Japanese in this kind of work, and the variety and exquisite perfection of its decorative treatment, which all go to place Japanese lacquer of high quality among the rarest and most prized treasures of decorative art. In the preparation of Japanese lacquer work the wooden object to be treated is first coated with several layers of raw lacquer mixed with brick-dust, etc., which, when hardened, are smoothed with gritty stone. A few layers of common or inferior varnish of the color desired in the finished object are then successively added. After each coating the objects are placed to dry in an inclosed box, the sides of which are kept moist with water, so that hardening takes place in a dark damp atmosphere. The final coating is composed of the best quality of lacquer, and it is smoothed with great care and polished with powdered deer horn. The brilliant smooth polish of plain black lacquer is brought up by repeated thin rubbings over with uncolored lacquer and polishings with deer horn. Such are the elaborate processes used for entirely unornamented lacquer; but most Japanese work is enriched with decorations which introduce an endless variety of treatment and much more complex, tedious, and costly processes of operation. Flat work, variously colored and speckled, ornamented with gilt patterns, is among the simplest of the artistic lacquer productions of Japan. Relief or raised lacquer-work, on the other hand, is a most elaborate and costly production, the labor of months and even years being expended on the preparation of fine high-relief examples. The raised designs are produced with a mixture of red oxide of iron and lacquer repeatedly applied till the desired elevation is attained, the form of the raised surface being carefully modelled and controlled between successive applications by rubbing and grinding with charcoal powder. Metallic powders—gold, silver, bronze, etc.—are applied with the final coat while the work is still in a viscous condition, and these sinking into the lacquer produce a strongly adherent surface with a fine subdued metallic lustre. Other methods of ornamental treatment consist of inlaying and incrusting the lacquer with mother of pearl, ivory, gold, bronze, or tinfoil. A great variety of decorative effect may be thus produced, but lacquers so treated are not held in the same high esteem as the raised or even the flat varieties. Thin sections of the substance to be inlaid are placed on the surface of a freshly coated and yet "tacky" object, and imbedded by the repeated applications of additional coatings; the surface is then rubbed and reduced till the inlay and lacquer form one smooth continuous surface. Relief incrustations are managed in an analogous manner, the lacquer being smoothed and polished around the incrusted object or pattern. Lacquer is also ornamented by carving, a style mostly applied to red lacquer, although it is also occasionally done in black and other dark colors. This method of treatment has been introduced from China, where red carved lac or Peking lac is a characteristic ornamental substance.

LACRETELLE, Charles de (1766–1855), historian and journalist, was born at Metz. Shortly before the Revolution he was introduced to some of the constitutionalist leaders, and soon joined the staff of the *Moniteur* and the *Débats;* then he became secretary to the Duc de la Rochefoucauld-Liancourt. He returned to journalism and joined Chénier and Roucher on the *Journal de Paris.* The triumph of the Jacobins was not without danger for him, and to avoid it he enlisted in the army, but after Thermidor returned once more to Paris, and to newspaper work. The 13th Vendémiaire again drove him from both, and he took to serious composition. He had more than one fluctuation of fortune of the same kind still to undergo, and was actually imprisoned for a considerable time, but continued his historical work, to which after the establishment of Napoleon's power he wholly devoted himself. He became a member of the Academy in 1811, and professor of history in the Parisian faculty of literature next year. The Restoration pleased him from the constitutional point of view, and after it the July monarchy. In 1848 he retired to Mâcon, where he died seven years later. Lacretelle's chief work is a series of histories of the 18th century, the Revolution and its sequel (*Eighteenth Century,* 1808; *Revolution,* 1821–26; *Consulate and Empire,* 1840; *Restoration,* 1846). He had previously given a *Précis Historique* of the Revolution (1801–6). Mr. Carlyle's sarcastic remark on Lacretelle's *History of the Revolution,* that it "exists but does not profit much," is partly true of all his books. The author was a moderate and fair-minded man, but possessed neither great powers of style nor striking historical insight, nor the special historian's power of uniting minute accuracy of detail with breadth of view. If his history of the 18th century deserves to be singled out from his other books, it is chiefly because no exact successor to it has appeared. Besides the works mentioned he also wrote a *History of the Religious Wars,* some sketches of his personal adventures in the Revolution, etc. As a journalist, if not as an historian, Lacretelle was not scrupulous about absolute accuracy. The legend of the Abbé Edgeworth's last words to Louis XVI. has been traced to him.

LACROSSE is the national ball game of Canada, as cricket is of England and base ball of the United States of America. The aborigines had the game before the discovery of the New World, and different Indian tribes played it in different manners, generally with much roughness and violence. The present name was given it by French Canadians, owing to the resemblance of the curved netted stick, the chief implement used in the pastime, to a bishop's crozier or *crosse.* As white men gradually took up the game it became more refined. In 1867 the National Lacrosse Association of Canada was formed, and drew up a recognized code of rules. Lacrosse cannot be aptly compared to hockey or football, since striking or even touching the ball with the hands or feet is inadmissible. The crosse somewhat resembles a racket bat. It is a stick with one end curved, and the hook so formed is fitted with network, which must not bag. The ball is of india-rubber, from 8 to 9 inches in circumference. The other requisites are a level piece of turf, about 200 by 100 yards, and the goals. These may be any distance apart, according to agreement and the space available. Each goal is composed of two flag posts, 6 feet high and a like distance apart. The usual number of players is twelve on each side, and the captains station them somewhat as in football. A game is scored by one side driving the ball between their opponents' goal posts, and a match is three games out of five. There is no "off side" as in football, and the chief feat of the player is to catch the ball on the network of the crosse, dodge his opponents by running as far as practicable, and then throw the ball to one of his own side who is nearer the enemy's goal. A game is commenced by the ball being placed on the ground midway between the two goals and a player from each side "facing" for it with the crosse till one of them succeeds in sending it on the way to the opposite goal. After each game goals are changed. During winter the game is played by skaters on the ice, or on the snow with the aid of snow-shoes. A native Indian team introduced the pastime into England in 1867; several amateur clubs were formed; and a set of rules was drawn up by an English Lacrosse Association on February 12,. 1868. They differ somewhat from the Canadian regulations,—the goal posts being 7 feet apart with tape across the top, and a match being decided by the number of goals won during a specified time. The pastime, however, never took deep root in England, so many other old-established games of ball being more popular, and is now but little practised.

LA CROSSE, chief city of La Crosse county, Wisconsin, United States, is situated on the east bank of the Mississippi, at the confluence of the Black and La Crosse rivers, 196 miles by rail west-northwest of Milwaukee. La Crosse is the second commercial city and the fourth in the scale of population in the State. An extensive lumbering trade is carried on by means of the Black river. The city contains foundries, machine-shops, saw-mills, flour-mills, shipbuilding yards, and manufactories of agricultural implements, beer, and leather. It has 3 English dailies and 5 weekly newspapers (2 English, 2 Norwegian, 1 German), 20 churches, and a public library containing 3300 volumes. La Crosse became a city in 1856. The population in 1880 was 14,505.

LACRYMATORY, a modern word employed to describe a class of small vessels of terra cotta, or, more frequently, of glass, found in Roman and late Greek tombs, and fancifully supposed to have been bottles into which mourners dropped their tears. They were used to contain unguents, and it is to the need of unguents at funeral ceremonies that the finding of so many of these vessels in tombs is due. They are shaped like a spindle, or a flask with a long small neck and a body in the form of a bulb.

LACTANTIUS FIRMIANUS, also called Lucius Cæcilius or Lucius Cælius Lactantius Firmianus, was a Christian writer who from the beauty of his style has been called the "Christian Cicero." His history is very obscure. His very name is doubtful; his birthplace, whether in Italy or in Africa, is uncertain; it is impossible to say with any accuracy when his writings were published; and the date of his death is unknown. His parents were heathens; he was a pupil of Arnobius in Sicca in Africa; he went to Nicomedia in Bithynia while Diocletian was emperor to teach rhetoric; but found little work to do in that Greek-speaking city; he became a convert to Christianity, probably late in life; and about ten or twelve years before his death (312–318) he went to Gaul on the invitation of Constantine the Great, and became tutor to his eldest son Crispus. These facts, with his writings, are all that is known about Lactantius. His chief work, *Divinarum Institutionum Libri Septem* is a long introduction to Christianity, written in exquisite Latin, but displaying such ignorance as to have incurred the charge of favoring the Arian and Manichæan heresies. The date of publication has been variously given from 302 to 323 A.D. One sentence seems to say that a persecution, which can scarcely be any other than the Diocletian, was raging while the book was being written (v. 17, 5); whilst in the first, second, fourth and fifth books Constantine is addressed as emperor. Those who assert the earlier date of publication point out that the references to Constantine are omitted in several MSS. Others adopt the conjecture of Baluze that an early edition was published in Nicomedia and a later twenty years afterwards (*cf.* Ebert, *Ueber den Verfasser des Buches De Mort. Persecut.*, p. 129 *sq.*). The seven books of the institutions have separate titles given to them either by the author or by a later editor. The first, *De Falsa Religione*, and the second, *De Origine Erroris*, attack the polytheism of heathendom, show the unity of the God of creation and providence, and try to explain how men have wandered from truth into polytheistic error. The third book, *De Falsa Sapientia*, describes and criticises the various systems of prevalent philosophy, showing how baseless and contradictory they are. The fourth book, *De Vera Sapientia et Religione*, insists upon the inseparable union of true wisdom and true religion, and maintains that this union is made real in the person of Christ. The fifth book, *De Justitia*, maintains that true righteousness is not to be found apart from Christianity, and that it springs from piety which consists in the knowledge of God. The sixth book, *De Vero Cultu*, describes the true worship of God, which is righteousness, and consists chiefly in the exercise of Christian love towards God and man. The seventh book, *De Vita Beata*, discusses, among a variety of subjects, the chief good, immortality, the second advent, and the resurrection. Jerome tells us that Lactantius wrote an epitome of these *Institutions*, and such a work was discovered in the royal library at Turin in 1712 by C. M. Pfaff; it is doubtful, however, whether this MS. is the epitome of Lactantius. Besides the *Institutions*, Lactantius wrote a treatise, *De Ira Dei*, addressed to one Donatus and directed against the Epicurean philosophy; an argument for the wisdom and goodness of God as exhibited in the creation and preservation of the world, *De Opificio Di sive de Formatione Hominis;* and a very celebrated treatise, *De Mortibus Persecutorum*, which describes God's judgments on the persecutors of his church from Nero to Diocletian, and has served as a model for numberless subsequent writings of a like nature. *De Mort. Persecut.* is not included in the earlier editions of Lactantius; it was discovered and printed by Baluze in 1679. Many critics do not believe it to be the work of our author, and ascribe it to an unknown Lucius Cæcilius (see the work of Ebert above quoted). Jerome speaks of Lactantius as a poet, and several poems have been attributed to him:—*De Phenice*, *Symposium*, *De Pascha ad Felicem Episcopum*, and *De Passione Domini.* It is extremely probable that all these are the productions of a much later age.

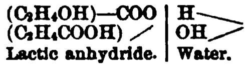
MSS. of Lactantius are very numerous; a very complete catalogue of these and of the earlier printed editions will be found in Le Brun and Lenglet Dufresnoy's edition, 2 vols. Paris, 1748. The best editions besides Dufresnoy's are those of Walch, Leipsic, 1715; of Bünemann, Leipsic, 1739; and in Migne's *Patrologia Latina*, vols. vi. and vii. A new edition is promised in the Vienna *Corpus Script. Eccles. Latin.*

LACTIC ACID, a chemical term, which, though originally invented to designate the particular acid contained in sour milk, has now, through the discovery of other acids isomeric with and very similar to that acid, acquired a generic, in addition to its original specific, meaning.

1. *Lactic Acid properly so called, Fermentation Lactic Acid, Ethylidene Lactic Acid.*—Scheele (*Transactions of Stockholm Acad.*, 1780) was the first to isolate this acid (from sour milk) and establish its individuality. About twenty-four years later Bouillon Lagrange, and, independently of him, also Fourcroy and Vauquelin maintained that Scheele's new acid was nothing but impure acetic. But this notion was combated by Berzelius, and finally refuted (in 1832) by Liebig and Mitscherlich, who by the elementary analyses of lactates proved the existence of this as a distinct acid.

In the article FERMENTATION (vol. ix. p. 86) it is explained how lactic acid is produced from milk-sugar and from ordinary glucose by "lactic fermentation." The most convenient process for the preparation of the acid is Bensch's. A solution of "invert-sugar" (see vol. ix. p. 84) is produced by dissolving 6 parts of cane-sugar and $\frac{1}{144}$th part of tartaric acid in 35 parts of boiling water and allowing to stand for two days. There is then added $\frac{1}{15}$th part of foul cheese, 8 parts of sour milk, and 2½ parts of carbonate of zinc, and the mixture kept at 40° to 45° C. for eight to ten days. The sugar, $C_6H_{12}O_6$, ferments into lactic acid, $C_3H_6O_3$, which, by the carbonate present, is converted into lactate of zinc. But part of the lactate is invariably lost through "butyric fermentation" with evolution of hydrogen, which latter converts part of the sugar into mannite, $C_6H_{14}O_6$. The fermented liquid is heated to boiling, strained clear, and allowed to cool, when the lactate of zinc separates out in crystalline crusts, which are purified by recrystallization from hot water. The free acid is obtained by decomposing the hot aqueous solution of the salt with sulphuretted hydrogen and filtering off the sulphide of zinc. The filtrate is evaporated on a water bath to a syrup, which is treated with ether. Mannite and other impurities remain, and the acid passes into the filtrate, from which the ether is easily expelled by distillation, and subsequent evaporation in an open basin. What ultimately remains is a thick colorless syrup, which, in ordinary chemical parlance, goes as *lactic acid*, although it is at best only an approximation to the hydrate, $C_3H_6O_3.H_2O$. The extra H_2O is easily enough removed by continued evaporation, but no portion of it can be thus got rid of without the acid $C_3H_6O_3$ itself suffering dehydration into *lactic anhydride*, $C_6H_{10}O_5$, and *lactide* $C_6H_8O_4$, by successive subtractions of H_2O from $2C_3H_6O_3$.

The behavior of lactic acid solution to basic reagents and of the acid itself to alcohols (in the presence of dehydrators) is strictly that of a monobasic acid $C_3H_6O_3$; *i.e.*, so much lactic is strictly equivalent to one molecule of acetic acid, and as the latter is proved to be $CH_3.COOH$, lactic acid must be assumed to be $(C_2H_5O)\ COOH$. But the radicle C_2H_5O (unlike the CH_3 of acetic acid) still contains one hydrogen atom, which, although not replaceable by metals, can be replaced by acid radicles such as acetyl C_2H_3O or, conjointly with the oxygen atom, by Cl, Br, I. Thus, for instance, lactic ether, $(C_2H_5O)COOC_2H_5$, when treated with chloride of acetyl, $C_2H_3O.Cl$, gets converted into acetyl-lactic ether, $[C_2H_4(C_2H_3O)O]COO(C_2H_5)$, with formation of hydrochloric acid. By the action of hydriodic acid the same H conjointly with the O of the radicle is replaced by iodine with formation of water. In a word, lactic acid, besides being an acid analogous to, for instance, acetic acid, CH_3COOH, is at the same time an alcohol analogous to ordinary spirit of wine, $C_2H_5.OH$, as shown by the formula $HO—C_2H_4—COOH$. This twofold character of our substance explains the readiness with which it passes into anhydrides. Lactic acid, the acid, acts upon lactic acid, the alcohol; the replaceable H in the former unites with the OH of the latter, and the two rests combine into an ether which is lactic anhydride. Thus:



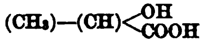
$$\begin{array}{l|l} (C_2H_4OH)—COO & H \\ (C_2H_4COOH) \diagup & OH \\ \text{Lactic anhydride.} & \text{Water.} \end{array}$$

The slanting lines show the mode of combination after the reaction. The anhydride, as we see, still contains an OH and COOH, and a repetition of the group within its molecule leads to lactide, $C_6H_8O_4$. This latter body could be presumed to be formed from one molecule of lactic acid:

$$HO(C_2H_4)COOH = (C_2H_4)COO + H.OH;$$

but the vapor density determination proves the molecular weight to be in accordance with the larger formula $C_6H_8O_4$.

Admitting, as well we may, that lactic acid is a compound of COOH and OH with C_2H_4, what is this C_2H_4 itself? This question has been satisfactorily answered. When lactic acid is distilled rapidly, it breaks up into formic acid, $H.COOH$, and aldehyde, $(CH_3)(CO)H$. Conversely when aldehyde is treated with hydrocyanic acid and muriatic acid it is converted into lactic acid, in two steps, thus: (1) the $C=O$ in the aldehyde combines with the $(NC)H$, the H going to the O and the (NC) by its C to the C, to form the group $(NC)—C—O—H$; and (2) the NC of this group, by the action of the water, gets converted into a COOH, with formation of NH_3, which combines with the muriatic acid. $NC + 2H_2O = NH_3 + COOH$. The (CH_3) and H in the original aldehyde retain their places, so that what we obtain ultimately must be



$$(CH_3)—(CH)<\begin{matrix} OH \\ COOH \end{matrix}$$

and this consequently is the structure of lactic acid. The radicle $(CH_3)(CH)$ is called ethylidene, to distinguish it from "ethylene," which is $(CH_2)(CH_2)$.

2. *Paralactic or Sarcolactic Acid.*—This acid was discovered by Berzelius in the juices of flesh. It is almost identical with ordinary lactic, but differs from it in this that it (and its salts) turn the plane of polarized light, and also in this that the sarcolactates in general are more readily soluble than ordinary lactates, and contain different proportions of crystal water from these. Thus, for instance, we have for the zinc salts

Ordinary.	*Sarco-.*
$Zn(C_3H_5O_3)_2 . 3H_2O$.	$Zn(C_3H_5O_3) . 2H_2O$.
Soluble in 60 parts of cold and in 6 parts of boiling water.	Soluble in 17 parts of cold water.

The isomerism of the two acids used to be explained by assuming that the sarco-acid contained ethylene in lieu of the ethylidene of the ordinary acid, thus:

$$(OH)—(CH_2)—(CH_2)—COOH,$$

i. e., that the OH and COOH were attached to different carbon atoms. But this has been proved by Erlenmeyer to be a mistake. The sarco-acid has precisely the same structure as ordinary lactic acid. It is a case of absolute (*i. e.*, of unexplained) isomerism.

3. *Hydracrylic Acid.*—From glyceric acid by the action of hydriodic acid we obtain β-iodopropionic, which, when treated with water and oxide of silver, exchanges its iodine for OH:

$$I . H_2C—CH_2—COOH$$

gives

$$(OH) . H_2C—CH_2—COOH,$$

which is hydracrylic, an ethylene-lactic acid. That this really is so was proved by Erlenmeyer, who obtained it by the action of water (+HCl) on undoubted ethylene-cyanhydrine $(OH)—(C_2H_4)—(CN)$. As suggested by the formula, it differs markedly in its reactions from the two more properly so-called lactic acids.

All lactic acids, when heated with hydriodic acid in sealed-up tubes, pass ultimately into (the same) propionic acid, $(CH_3)—(CH_2)—COOH$. (W. D.)

LADÁC AND BALTI. The name Ladák (pronounced in Tibetan Lata) belongs primarily to the broad valley of the Upper Indus in West Tibet, but includes several surrounding districts in political connection with it; the present limits are between 75° 40′ and 80° 30′ E. long., and between 32° 25′ and 36° N. lat. It is bounded N. by the Kuenlun range and the slopes of the Karakorum, N. W. and W. by the Mussulman state of Balti or Little Tibet, S. W. by Kashmir, S. by British Himalayan territory, and E. by the Chinese Tibetan provinces of Ngari and Rudók.[1] The whole region lies very high, the valleys of Rukshu in the southeast being 15,000 feet, and the Indus near Lé 11,000 feet, while the average height of the surrounding ranges is 19,000 feet. The proportion of arable and even possible pasture land to barren rock and gravel is very small.

The natural features of the country may be best explained by reference to two native terms, under one or other of which every part is included, viz., *changtang*, *i. e.*, "northern, or high plain," where the amount of level ground is considerable, and the hills proportionally further apart; and *rong*, *i. e.*, "deep valley," where the contrary condition prevails. The former predominates in the east, diminishing gradually westwards. There, although the vast alluvial deposits which once filled the valley to a remarkably uniform height of about 15,000 feet have left their traces on the mountain sides, they have undergone immense denudation, and their débris now forms secondary deposits, flat bottoms, or shelving slopes, the only spots available for cultivation or pasture. These masses of alluvium are often found either metamorphosed to a sub-crystalline rock still showing the composition of the strata, or simply consolidated by lime.

Grand scenery is exceptional, for the valleys are confined, and from the higher points the view is generally of a confused mass of brown or yellow absolutely barren hills, of no great apparent height. The parallelism characteristic of the Himalayan ranges continues here, the direction being northwest and southeast. A central range divides the Indus valley, here 4 to 8 miles wide, from that of its north branch the Shayok, which with its fertile tributary valley of Nubra is again bounded on the north by the Karakorum. This central ridge is mostly syenitic gneiss, and northeast from it are found, successively, Silurian slates, Carboniferous shales, and Triassic limestones, the gneiss recurring at the Turkestan frontier. The Indus lies along the line which separates the crystalline rocks from the Eocene sandstones and shales of the lower range of hills on the left bank, the lofty mountains behind them consisting of parallel bands of rocks from Silurian to Cretaceous.[2]

There are several lakes in the east districts at about 14,000 feet. They have evidently been of much greater extent, and connected with the river systems of the country, but they are now mostly without outlet, saline, and in the process of desiccation.

The climate is intensely dry, practically rainless, the little snow which falls soon disappearing;[3] above a certain height no dew is deposited. The alternations of temperature are great; the sun's direct rays are hotter than in the Indian plains,[4] while the afternoon winds are piercingly cold; except in summer it freezes every night, even in the lower districts, and nightly throughout the year at 15,000 feet.

Vegetation therefore is confined to valleys and sheltered spots, where a stunted growth of tamarisk and *Myricaria*, *Hippophae* and *Elæagnus*, furze, and the roots of *burtsi*, a salsolaceous plant, supply the traveller with much-needed firewood. The trees are the pencil cedar (*Juniperus excelsa*), the poplar and the willow (both extensively planted, the latter sometimes wild), apple, mulberry, apricot, and walnut. Agriculture depends on irrigation, which is skilfully managed, the principal products being wheat, common and naked barley (from which the returns are usually small), millet, buckwheat, pease, beans, and turnips. Lucerne and prangos (an umbelliferous plant) are used as fodder.

Among domestic animals are the famous shawl goat, two kinds of sheep, of which the larger (*huniya*) is used for carrying burdens, and is a principal source of wealth, the yak, and the dso, a valuable hybrid between the yak and common cow. Among wild animals are the kyang or wild ass, ibex, markhor, antelope, *Ovis Poli*, marmot, hare, and other Tibetan fauna.

The capital, Lé (population 4000), lies 4 miles from the river on the right bank, 11,540 feet above the sea, at the southern base of a spur from the central range, —a terraced slope, with scattered hamlets, extending thence to the Indus. It contains the palace of the old gyalpos, an imposing structure seven stories high, and a wide bazaar where polo is played. It is surrounded by poplar plantations, with manis[5] and ch'hordtens[6] beyond. The houses are usually two-storied, with flat roofs and balconies to the south or west, the doors and shutters striped red and white.

The numerous monasteries are built (as the houses used to be, for defence) in lofty and picturesque situations, and would be strategically strong but for the absence of water. They are supported partly by their own lands, but chiefly by liberal gifts from the peasantry, with whose interests the lamas identify themselves. The latter are hospitable, and their superiors often refined, intelligent, and genial.

The religion is Buddhist, chiefly of the Dukpa or Red sect, but traces of an older faith linger, to which the masked dances of the monks may possibly be referred. Mohammedanism, previously on the increase, is discouraged by the Kashmir Government, its Hindu influence tending, as Hinduism has done in Nepal, to introduce caste ideas.

Polyandry is general, except among the rich.

The home trade is worth little over £4000; the chief exports are wool, dried fruits, salt, and small quantities of gold, borax, and sulphur; the chief imports, provisions, hardware, and tea; but the transit trade is relatively very important, the chief routes from the Punjab, Afghanistan, and Kashmir into Eastern Turkestan and Chinese Tibet all passing through Lé.[7] It is carried by coolies, or on ponies, sheep, or yaks, over difficult passes often 18,000 feet high, and is further hampered by the exclusive policy of China and Russia. The mechanical and political obstacles have long engaged the attention of the Indian Government.

History.—The earliest notice of Ladák is by the Chinese pilgrim Fa-hian, 400 A.D., who, travelling in search of a purer faith, found Buddhism flourishing there, the only novelty to him being the prayer-cylinder, the efficacy of which he declares is incredible. Ladák formed part of the Tibetan empire until its disruption in the 10th century, and since then has continued ecclesiastically subject, and sometimes tributary, to Lhasa. Its inaccessibility saved it from any Mussulman invasion until 1531, when Sultan Said of Kashgar marched an army across the Karakorum, one division fighting its way into Kashmir and wintering there. Next year they invaded Eastern Tibet, where nearly all perished from the effects of the climate.

Early in the 17th century Ladák was invaded by its Mohammedan neighbors of Balti, who plundered and destroyed the temples and monasteries; and again, in 1685-88, by the Sokpa or Calmucks, who were expelled only by the aid of the lieutenant of Aurangzeb in Kashmir, Ladák thereafter becoming tributary. The gyalpo or king then made a nominal profession of Islam, and allowed a mosque to be founded at Lé, and the Kashmiris have ever since addressed his successors by a Mohammedan title. When the Sikhs took Kashmir, Ladák, dreading their approach, offered allegiance to Great Britain. It was, however, conquered and annexed in 1834–41 by Ghulab Singh of Jamu—the unwarlike Ladákis, even with nature fighting on their side, and against indifferent generalship, being no match for the Dogra troops. These next turned their arms successfully against the Baltis (who in the 18th century were subject to the Mogul), and were then tempted to revive the claims of Ladák to the Chinese provinces of Rudók and Ngari. This, however, brought down an army from Lhasa, and after a three days' fight the Indian force was almost annihilated—chiefly indeed by frostbite and other sufferings, for the battle was fought in mid-winter, 15,000 feet above the sea. The Chinese then marched on Lé, but were soon driven out again, and peace was finally made on the basis of the old frontier. The widespread prestige of China is curiously illustrated by the fact that tribute, though disguised as a present, is paid to her, for Ladák, by the maharaja of Kashmir.

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[1] Geographically the east boundary is a mountain ridge some way within Chinese territory, which, running north, is the watershed between East and West Tibet, and from the north part of which the Indus, from the south the Sutlej, take their rise.

[2] Here, in the Zanskar, as the name implies, copper is found.

[3] The average height of the snow-line is about 19,000 feet.

[4] Gerard records 158° in Rupshu, *i. e.*, only 27° below boiling-point at that altitude.

[5] "Mani," a long stone wall, several feet wide, running along the roadside, covered with loose stones deposited by the passers-by, inscribed with the prayer or ejaculation, "Om mani padme hom."

[6] "Ch'hordten," the monumental tomb of a lama.

[7] The trade registered at Lé, chiefly between India and Eastern Turkestan, averages £184,000, the principal exports from India being cotton goods, value £29,200; silk ditto, £6000; skins, £3600; and tea, £8500; and from Eastern Turkestan—raw silk, £14,100; silver, £29,700; gold, £7000; charas, £6400; horses, £3200.

The adjoining territory of Balti—possibly the Byltæ of Ptolemy—forms the west extremity of the vast region known as Tibet, whose natural limits here are the Indus from its abrupt southward bend in 74° 45′ E. long., and the mountains to the north and west, separating a comparatively peaceful Tibetan population from the fiercer Aryan tribes beyond. Mohammedan writers about the 16th century speak of Balti as "Little Tibet," and of Ladák as "Great Tibet," thus ignoring the really Great Tibet altogether. The Balti people call Gilghit "a Tibet," and Dr. Leitner says that the Chilasi, a Dard people west of the Indus, call themselves Boté, or Tibetans;[1] but, although these districts may have been, like Kashmir, overrun by the Tibetans, or have received rulers of that race, the ethnological frontier coincides with the geographical one here given. Balti is a mass of lofty mountains, the prevailing formation being gneiss. In the north is the Baltoro glacier, the largest out of the arctic regions, 35 miles long, contained between two ridges whose highest peaks to the south are 25,000 and to the north 28,265 feet. The Indus, as in Lower Ladák, runs in a narrow gorge, widening for nearly 20 miles after receiving the Shayok. The capital, Skardo, a scattered collection of houses, stands here, perched on a rock 7740 feet above the sea. The house roofs are flat, occupied only in part by a second story, the remaining space being devoted to drying apricots, the chief staple of the main valley, which supports little cultivation. But the rapid slope westwards is seen generally in the vegetation. Birch, plane, spruce, and *Pinus excelsa* appear; the fruits are finer, including pomegranate, pear, peach, vine, and melon, and where irrigation is available, as in the North Shigar, and at the deltas of the tributary valleys, the crops are more luxuriant and varied.

Population.—The Ladákis, numbering about 21,000, are Tibetan, with a slight Caucasian admixture, and there are numerous Baltis and Dards (the latter superficially Buddhist) in the western districts. The Changpa, *i.e.*, "mountaineers," in the east are also Tibetan. They are singularly hardy, good-humored, not stupid, though simple and clumsy, dirty (washing it is said once a year, but not regularly), fond of social gatherings. The national drink, chang, is a sort of beer made from barley. The Balti type contains a much larger Aryan element, the isolated Dard (or Shin) communities being probably relics of an early Aryan population, subsequently overlaid by a Tibetan. The cross is a good one, the Baltis being more intelligent, if less genial, than the Ladákis, and equally industrious. They are taller, less beardless, and their noses less flat. They eschew pigtails. Polo is played more generally, and with more spirit, than in Ladák. The two languages are mutually intelligible. Like many Tajik and other mountain tribes westwards, the Baltis are Shiah Mohammedans. The women are thus more secluded than in Ladák, where they are particularly independent. They have abandoned polyandry, and (possibly in consequence) their numbers—some 58,000 in Balti and Western Ladák—are larger than the country can support. Many emigrate to Kashmir and to British territory, where they do well. In the west the Dards are numerous, and a Dard element is especially observable in the families of the chiefs, some of whom, as in Ladák, were semi-independent before the annexation.

The principal works consulted have been Mr. F. Drew's excellent book on *The Jummoo and Kashmir Territories;* a valuable paper by General H. Strachey "On the Physical Geography of Western Tibet," in the *Roy. Geog. Soc. Journ.*, vol. xxiii.; Cunningham's *Ladak; The Tribes of the Hindoo Koosh*, by Major J. Biddulph; the travels of Vigne, and of Moorcroft and Trebeck; papers by R. Lydekker, in *Records of the Geological Survey of India*, vols. xiii. and xiv., and by Dr. F. Stoliczka, in *Report* of Sir T. D. Forsyth's mission to Yarkand. (C. T.)

LA DIXMERIE, Nicolas Bricaire de (1730–1791), French man of letters, was a native of Champagne, and was born about 1730. While still young he removed to Paris, where the rest of his life was spent in considerable literary activity. He died suddenly on November 26, 1791. His numerous works include *Contes Philosophiques et Moraux* (1765), characterized by Sabatier as "less agreeable than those of Marmontel, but more moral, more varied, and showing a keener sensibility;" *Les deux âges du Goût et du Génie sous Louis XIV. et sous Louis XV.*, a parallel and contrast, in which the decision is given, in favor of the latter; *L'Espagne littéraire* (1774); *Éloge de Voltaire* (1779), and *Éloge de Montaigne* (1781).

LADOGA, formerly Nevo, a lake of Northern Russia, situated between 59° 56′ and 61° 46′ N. lat., and 29° 53′ and 32° 50′ E. long., surrounded by the governments of St. Petersburg, Olonetz, and Wiborg. It has the form of a quadrilateral, elongated from northwest to southeast. Its eastern and southern shores are flat and marshy, whilst the northwestern margin is craggy and fringed by numerous small rocky islands, the largest of which are Valaam and Konevetz, and which occupy altogether an area of 223 square miles. Lake Ladoga is 7000 square miles in area, that is, thirty-one times as large as the Lake of Geneva; but its depth being less, it contains only nineteen times as much water as the great lake of Switzerland. The greatest depth, 244 yards, is in a cavity situated in the northwestern part of the lake, the average depth not exceeding 100 yards. The level of Lake Ladoga is 55 feet above the Gulf of Finland, but it rises and falls about 7 feet according to atmospherical conditions. The western and eastern shores consist of boulder clay, as well as a narrow strip on the southern shore, south of which runs a ridge of crags of Silurian sandstones; the hills of the northwestern shore afford a variety of granites and crystalline slates of the Laurentian system, whilst the Valaam island is made up of a rock which Russian geologists describe as orthoclastic hypersthenite. The granite and marble of Serdobol, and the sandstone of Poutilov, are much used for buildings at St. Petersburg; copper and tin from the Pitkaranda mine are exported. No less than sixty rivers enter Lake Ladoga, pouring into it the waters of numberless smaller lakes which lie at higher levels around it. The Volkhov, which conveys the waters of Lake Ilmen, is the largest; Lake Onega discharges its waters by the Svir, and the Saima system of lakes of Eastern Finland contributes the Wuoxen and Taipala rivers; the Syass brings the waters from the smaller lakes and marshes of the Valdai plateau. Lake Ladoga discharges its surplus waters by means of the Neva, which flows from its southwestern corner into the Gulf of Finland, rolling down its broad channel 104,000 cubic feet of water per second. The water of Lake Ladoga is very pure and cold; in May its temperature on the surface does not exceed 36° Fahr., and even in August it reaches only 50° and 53°, the average yearly temperature of the air at Valaam being 36.8°. The lake begins to freeze in October, but it is only about the end of December that it is frozen in its deeper parts; and it remains under the ice covering until the end of March, whilst wide icefields continue to float in the middle of the lake until they are broken up by gales and scattered on the shores. Only a small part of the Ladoga ice is discharged by the Neva; but it is enough to produce in the middle of June a return of cold in the northern capital. The thickness of the ice does not exceed 3 or 4 feet; but during the alternations of cold and warm weather, with strong gales, in winter, heaps of ice, 70 and 80 feet high, are raised on the banks and on the icefields. The water of the lake is in continuous rotatory motion, being carried along the western shore from north to south and along the eastern from south to north. The vegetation on the shores is poor; immense forests, which formerly covered them, are now mostly destroyed; but the fauna of the lake is somewhat rich; a species of seal which inhabits its waters, as well as several Arctic species of crustaceans, recall its former connection with the Arctic Ocean. The great variety of sweet water *Diatomaceæ* which are found in the ooze of the deepest parts of the lake has also an Arctic character. Fishing is very extensively carried on. Navigation on the lake, which is practicable for only one hundred and eighty days in the year, is rather difficult owing to fogs and gales, which are often accompanied, even in April and September, with snowstorms. The prevailing winds are northwest and southwest; northeast winds cause the water to rise in the southwestern part of the lake, sometimes from 3 to 5 feet. A phenomenon very similar to the *seiches* of the Lake of Geneva is observed in connection with the rise and fall of the barometer. Steamers ply regularly in two directions from St. Petersburg—to the monasteries of Konevetz and Valaam, and to the mouth of the Svir, whence they go up that river to Lake Onega and Petrozavodsk; and no less than from 600 to 800 small vessels transport timber, firewood, planks, iron, kaolin, granite, marble, fish, hay, and various small wares from the northern shore to Schlüsselburg, and thence to St. Petersburg. The rivers Volkhov, Syass, and Svir being parts of the three great systems of canals which unite the Upper Volga with the Gulf of Finland, and the navigation on Lake Ladoga being too dangerous for small craft, three canals with an aggregate length of 70 miles were dug along the southern shore of Lake Ladoga, uniting the mouths of these three rivers with the Neva at Schlüsselburg; thousands of vessels pass yearly along them on their way to St. Petersburg. The population on the shores of the lake is sparse, and the towns Schlüsselburg, with 6000 inhabitants, New Ladoga (4500), Kexholm (1000), and Serdobol (800) are poor; many small villages are situated on the southern, northeastern, and western shores, but the total population of the shores of Lake Ladoga does not exceed 35,000. The monasteries of Valaam, founded in 960, on the island of same name, and Konevskiy, on the Konevetz island, founded in 1393, are highly venerated, and are visited every year by many thousands of pilgrims.

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[1] This, however, it has been said, is only taken from the name of a former ruling family.

LADRONE, OR MARIANA ISLANDS, a chain of fifteen islands in the North Pacific Ocean, situated to the north of the Carolines, and between 13° and 21° N. lat., and 144° and 146° E. long. The name Islas de los Ladrones, or "Islands of the Thieves," was given them by the ship's crew of Magellan on account of the thieving propensities of the inhabitants. Magellan himself styled them Islas de las Velas Latinas, or "Islands of the Lateen Sails." San Lazarus archipelago, Jardines, and Prazeres are among the names applied to them by later navigators. They received their present recognized official appellation "Las Marianas" in 1668 in honor of Maria Anna of Austria, widow of King Philip IV. of Spain, and they still form a Spanish colony under the general government of the Philippines. A broad channel divides the Ladrones into two groups, containing a total area of about 417 square miles. The northern group (Gani) consists of ten islands, now uninhabited; five islands, of which four are inhabited, form the southern group, viz., Guahan (Guam, Spanish Guajan, the San Juan of old Spanish charts), Rota, Aguigan, Tinian, and Saypan. On Guahan, the largest and southernmost of the group, is the only town in the colony, San Ignacio de Agaña, and the fortified harbor of Umata.

The general surface of the southern islands is far inferior in elevation to that of the northern group, which is mountainous, though the altitudes do not exceed 2600 to 2700 feet. The predominant rock in the southern group is madreporic limestone, but in some instances, and especially at Guahan, volcanic formations occur. The northern islands are entirely of igneous origin, and on Pagan and Uraccas are smoking craters. The coasts of the southern islands are in many instances surrounded by reefs. All the islands except Farallon de Medinilla and Mangs (in the northern group) are more or less densely wooded, and the vegetation is luxuriant, much resembling that of the Philippines, whence many species of plants have been introduced. Owing to the humidity of the soil, cryptogams are very numerous, as also most kinds of grasses. Among the useful vegetable products may be mentioned areca and cocoa-nut palms, rice, maize, sugar, tobacco, cotton, indigo, breadfruit, bananas, and castor oil. In consequence of the laziness of the native population, agriculture is almost entirely neglected, in spite of the exceptional advantages offered by the climate and soil. On most of the islands there is a plentiful supply of water; at Guahan, however, the partial clearing away of the woods has caused several full streams to dwindle to mere brooks.

The fauna of the Ladrones, though inferior in number and variety, is similar in character to that of the Carolines, and certain species are indigenous to both colonies. Swine and oxen are allowed to run wild, and are hunted when required: the former were known to the earlier inhabitants; the latter with most other domestic animals were introduced by the Spaniards. The roe was imported from the Philippines.

The climate of the Ladrones, though humid, is salubrious, whilst the heat, being tempered by the trade winds, is milder than that of the Philippines. The yearly mean temperature at Guahan is about 81° Fahr. August and September are the warmest months, but the variations of temperature are not great. The year may be divided into a wet and dry season, though even in the latter rain often falls. From October to May the general winds are northeasterly; during the other four months they are often northwesterly and southwesterly, the latter being accompanied by much rain.

The present population of the Ladrones consists of descendants from the original inhabitants, called by the Spaniards Chamorros, of Tagal settlers from the Philippines, and of a mixed race formed by the union of Spaniards and Chamorros. On the island of Saypan there is a colony from the Carolines. With the exception of the last-mentioned settlers, who are very active, and have founded the village of Garapan, the inhabitants are generally wanting in energy, of indifferent moral character, and miserably poor. Little has yet been done for the improvement of their intellectual and social condition, with the exception of the establishment of a few schools, now mostly fallen to decay. The number of the original inhabitants previous to the subjection of the islands by the Spaniards in 1668 has been variously estimated at from 40,000 to 60,000. The Spanish conquest and the forcible suppression of the protracted opposition of the natives reduced their numbers to such an extent that in 1741 the population was only 1816. From that date, however, owing to the introduction of new colonists from the Philippines, the population began to increase, and in 1856 was 9500.

in the last year a severe epidemic carried off more than a third of the inhabitants. Since 1871 the total population of the Ladrones has been roughly estimated at 8000. All the inhabitants understand and are able to speak Spanish, which is gradually supplanting the native language, a Micronesian dialect nearly allied to that used by the Tagals of the Philippines. The residence of the governor is at Agaña in Guahan. Spain gains no revenue by the possession of these islands.

The honor of the discovery of this archipelago, the first found by Europeans in the Pacific, is due to Magellan, who upon the 6th of March, 1521, observed the two southernmost islands, and sailed between them (O. Peschel, *Geschichte des Zeitalters der Entdeckungen*, Stuttgart, 1877, p. 500). Modern research in the archipelago began with the visit of Commodore Anson, who in August, 1742, landed upon the island of Tinian, where he found extensive ruins (Anson's *Voyage*, bk. iii). The Ladrones were visited by Byron in 1765, Wallis in 1767, and Crozet in 1772. Great additions to our knowledge of the islands were made in the present century by Freycinet, in 1829 (*Voyage autour du monde*, part histor. ii), and the Spanish captain Sanchez y Zayas, in 1865.

Besides works above mentioned, see especially C. E. Meinicke, *Die Inseln des Stillen Oceans*, Leipsic, 1875–76, part ii.; "The Marianas Islands," in the *Nautical Magazine*, vols. xxxiv., xxxv., London, 1865, 1866; and P. A. Lesson, *Les Polynésiens, leur origine*, etc., Paris, 1880. (E. D. B.)

LADY DAY, the Feast of the Annunciation of the Virgin Mary. See ANNUNCIATION.

LAENNEC, RENÉ THÉODORE HYACINTHE (1781–1826), inventor of the stethoscope, was born in Quimper in Brittany, February 17, 1781. Early trained to medicine under his uncle at Nantes, he completed his medical studies at Paris, where he received the degree of doctor in 1804. He specially distinguished himself by his researches in pathological anatomy, and was regarded as one of the first practitioners of the capital when in 1816 he was appointed physician at the Necker hospital. There he continued those researches which resulted in the discovery of the stethoscope in the manner already fully described under AUSCULTATION (vol. iii. p. 87). Laennec himself fell a victim to phthisis, the disease which, of all others, he had specially studied. For a few years he was able to occupy a medical chair in the Collége de France; but he died on August 13, 1826.

Laennec's chief work is the *Traité de l'Auscultation médicale*, 1819, in which he announced his discovery. It has been translated into various languages. He was the author also of *Propositions sur la doctrine médicale d'Hippocrate*, 1804; of *Mémoires sur les vers vésiculaires*, 1804; and of articles in the *Dict. des Sciences Médicales*, and other publications.

LAER, or LAAR, PIETER VAN (1613–1675), painter, was born at Laaren in Holland in 1613. The influence of a long stay in Rome begun at an early age is to be traced in his landscape and backgrounds, but in his subjects he remained true to the Dutch tradition, choosing generally lively scenes from peasant life, as markets, feasts, bowling scenes, farriers' shops, robbers, hunting scenes, peasants with cattle, and the like. From this taste, or from his personal deformity, he was nicknamed Bamboccio by the Italians. On his return to Holland about 1639, he lived chiefly at Amsterdam and Haarlem, in which latter city he died in 1674 or 1675. Pieter van Laer's pictures are marked by skilful composition and good drawing; he was especially careful in perspective. His coloring, according to Crowe, is "generally of a warm brownish tone, sometimes very clear, but oftener heavy, and his execution broad and spirited." Certain etched plates are also attributed to him.

LÆSTRYGONES, a mythic race of giants, mentioned in the *Odyssey*. After leaving the island of Æolus, Ulysses reached in six days the coast of the Læstrygonians and the city of Lamus, where the paths of day and night approach so close that a sleepless man might make double wages by herding continuously, watching one flock while the other rested. This feature of the tale obviously contains some hint of the long nightless summer in the Arctic regions, which perhaps penetrated to the Greeks with the merchants who fetched amber from the Baltic coasts. The Læstrygonians were cannibals; and, when three sailors sent as scouts incautiously entered the city, the king Antiphates ate one and the people pursued the others to the ships. As the vessels tried to escape from the harbor, the giants pelted them with masses of rock, and sunk all except the one in which Ulysses was. The Læstrygonians must be a mythic multiplication of the one ultimate demoniac being who is called their king, just as the kindred race of the Cyclopes is a multiplication of the single one-eyed sun god Polyphemus, the Cyclops *par excellence*. The name Antiphates is a fanciful one, but the other name Lamus takes us into a religious world where we can trace the origin of the legend, and observe the god of an older religion becoming the subject of fairy tales in a later period (see LAMIA). Among the Greeks it was usual to place the country of the Læstrygones in Sicily, either beside Etna or towards the northwest promontory of the island; but, on the other hand, Horace and other Latin authors speak of them as living in Southern Latium, near Formiæ.

LA FARINA GIUSEPPE (1815–1863), Italian author and politician, was born at Messina in 1815. On account of the part taken by him in the insurrection of 1837 he found it necessary to quit Sicily, but returning in 1839 he conducted various newspapers of liberal tendencies, until his efforts were completely interdicted, when he removed to Florence. In 1840 he had published *Messina ed i suoi Monumenti*, and after his removal to Florence he brought out *La Germania coi suoi Monumenti*, 1842; *L'Italia coi suoi Monumenti*, 1842; *La Svizzera Storica ed Artistica*, 1842–43; *La China*, 4 vols., 1843–47; and *Storia d'Italia*, 7 vols., 1846–54. He also in 1847 established a democratic journal *L'Alba* in the interest of Italian freedom and unity, but on the outbreak of the revolution in Sicily in 1848 he returned thither and was elected one of the committee of war. In the following year he was chosen to represent Messina in parliament, where he moved the deposition of King Ferdinand and the adoption of a new constitution. In April, 1849, the provisional government, in which La Farina was minister successively of public instruction, of public works, and of the interior, resolved, notwithstanding his strong advocacy of resistance, to submit to the royal authority, and he removed to France. In 1850 he published *Istoria della Rivoluzione Siciliana*, and in 1851–52, in 6 vols., *Storia d'Italia dal* 1815 *al* 1850. He also began in 1851 *Rivista Enciclopedica Italiana*, and in 1856 *Piccolo Corriere d'Italia*, an organ which had great influence in propagating the political sentiments of the Societa Nazionale Italiana, of which he ultimately was chosen president. During the remainder of his life he was a devoted supporter of Victor Emmanuel, and in 1860 he was chosen a member of the first Italian parliament. He died 5th September, 1863. See Franchi's *Epistolario de Giuseppe La Farina*, 2 vols., 1869.

LA FAYETTE, the capital of Tippecanoe county, Indiana, U. S., is situated at the head of navigation on the Wabash river, and near the battle-ground of Tippecanoe, where, in 1811, General Harrison, afterwards president, defeated a large force of Indians. The city—which is much the largest of the twenty-four towns in the United States named in honor of General La Fayette—is beautifully situated in the centre of a rich agricultural region and amid an amphitheatre of hills, which are covered with suburban homes. La Fayette has eight lines of railway communication and ten graded turnpikes extending in various directions. The La Fayette car-works employ eight hundred men. There are four national banks, three daily and nine weekly newspapers, five large boot and shoe manufactories, four breweries, one distillery, four large cooperage establishments, a paper mill, pork-houses for summer and winter curing, a horning mill, iron-works, together with numerous foundries and smaller manufacturing enterprises. The city is supplied with gas and water-works, and sulphur water, valuable for drinking and bathing purposes, flows from an artesian well in the public square. It is the seat of Purdue University, an agricultural college, richly endowed by a Congressional land grant, and named in honor of John Purdue, who gave it $150,000. Population in 1880, 14,860.

LA FAYETTE.

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MARIE JEAN PAUL ROCH YVES GILBERT MOTIER, MARQUIS DE LA FAYETTE, soldier, statesman and patriot, one of the most inspiring and attractive figures in both the American and French revolutions, was a native of Auvergne, and was born in the château of Chavagnac, near Brioude, in the present department of Haute Loire, France, on September 6, 1757. His family had for generations been prominent in the chivalry and statesmanship of France. One ancestor was a Marshal of France, who defeated and slew the Duke of Clarence at Beague, and thus checked Henry V. of England in his intended conquest of France. Another, a Mme. de La Fayette, was a friend of Mme. de Sevigne and one of the most accomplished members of the court of Louis XIV. His father was an officer in the French army, and was killed in battle at the age of twenty-five, when the subject of this sketch was an infant; a tragedy which sent the young wife and mother to an untimely grave and left the future hero an orphan. Happily, he inherited vast wealth, and was well cared for by relatives. He was educated at the College of Plessis, in Paris, and while yet a mere boy was married to a daughter of the Count d'Ayen and granddaughter of the Duke de Noailles. Thus, of noble birth, of romantic disposition, of accomplished mind, and influential matrimonial alliance, he entered upon his career as a soldier of France.

He was only nineteen when, in 1776, he was stationed at Metz as an officer of the Guards, and attended a dinner given in honor of the Duke of Gloucester, brother of King George III. Conversation naturally touched upon the rebellion of the American colonies, and the young officer was deeply impressed by it. He formed the romantic resolution of visiting America and aiding the colonists. Accordingly he repaired to Paris, formed the acquaintance of the American agents there, and fitted out a vessel of his own in which to cross the Atlantic. Learning that the British government had discovered his design and that the French government had ordered his arrest, he at once put to sea in an unfinished vessel, and sought temporary refuge in a Spanish port. There he met messengers from Paris, bearing letters from the king and from La Fayette's young wife. The king commanded him to return to France and to stay there. His wife encouraged him to proceed with his enterprise. He feigned to obey the king and set out overland for France, but on the way gave his escort the slip, hastened back to Spain, and set sail for America, accompanied by Baron de Kalb and some other officers. After a long and stormy voyage he landed at Georgetown, S. C., whence he repaired to Charleston. His arrival there, on April 25, 1777, created a great sensation and gave much encouragement to the American cause. He soon reached Philadelphia, where the Continental Congress was in session, and made application for a commission in the army, without pay. Congress responded by voting that "his services be accepted, and that in consideration of his zeal, illustrious family and connections, he have the rank and commission of major-general in the army of the United States." This was going too far for prudence, for the young man was still less than twenty years of age; and it was intimated that the appointment to so high a rank was not to be taken seriously, but was to be regarded as an honorary compliment. But when, a few days later, Washington met La Fayette and read him with a master's eye, that veteran chieftain discerned in him a spirit worthy to command. He invited him to become a member of his military family, and formed forthwith an intimate friendship that lasted for the rest of his life. A little later, when irritated almost beyond endurance by the insolent importunities of self-seeking adventurers, Washington wrote that he wished every foreigner were back in Europe, "excepting M. de La Fayette."

The young Frenchman soon showed himself worthy of Washington's high esteem. His "baptism of fire" occurred at the battle of the Brandywine, where he served as a volunteer member of Washington's staff, and in his heroic efforts to rally the retreating Americans was shot through the leg. He did not notice the wound until a comrade told him blood was pouring from his boot. Then he rode with a surgeon to Chester, but would not let his wound be dressed until he had succeeded in establishing order among the troops. Upon his recovery and return to action, two months later, Congress, at Washington's urgent request, appointed him to be commander of a division of the army, and he was assigned to the division from which General Stephen had been dismissed for intoxication. His first service in that position was to join the expedition intended for the invasion of Canada, and proceed as far as Albany. There he was halted for a time, which he improved by perfecting the defences of the Mohawk Valley. Then, without proceeding further toward Canada, he was ordered back to Washington's headquarters at Valley Forge. He was stationed at Barren Hill, near Valley Forge, and was there attacked by the British with twice his own numbers. With masterly skill he extricated himself from what had seemed a hopeless situation, and rejoined Washington at Valley Forge. Next, at Monmouth, the wretched half-traitor Charles Lee at first refused to command the army, and the chief command therefore devolved upon La Fayette. But upon the very eve of the conflict Lee "changed his mind" and demanded to be put in command, to which La Fayette amiably and loyally assented, and served under Lee with conspicuous gallantry. Indeed, it was La Fayette who chiefly saved the day from the consequences of Lee's poltroonery and scoundrelism. Seeing a good opportunity to make a spirited attack upon the British, he asked Lee's permission to make it. Lee at first refused, but La Fayette's zeal at last prevailed. The attack was made, with great success, and would have turned the tide of battle then and there had Lee not imperatively ordered a retreat. A few weeks later La Fayette co-operated with Greene and Sullivan in Rhode Island, but their operations were brought to naught by the failure of the French fleet to play its essential part. Nevertheless, the young Frenchman acquitted himself so well as to win and deserve the thanks of Congress, together with a sword of honor.

La Fayette now deemed it fitting to return to France, partly to aid his own country which was at war with England, and partly to urge the French government to give more aid to America. In January, 1779, he sailed for home, and was received with extraordinary enthusiasm by almost everybody save the king, who could not forgive him for going to America against his orders, and who to mark his displeasure compelled La Fayette to undergo a brief nominal imprisonment. The French queen was, however, much interested in La Fayette, and furthered his cause at court. It was due chiefly to the efforts of La Fayette that Rochambeau's army was finally sent to America. In May, 1780, he himself returned to America and again reported to Washington for duty. He was sent first to Newport to arrange with Rochambeau for co-operation between the American army and the French allies. Next he commanded at Tappan, on the Hudson, at the time of Benedict Arnold's treason, and he was one of the court-martial that tried the unfortunate André. At the beginning of the next year Arnold invaded Virginia, and La Fayette was sent by Washington to repel him. The army being destitute and Congress penniless, La Fayette at his own expense supplied his forces with clothing and tents. More than that, he increased his force by the addition of many volunteers, and inspired them all with something of his own zeal and confidence. He soon found himself confronted by Cornwallis himself, with a much superior force, near Richmond. "The boy cannot escape me!" declared Cornwallis, much in the same spirit as that in which at Trenton he said of Washington, "At last we have run the old fox to earth, and we shall bag him in the morning." La Fayette baffled the British commander scarcely less skilfully than Washington had done. He escaped his toils, marched to the northward, effected a junction with Wayne, and then returned to harass and to menace Cornwallis. It was this shrewd and daring action of La Fayette's that ultimately drove Cornwallis to retire to Yorktown, where he met his fate. "La Fayette," declared Edward Everett, "conducted this campaign with a vigor, discretion and success, which saved the State of Virginia, and proved himself to be endowed with the highest qualities of generalship." When at last he had driven Cornwallis into Yorktown, he stood guard to prevent his escape until Washington and Rochambeau could come down from the north. Then, side by side with Hamilton, he led the final assault upon the British works. He shared in the joyous splendors of the final victory, and received the public thanks of Washington for his services.

He did not realize that this victory was the end of the war, but he at once began to plan for the raising of another army to pursue the work to its end. For that purpose he returned to France and besought the government to send more troops to America. The government acquiesced, and placed an expedition of sixty ships and 24,000 men at his disposal. He sailed with it for America, but first put in at Cadiz. There he learned, at the beginning of February, 1783, that peace had been concluded between America and Great Britain, and consequently his expedition returned to France. He himself, on Washington's invitation, revisited the United States in 1784, landing at New York, and was for some time a guest at Mount Vernon. He also visited Annapolis, Baltimore, Philadelphia, Albany, and Boston, and was everywhere regarded with a popular interest and enthusiasm second only to those accorded to Washington himself. When he took his departure, in December of that year, Congress sent a delegation, consisting of one member from each of the States, to bid him farewell. He returned to France, and thence went to Prussia, where the aged Frederick the Great received him with scarcely less than royal honors. The next few years were spent by him in efforts to improve the condition of the French people, and especially of the French Protestants, who were suffering political disabilities. He also sought to have slavery abolished in the French colonies. From his own fortune he emancipated many slaves and gave them homes. Thus he was occupied when the French revolution began.

In that colossal cataclysm he was a marked figure. He was a member of the first Assembly of the Notables, in February, 1787, and was one of the foremost advocates of the rights of the people. He demanded not only the convocation of the States-General, but also, as he said, "something better than that." Of the States-General he became the leader, and it was he who framed the decree providing for ministers' responsibility to the assembly. Three days later, after the fall of the Bastille, he was made commander-in-chief of the National Guard, which soon numbered 3,000,000 men throughout the country and controlled France. It was he who suggested the substitution of the tricolor for the white flag and lilies of the Bourbons. But he was no fanatic. He upheld the rights and liberties of the king and royal family as earnestly as those of the people. It was he who, by his personal courage and imperturable coolness, saved the royal family from the mob amid the tumults of October, 1789, which took possession of Versailles. When the National Assembly decreed the abolition of nobiliary titles, he was the first to renounce his own, ancient and honorable though it was, and thereafter he acknowledged no title but that of general, which had been given to him by the American government. After the adoption of the Constitution on July 14, 1790, he resigned his command of the National Guard, and retired to his country home. He was recalled thence in March, 1792, to command an army for the guarding of the frontiers of France against the Austrians, and was victor in battles at Philippeville, Maubege, and Florennes. He was, however, hated and feared by the Jacobins, who recognized in his virtue and moderation the chief obstacles to their mad designs. After a violent controversy, in which he denounced them as enemies of the people, they moved for his arrest. The motion was defeated by a vote of 224 to 407. But the Reign of Terror quickly came, and his arrest was ordered, with the intention of putting him to death. He disposed his army in safety, and then fled across the frontier into Holland. There an Austrian patrol seized him, treated him with infamous indignities, and handed him over to the Prussians who put him into prison. But the countrymen of the great Frederick would not bear the shame of being his jailers, so they returned him to the Austrians, who flung him into what was practically an *oubliette*, telling him he was thenceforth dead to the world. Indescribable privations and cruelties were inflicted upon him, for the purpose of killing him, and they came near effecting their purpose. At last, through the romantic heroism of Dr. Bollmann, of Hanover, and Francis K. Huger, of South Carolina, he was rescued by stratagem, but only to be recaptured and treated with still greater severity, while his rescuers were themselves chained by their necks to a prison floor for eight months. After the fall of Robespierre Mme. La Fayette, who had been imprisoned, regained her liberty in France, only to share, at her own request, her husband's confinement. Then the world arose in indignation. The British government protested against further imprisonment of La Fayette. Washington personally wrote to the Austrian sovereign, asking his release. These appeals were in vain. But when Bonaparte made the release of La Fayette a *sine qua non* of the peace of Campo Formio, the obdurate Habsburg yielded. On August 25, 1797, the hero was released. He had been in prison five years, and his wife had been with him there for nearly two years.

With health impaired but spirit unbroken, he settled in Holstein and devoted himself to agriculture until 1799, when he removed to an estate near Paris. Bonaparte begged him to become a Senator of France, but he refused. He offered him the decoration of the Legion of Honor, but La Fayette rejected it as an absurdity. When the vote to make Bonaparte Consul for life was taken, La Fayette not only voted "No," but also took pains to inform Bonaparte of the fact. That ended their friendship. When Louisiana was purchased, Jefferson invited La Fayette to become governor of the Territory, but the Frenchman declined. His duty to the cause of human freedom and constitutional government required him, he said, to remain in Europe. When Napoleon returned from his exile in Elba for the Hundred Days, he turned to La Fayette for help, and offered him a peerage. La Fayette refused it, but emerged from his retirement and took his seat in the House of Deputies. After Waterloo his voice was foremost in demanding Napoleon's abdication. Lucien Bonaparte replied to him, denouncing his proposal as a monstrous example of inconstancy and ingratitude. To this La Fayette retorted with tremendous power. "The assertion," he thundered, "which has just been uttered is a calumny. Who shall dare to accuse the French nation of inconstancy to Napoleon? That nation has followed his bloody footsteps through the sands of Egypt and through the snows of Russia, over fifty fields of battle, in disaster as faithfully as in victory, and it is for thus having followed him that we now mourn the blood of three millions of Frenchmen." To this Lucien dared venture no reply. When Napoleon in his flight reached Paris, La Fayette offered to secure his escape to America, but Napoleon pettishly refused the favor and went to St. Helena. In 1818 La Fayette was elected a member of the Chamber of Deputies, where he steadfastly opposed the reactionary policy of the restored Bourbons.

Congress unanimously voted in 1824 that President Monroe should invite La Fayette to visit America as the nation's guest. The invitation was accepted, though the distinguished visitor declined to travel in a ship sent by the government, but insisted upon paying his way in an ordinary passenger packet. He reached New York on August 14, 1824, and made an extended tour of the country, being received everywhere with expressions of public esteem and enthusiasm such as probably no other foreigner has ever known. Congress voted him a grant of $200,000 and a large tract of land, "in consideration of his important services and expenditures during the American revolution." This grant was the more welcome to La Fayette because his own great fortune had been confiscated and lost to him during the Reign of Terror. He sailed for home on September 7, 1825, on a warship which had, in memory of his first battle, been named the "Brandywine." On his landing at Havre the French populace assembled to do him honor, but were dispersed by the Bourbon police. He remained a member of the Chamber of Deputies, and in the revolution of July, 1830, was made commander-in-chief of the National Guard, in which office he prevented bloodshed and disorder and assured the success of the revolution through peaceful means. His own preferences were for a republic, but realizing that France was not ready for it, or perhaps that Europe would not tolerate it, he acquiesced in a constitutional monarchy, and placed Louis Philippe, the "citizen king," upon the throne. Soon after he resigned his commission as commander of the National Guard, but remained a deputy until the end of his life. The end was precipitated by his act of self denying generosity in attending, on foot, in midwinter, the funeral of a colleague. He contracted a severe cold, and never recovered from it. He lingered until May 19, 1834, and then passed away, honored and lamented above most other men of his time. In America his death was regarded as a national bereavement. A public eulogy was pronounced upon him by Edward Everett in Faneuil Hall, Boston, on September 6, 1834, and his name was given to counties, cities, streets and avenues, and public institutions in all parts of the country. With the passage of time and the ripening of judgment his fame has grown steadily more brilliant and more secure. Few, if any, will now deny him the distinction of greatness. His title thereto was formerly disputed, but was, it must seem, well vindicated by Everett in the eulogy already mentioned. "What," demanded the orator in Faneuil Hall, "What is greatness? Does goodness belong to greatness and make an essential part of it? If it does, I would ask who, of all the prominent names in history, has run through such a career, with so little reproach justly or unjustly bestowed? Are military courage and conduct the measure of greatness? La Fayette was entrusted by Washington with all kinds of service—the laborious and complicated, which required skill and patience; the perilous, which demanded nerve; and we see him keeping up a pursuit, effecting a retreat, outmanœuvring a wary adversary with a superior force, commanding an assault at the point of the bayonet, and all with entire success. Is it any proof of greatness to be able, at the age of 73, to take the lead in a successful and bloodless revolution, to change the dynasty, to organize, exercise and abdicate a military command of three and a half millions of men; to take up, to perform, and to lay down the most momentous, delicate and perilous duties, without passion, without hurry and without selfishness?" Such, without doubt, was a just description of La Fayette's achievements, and it indubitably indicates a man of true greatness, whom the world may well delight to honor.

La Fayette has been the theme of biographers, historians, orators and poets, and has well deserved their best attention. His "Memoirs, Correspondence and Manuscripts" were published in Paris in 1837–40. Regnault Warin in 1824 and Sarrane in 1832 published critical studies of his career. His "Life," by Tuckerman, in 1889, and Tower's "La Fayette in the American Revolution," 1895, are works of authoritative and standard value.

June, 1904. W. FLETCHER JOHNSON.

LA FLÈCHE, chief town of an arrondissement in the department of Sarthe, France, is situated on the right bank of the Loir, about 24 miles southwest of Le Mans. The chief buildings are the military academy (Prytanée), originally a college founded in 1607 by Henry IV., the church of St. Thomas, the prison, and the hospital. Near the bridge are the ruins of an ancient castle. La Flèche carries on manufactures of cloth, gloves, hosiery, candles, and glue, besides wax bleaching, tanning, and paper-making. It has the usual country trade, managed mainly by means of fairs. The population in 1876 was 7468.

LA FONTAINE, JEAN DE (1621–1695), one of the most popular and original of French poets, was born at Château Thierry in Champagne, probably on the 8th of July, 1621, and died at Paris on the 13th of April, 1695. His father was Charles de La Fontaine, "maître des eaux et forêts"—a kind of deputy-ranger—of the duchy of Château Thierry; his mother was Françoise Pidoux. On both sides his family was of the highest provincial middle class, but was not noble; his father was also fairly wealthy. Jean, who was the eldest child of his parents, was educated at the *collège* (grammar-school) of his native town, and at the end of his school days he had, singularly enough, an idea of taking orders. He entered the oratory in May, 1641, and the seminary of St. Magloire in October of the same year; but a very short sojourn proved to him that he had mistaken his vocation. He then apparently studied law, and is said to have been admitted as *avocat*, though there does not seem to be actual proof of this. He was, however, settled in life, or at least might have been so, somewhat early. In 1647 his father resigned his rangership in his favor, and arranged a marriage for him with Marie Héricart, a young girl of sixteen, who brought him twenty thousand livres, and expectations. She seems to have been both handsome and intelligent, but the two did not get on well together. There appears to be absolutely no ground for the vague scandal as to her conduct, which was, for the most part long afterwards, raised by gossips or personal enemies of La Fontaine. All that is positively said against her is that she was a negligent housewife and an inveterate novel reader; La Fontaine on the other hand was constantly away from home, was certainly not strict in point of conjugal fidelity, and was so bad a man of business that his affairs became involved in hopeless difficulty, and a *séparation de biens* had to take place in 1658. This was for the benefit of the family, and was a perfectly amicable transaction; by degrees, however, the pair, still without any actual quarrel, ceased to live together, and for the greater part of the last forty years of La Fontaine's life he himself lived in Paris while his wife dwelt at Château Thierry, which, however, he frequently visited. One son was born to them in 1653, and was educated and taken care of wholly by his mother.

Even in the earlier years of his marriage La Fontaine seems to have been much at Paris, but it was not till about 1656 that he became a regular visitor to the capital. The duties of his office, which were only occasional, were compatible with this non-residence, and he continued to hold it till 1672. It was not till he was past thirty that his literary career began, for he was by no means a precocious writer. The reading of Malherbe, it is said, first awoke poetical fancies in him, but for some time he attempted nothing but trifles in the fashion of the time—epigrams, ballades, rondeaux, etc. His first serious work was a translation or adaptation of the *Eunuchus* of Terence (1654). At this time the Mæcenas of French letters was the superintendent Fouquet, to whom La Fontaine was introduced by Jacques Jannart, a connection of his wife's. Few people who had paid their court to Fouquet went away empty-handed, and La Fontaine soon received a pension of 1000 livres (1659), in repayment possibly of the poem of *Adonis* which in 1658 he had, in manuscript, dedicated to the financier. He began too a medley of prose and poetry, entitled *Le Songe de Vaux*, on Fouquet's famous country house. It was about this time, as has been said, that his wife's property had to be separately secured to her, and he seems by degrees to have had to sell everything of his own; but, as he never lacked powerful and generous patrons, this was of small importance to him, especially as he had no establishment to maintain. In the same year he wrote a ballet, *Les Rieurs du Beau-Richard*, and this was followed by many small pieces of occasional poetry addressed to various personages great and small, from the king downwards. Fouquet soon incurred the royal displeasure, but La Fontaine, like most of his literary protégés, was not unfaithful to him, the well-known elegy *Pleurez, Nymphes de Vaux*, being by no means the only proof of his devotion. Indeed it is thought not improbable that a journey to Limoges which he took in 1663 in company with Jannart, and of which we have an account written to his wife, was not wholly spontaneous, as it certainly was not on Jannart's part. Just at this time his affairs did not look promising. His father and himself had assumed the title of esquire, to which they were not strictly entitled, and, some old edicts on the subject having been put in force by the king, an informer procured a sentence against the poet fining him 2000 livres, which from what is known of the state of his private affairs it was probably impossible for him to pay. He found, however, a new protector in the duke and still more in the duchess of Bouillon, his feudal superiors at Château Thierry, and nothing more is heard of the fine. Some of La Fontaine's liveliest verses are addressed to the duchess, Anne Mancini, the youngest of Mazarin's nieces, and it is even probable that the taste of the duke and duchess for Ariosto had something to do with the writing of his first work of real importance, the first book of the *Contes*, which appeared in 1664. He was then, let it be remembered, forty-three years old, and his previous printed productions had been comparatively trivial, though, as was the habit of the time, much of his work was handed about in manuscript long before it was regularly published. It was about this time that the quartette of the Rue du Vieux Colombier, so famous in French literary history, was formed. It consisted of La Fontaine, Racine, Boileau, and Molière, the last of whom was almost of the same age as La Fontaine, the other two considerably younger. Chapelle was also a kind of outsider in the coterie. There are many anecdotes, some of which are pretty obviously apocryphal, about these meetings. The most characteristic of these is perhaps that which asserts that a copy of Chapelain's unlucky *Pucelle* always lay on the table, a certain number of lines of which was the appointed punishment for offences against the company. The coterie furnished under feigned names the personages of La Fontaine's version of the Cupid and Psyche story, which, however, with *Adonis*, was not printed till 1669. Meanwhile the poet continued to find friends. In 1664 he was regularly commissioned and sworn in as gentleman to the duchess dowager of Orleans, and was installed in the Luxembourg. He still retained his rangership, and in 1666 we have something like a reprimand from Colbert suggesting that he should look into some malpractices at Château Thierry. In the same year appeared the second book of the *Contes*, and in 1668 the first six books of the *Fables*, with more of both kinds in 1671. In this latter year a curious instance of the docility with which the poet lent himself to any influence was afforded by his officiating at the instance of the Port-Royalists as editor of a volume of sacred poetry dedicated to the Prince de Conti. A year afterwards his situation, which had for some time been decidedly flourishing, showed signs of changing very much for the worse. The duchess of Orleans died, and he apparently had to give up his rangership, probably selling it to pay debts. But there was always a providence for La Fontaine. Madame de la Sablière, a woman of great beauty, of considerable intellectual power, and of high character, invited him to make his home in her house, where he lived for some twenty years. He seems to have had no trouble whatever about his affairs thenceforward; he was free to amuse himself or to work as he liked, and as a matter of fact he worked steadily at his two different lines of poetry. Besides these he ventured on a third, in which he met and indeed deserved much less success,—that of theatrical composition.

The next event of importance in La Fontaine's life, apart from the publication of his works, did not occur till after nearly ten years. In 1682 he was a man of more than sixty years old, recognized as one of the first men of letters of France. Madame de Sévigné, one of the soundest literary critics of the time, and by no means given to praise mere novelties, had spoken of his second collection of *Fables* published in the winter of 1678 as divine; and it is pretty certain that this was the general opinion. It was not unreasonable therefore that he should present himself to the Academy, and, though the subjects of his *Contes* were scarcely calculated to propitiate that decorous assembly, while his attachment to Fouquet and to more than one representative of the old Frondeur party made him suspect to Colbert and the king, most of the members were his personal friends. He was first proposed in 1682, but was rejected for Dangeau. The next year Colbert died and La Fontaine was again nominated. Boileau was also a candidate, but the first ballot gave the fabulist sixteen votes against seven only for the critic. The king, whose assent was necessary, not merely for election but for a second ballot in case of the failure of an absolute majority, was ill-pleased, and the election was left pending. Another vacancy occurred, however, some months later, and to this Boileau was elected. The king hastened to approve the choice effusively, adding, "Vous pouvez incessamment recevoir La Fontaine, il a promis d'être sage." His admission was indirectly the cause of the only serious literary quarrel of his life. A dispute, into the particulars of which there is no need to enter here, took place between the Academy and one of its members, Furetière, on the subject of the latter's French dictionary, which was decided to be a breach of the Academy's corporate privileges. Furetière, a man of no small ability, bitterly assailed those whom he considered to be his enemies, and among them La Fontaine, whose fault probably was not so much that he was a principal offender as that the unlucky *Contes* made him peculiarly vulnerable. His second collection of these tales had been actually the subject of a police condemnation, of which, as may be supposed, Furetière did not fail to make the most. The death of the author of the *Roman Bourgeois*, however, put an end to this quarrel. Shortly afterwards La Fontaine had a share in a still more famous affair, the celebrated ancient-and-modern squabble in which Boileau and Perrault were the chiefs, and in which La Fontaine (though he had been specially singled out by Perrault for favorable comparison with Æsop and Phædrus) took the ancient side. About the same time (1685–87) he made the acquaintance of the last of his many hosts and protectors, Monsieur and Madame d'Hervart, and fell in love with a certain Madame Ulrich, a lady of some position but of doubtful character. This acquaintance was accompanied by a great familiarity with Vendôme, Chaulieu, and the rest of the libertine coterie of the Temple; but, though Madame de la Sablière had long given herself up almost entirely to good works and religious exercises, La Fontaine continued an inmate of her house until her death in 1693. What followed is told in one of the best known of the many stories bearing on his childlike nature. Hervart on hearing of the death, had set out at once to find La Fontaine. He met him in the street in great sorrow, and begged him to make his home at his house. "J'y allais" was La Fontaine's answer. He had already undergone the process of conversion during a severe illness which befell him the year before. An energetic young priest, M. Poucet, had brought him, not indeed to understand, but to acknowledge the impropriety of the *Contes*, and it is said that the destruction of a new play of some merit was demanded and submitted to as a proof of repentance. A pleasant story is told of the young duke of Burgundy, Fénelon's pupil, who was then only eleven years old, sending 50 louis to La Fontaine as a present of his own motion. But though La Fontaine recovered for the time, he was quite broken by age and infirmity, and his new hosts had to nurse rather than to entertain him, which they did very carefully and kindly. He did a little more work, completing his *Fables* among other things; but he did not survive Madame de la Sablière much more than two years, dying on the 13th of April, 1695, at the age of seventy-three. He was buried in the cemetery of the Holy Innocents. His wife survived him nearly fifteen years, and his posterity lasted until the present century.

The curious personal character of La Fontaine, like that of some other men of letters, has been enshrined in a kind of myth or legend by literary tradition. At an early age his absence of mind and indifference to business gave a subject to Tallemant des Réaux, the most indefatigable and least scrupulous (at best the least critical) of gossips. His later contemporaries helped to swell the tale, and the 18th century finally accepted it. We have neither space nor desire to recount the anecdotes of his meeting his son, being told who he was, and remarking, "Ah, yes, I thought I had seen him somewhere!" of his insisting on fighting a duel with a supposed admirer of his wife, and then imploring him to visit at his house just as before; of his going into company with his stockings wrong side out, etc. It may be taken for granted that much of this is apocryphal, and the companion anecdotes of his awkwardness and silence, if not positive rudeness, in company are still more doubtful. It ought to be remembered as a comment on the unfavorable description which La Bruyère gives or is supposed to give of his social abilities, that La Fontaine was a special friend and ally of Benserade, La Bruyère's chief literary enemy, who long prevented the author of the *Caractères* from entering the Academy. But after all deductions much will remain, especially when it is remembered that one of the chief authorities for such anecdotes is Louis Racine, a man who possessed intelligence and moral worth, and who received them from his father, La Fontaine's attached friend for more than thirty years. Perhaps the best worth recording of all these stories is one of the Vieux Colombier quartette, which tells how Molière, while Racine and Boileau were exercising their wits upon "le bonhomme" or "le bon" (by both which titles La Fontaine was familiarly known), remarked to a bystander "nos beaux esprits ont beau faire, ils n'effaceront pas le bonhomme." They have not effaced him and will not do so, and the half contemptuous term "nos beaux esprits" marks well enough the sound judgment of the greatest of the four as to the merits of his companions.

The works of La Fontaine, the total bulk of which is considerable, fall no less naturally than traditionally into three divisions, the *Fables*, the *Contes*, and the miscellaneous works. Of these the first may be said to be known universally, the second to be known to all lovers of French literature, the third to be with a few exceptions practically forgotten. This distribution of the judgment of posterity is as usual just in the main, but not wholly. There are excellent things in the *Œuvres Diverses*, but their excellence is only occasional, and it is not at the best equal to that of the *Fables* or the *Contes*. It was thought by contemporary judges who were both competent and friendly that La Fontaine attempted too many styles, and there is something in the criticism. His dramatic efforts are especially weak, and indeed it is evident that his forte lay neither in the dramatic delineation of character nor in the arrangement of dramatic action. The best pieces usually published under his name—*Ragotin*, *Le Florentin*, *La Coupe Enchantée*, were not originally fathered by him but by Champmeslé, the husband of the famous actress who captivated Racine and Charles de Sévigné. His avowed work was chiefly in the form of opera, a form of no great value at its best. *Psyche* has all the advantages of its charming story and of La Fontaine's style, but it is perhaps principally interesting nowadays because of the framework of personal conversation already alluded to. The mingled prose and verse of the *Songe de Vaux* is not uninteresting, but its best things, such as the description of night—

> "Laissant tomber les fleurs et ne les semant pas,"

which has enchanted French critics, are little more than conceits, though as in this case sometimes very beautiful conceits. The elegies, the epistles, the epigrams, the ballades contain many things which would be very creditable to a minor poet or a writer of vers de société, but even if they be taken according to the wise rule of modern criticism, each in its kind, and judged simply according to their rank in that kind, they fall far below the merits of the two great collections of verse narratives which have assured La Fontaine's immortality.

Between the actual literary merits of the two there is not much to choose, but the change of manners and the altered standard of literary decency has thrown the *Contes* into the shade. The tales are identical in general character with those which amused Europe from the days of the early *fabliau* writers through the period of the great Italian *novellieri* to that of the second great group of French tale-tellers ranging from Antoine de la Salle to Béroalde de Verville. Light love, the misfortunes of husbands, the cunning of wives, the breach of their vows by ecclesiastics, constitute the staple of their subject. In some respects La Fontaine is the best of such tale-tellers, while he is certainly the latest who deserves such excuse as may be claimed by a writer who does not choose indecent subjects from a deliberate knowledge that they are considered indecent and with a deliberate desire to pander to a vicious taste. No one who followed him in the style can claim this excuse; he can, and the way in which contemporaries of stainless virtue such as Madame de Sévigné speak of his work shows that though the new public opinion was growing up it was not finally accepted. In the *Contes* La Fontaine for the most part attempts little originality of theme. He takes his stories (varying them, it is true, in detail not a little) from Boccaccio, from Marguerite, from the *Cent Nouvelles Nouvelles*, etc. He applies to them his marvellous power of easy sparkling narration, and his hardly less marvellous faculty of saying more or less outrageous things in the most polite and gentlemanly manner. These *Contes* have indeed certain drawbacks. They are not penetrated by the half pagan ardor for physical beauty and the delights of sense which animates and excuses the early Italian Renaissance. They have not the subtle mixture of passion and sensuality, of poetry and appetite, which distinguishes the work of Marguerite and of the Pléiade. They are emphatically *contes pour rire*, a genuine expression of the *esprit gaulois* of the fabliau writers and of Rabelais, destitute of the grossness of envelope which had formerly covered that spirit. A comparison of "La Fiancée du Roi de Garbe" with its original in Boccaccio (especially if the reader takes M. Émile Montégut's admirable essay as a commentary) will illustrate better than anything else what they have and what they have not. Some writers have pleaded hard for the admission of actual passion of the poetical sort in such pieces as "La Courtisane Amoureuse," but as a whole it must be admitted to be absent.

The *Fables*, with hardly less animation and narrative art than the *Contes*, are free from disadvantages (according to modern notions) of subject, and exhibit the versatility and fecundity of the author's talent perhaps even more fully. La Fontaine had of course many predecessors in the fable and especially in the beast fable. In his first issue, comprising what are now called the first six books, he adhered to the path of these predecessors with some closeness; but in the later collections he allowed himself far more liberty, and it is in these parts that his genius is most fully manifested. The boldness of the politics is as much to be considered as the ingenuity of the moralizing, as the intimate knowledge of human nature displayed in the substance of the narratives, or as the artistic mastery shown in their form. It has sometimes been objected that the view of human character which La Fontaine expresses is unduly dark, and resembles too much that of La Rochefoucauld, for whom the poet had certainly a profound admiration. The discussion of this point would lead us too far here. It may only be said that satire (and La Fontaine is eminently a satirist) necessarily concerns itself with the dark rather more than with the lighter shades. Indeed the objection has become pretty nearly obsolete with the obsolescence of what may be called the sentimental-ethical school of criticism. Its last overt expression was made some thirty years ago, in a curious outburst of Lamartine's, excellently answered by Sainte-Beuve. Exception has also been taken to the *Fables* on more purely literary grounds by Lessing, but, as this exception depends on differences inevitable between those who would shape all literature on rules derived from the study of Greek models and those who with the highest respect for those models rank them only among and not above others, it is equally needless to enter into it. Perhaps the best criticism ever passed upon La Fontaine's *Fables* is that of Silvestre de Sacy, to the effect that they supply three several delights to three several ages: the child rejoices in the freshness and vividness of the story, the eager student of literature in the consummate art with which it is told, the experienced man of the world in the subtle reflections on character and life which it conveys. Nor has any one, with the exception of a few paradoxers like Rousseau and a few sentimentalists like Lamartine, denied that the moral tone of the whole is as fresh and healthy as its literary interest is vivid. The book has therefore naturally become the standard reading book of French both at home and abroad, a position which it shares in verse with the *Télémaque* of Fénelon in prose. It is no small testimony to its merit that not even this use or misuse has interfered with its popularity among French men of letters, who, with hardly an exception, speak as affectionately of it as if they had never been kept in on a summer's day to learn *La Cigale et la Fourmi*.

The general literary character of La Fontaine is, with the allowance made for the difference of subject, visible equally in the *Fables* and in the *Contes*, and it is necessary to say a few words as to the nature of this character. Perhaps one of the hardest sayings in French literature for an English student is the dictum of Joubert to the effect that "Il y a dans La Fontaine une plénitude de poésie qu'on ne trouve nulle part dans les autres auteurs Français." Most English critics would probably admit at once La Fontaine's claim to a position in the first class of writers, but would demur to his admission to the first class of poets. The difference arises from the ambiguity of the terms. In Joubert's time, and perhaps a good deal later, inventiveness of fancy and diligent observation of the rules of art were held to complete the poetical differentia, and in both these La Fontaine deserves if not the first almost the first place among French poets. As to the first point there is hardly any dispute; few writers either in French or any other language have ever equalled him in this respect. In his hands the oldest story becomes novel, the most hackneyed moral piquant, the most commonplace details fresh and appropriate. As to the second point there has not been such unanimous agreement. It used to be considered that La Fontaine's ceaseless diversity of metre, his archaisms, his licenses in rhyme and orthography, were merely ingenious devices for the sake of easy writing, intended to evade the trammels of the stately couplet and *rimes difficiles* enjoined by Boileau. Lamartine in the attack already mentioned affects contempt of the "vers boiteux, disloqués inégaux sans symmétrie ni dans l'oreille ni sur la page." This opinion may be said to have been finally exploded by the most accurate metrical critic and one of the most skilful metrical practitioners that France has ever had, M. Théodore de Banville; and it is only surprising that it should ever have been entertained by any professional maker of verse. There can be little doubt that La Fontaine saw the drawbacks of the "Alexandrine prison," as it has been called, but in freeing himself from it he by no means took refuge in merely pedestrian verse. His irregularities are strictly regulated, his cadences carefully arranged, and the whole effect may be said to be (though of course in a light and tripping measure instead of a stately one) similar to that of the stanzas of the English pindaric ode in the hands of Dryden or Collins. There is therefore nothing against La Fontaine on the score of invention and nothing on the score of art. But something more, at least according to English standards, is wanted to make up a "plenitude of poesy," and this something more La Fontaine seldom or never exhibits. In words used by Joubert himself elsewhere, he never "transports." The faculty of transporting is of course possessed and used in very different manners by different poets. In some it takes the form of passion, in some of half mystical enthusiasm for nature, in some of commanding eloquence, in some of moral fervor. La Fontaine has none of these things: he is always amusing, always sensible, always clever, sometimes even affecting, but at the same time more or less prosaic, were it not for his admirable versification. The few passages which may be cited to the contrary are doubtfully admissible, and cannot in any case suffice to leaven so great a mass of other work. It is needless to say that this is no discredit to him. A man can but be the very best in his own special line, and that very best La Fontaine assuredly is. He is not a great poet, and a deficiency very similar to that which deprives him of this name deprives him of the name of a great humorist; but he is the most admirable teller of light tales in verse that has ever existed in any time or country; and he has established in his verse-tale a model which is never likely to be surpassed, and which has enriched literature with much delightful work.

La Fontaine did not during his life issue any complete edition of his works, nor even of the two greatest and most important divisions of them. The most remarkable of his separate publications have already been noticed. Others were the *Poëme de la Captivité de St. Malc* (1673), one of the pieces inspired by the Port-Royalists, the *Poëme du Quinquina* (1602), a piece of task work also, though of a very different kind, and a number of pieces published either in small pamphlets or with the works of other men. Among the latter may be singled out the pieces published by the poet with the works of his friend Maucroix (1685). The year after his death some posthumous works appeared, and some years after his son's death the scattered poems, letters, etc., with the addition of some unpublished work bought from the family in manuscript, were carefully edited and published as *Œuvres Diverses* (1729). During the 18th century two of the most magnificent illustrated editions ever published of any poet reproduced the two chief works of La Fontaine. The *Fables* were illustrated by Oudry (1755–59), the *Contes* by Eisen (1762). This latter, under the title of "Edition des Fermiers-Généraux," fetches a high price. During the first thirty years of the present century Walckenaer, a great student of French 17th century classics, published for the house of Didot three successive editions of La Fontaine, the last (1826–27) being perhaps entitled to the rank of the standard edition. More recently the editions of M. Marty-Laveaux in the *Bibliothèque Elzévirenne*, A. Pauly in the *Collection des Classiques Françaises* of M. Lemerre, and L. Moland in that of M. Garnier supply in different forms all that can be wished. The second is the handsomest, the third, which is complete, perhaps the most generally useful. Editions, selections, translations, etc., of the *Fables*, especially for school use, are innumerable; but an illustrated edition published by the *Librairie des Bibliophiles* (1874) deserves to be mentioned as not unworthy of its 18th century predecessors. (G. SA.)

LAFOSSE, CHARLES DE (1640–1716), French painter, was one of the most noted and least servile pupils of Lebrun, under whose direction he shared in the chief of the great decorative works undertaken in the reign of Louis XIV. He was born at Paris in 1640, and left France for Italy in 1662. He then spent two years in Rome and three in Venice, and the influence of his prolonged studies of Veronese is evident in his Finding of Moses (Louvre), and in his Rape of Proserpine (Louvre), which he presented to the Academy as his diploma picture in 1673. He was at once named assistant professor, and in 1674 the full responsibilities of the office devolved on him, but his engagements did not prevent his accepting in 1689 the invitation of Lord Montagu to decorate Montagu House. He visited London twice, remaining on the second occasion—together with Rousseau and Monnoyer—more than two years. William III. vainly strove to detain him in England by the proposal that he should decorate Hampton Court, for Lebrun was dead, and Mansart pressed Lafosse to return to Paris to take in hand the cupola of the Invalides. The decorations of Montagu House are destroyed, those of Versailles are restored, and the dome of the Invalides (engraved, Picart and Cochin)—for to his vexation the rest of the surface fell into other hands—is now the only work existing which gives a full measure of his talent. During his latter years Lafosse executed many other important decorations in public buildings and private houses, notably in that of Crozat, under whose roof he died on 13th December, 1716.

LAGO MAGGIORE. See MAGGIORE.

LAGOS, a town in the district of Faro, which is coextensive with the province of Algarve, in Portugal, is situated on the south coast of the kingdom, on a bay which forms its harbor. The town is fairly well built; but beyond one or two churches, the batteries that defend the port, and an aqueduct 800 yards long, it has no special features of interest. It holds the formal rank of city, and enjoys a respectable historical position from its connection with Prince Henry the Navigator, whose caravels generally sailed from its harbor. The material prosperity of the town was injured by an earthquake that laid it in ruins in 1755. The inhabitants are engaged in the tunny fishery and in vine raising. The population in 1878 was 7881. Lagos is held to be situated on or near the site of the Roman colony Lacobriga.

LAGOS, a British settlement on the west coast of Africa, united since 1876 with the Gold Coast colony, and by the terms of the charter comprising all British possessions between the second and fifth degrees of east longitude. The actual settlement is situated on a low island within the mouth of the so-called Lagos river, which is really a lagoon of considerable extent, into which the Ogun and several other rivers discharge. The seaward entrance is about 3 miles wide, but it requires skilful pilotage to take a vessel across the bar into the smooth and deep water. Lagos was formerly the chief seat of the slave trade in the Bight of Benin. In 1851 it was captured by the British, and in 1861 the "king" Docemo was practically constrained to give up his territorial jurisdiction, and accept a pension of 1200 bags of cowries, or about £1030. There is now a flourishing settlement. The mangrove swamp has been cleared away from a large part of the island; a well-kept road runs for a mile along the shore in front of the European quarter; wooden wharves have been built; marshy spots have been turned into gardens, and among the houses are a number of bright stucco-fronted villas.

Immediately after the proclamation of the British annexation, a steady current of immigration from the mainland set in, and in 1871 the population of Lagos proper was 13,520 males and 14,998 females. Within the Lagos district are Badagry (1148 males, 1343 females), Palma (814), and Leke (165), making a total for the settlement of 31,998. Besides the local tribes, the population contains Sierra-Leonians, Krumen, and Fanti, as well as from 4000 to 6000 Brazilian *emancipados*. The trade of Lagos consists mainly in the exportation of palm oil and palm kernels, and the importation of liquors, tobacco, and cotton goods. Most of the business is in the hands of German and French houses. The average value of imports for 1875–1879 was £512,857, and of exports £620,644. In 1879 the Church of England had 13 churches in the settlement, the Wesleyans 7, the Roman Catholics (who are largely recruited by the Brasilian immigrants) 2, and the Baptists 1. The schools numbered 28, several being subsidized by the Government. The 8000 Mohammedans have 27 mosques and about 37 small Koran schools. During the five years from 1875 to 1879 the aggregate revenue of the settlement was £253,445, the aggregate expenditure £227,523.

LAGRANGE, JOSEPH LOUIS (1736–1813), a mathematician of the highest rank, was born at Turin, January 25, 1736. He was of French extraction, his great-grandfather, a cavalry captain, having passed from the service of France to that of Sardinia, and settled in Turin under Emmanuel II. His father, Joseph Louis Lagrange, married Maria Theresa Gros, only daughter of a rich physician at Cambiano, and had by her eleven children, of whom only the eldest (the subject of this notice) and the youngest survived infancy. From his post as treasurer at war, as well as through his wife, he derived ample means, which he, however, lost by rash speculations, a circumstance regarded by his son as the prelude to his own good fortune; for had he been rich, he used to say, he might never have known mathematics.

The genius of Lagrange did not at once take its true bent. His earliest tastes were literary rather than scientific, and he learned the rudiments of geometry during his first year at the college of Turin, without difficulty, but without distinction. The perusal of a tract by Halley (*Phil. Trans.*, vol. xviii. p. 960) roused his enthusiasm for the analytical method, of which he was destined to develop the utmost capabilities. He now entered, without aid or guidance save those afforded by his own unerring tact and vivid apprehension, upon a course of study which in two years placed him on a level with the greatest of his contemporaries. At the age of nineteen he communicated to the celebrated Euler his idea of a general method of dealing with "isoperimetrical" problems, known later as the Calculus of Variations. It was eagerly welcomed by the Berlin mathematician, who had the generosity to withhold from publication his own further researches on the subject until his youthful correspondent should have had time to complete and opportunity to claim the invention. This prosperous opening gave the key-note to Lagrange's career. Appointed, in 1754, professor of geometry in the royal school of artillery, he formed with some of his pupils—for the most part his seniors—friendships based on community of scientific ardor. With the aid of the Marquis de Saluces and the eminent anatomist Cigna, he founded in 1758 a society which rose later to the dignity of the Turin Academy of Sciences. The first volume of its memoirs, published in the following year, contained a paper by Lagrange entitled *Recherches sur la nature et la propagation du son*, in which the power of his analysis and his address in its application were equally conspicuous. Without assumption, but without hesitation, he made his first appearance in public as the critic of Newton, and the arbiter between D'Alembert and Euler. By considering only the particles of air found in a right line, he reduced the problem of the propagation of sound to the solution of the same partial differential equations that include the motions of vibrating strings, and demonstrated the insufficiency of the methods employed by both his great contemporaries in dealing with the latter subject. He further treated in a masterly manner of echoes and the mixture of sounds, and explained the phenomenon of grave harmonics as due to the occurrence of beats so rapid as to generate a musical note. This was followed, in the second volume of the *Miscellanea Taurinensia* (1762) by his "Essai d'une nouvelle méthode pour déterminer les maxima et les minima des formules intégrales indéfinies," together with the application of this important development of analysis to the solution of several dynamical problems, as well as to the demonstration of the mechanical principle of "least action." The essential point in his advance on Euler's mode of investigating curves of maximum or minimum consisted in his purely analytical conception of the subject. He not only freed it from all trammels of geometrical construction, but by the introduction of the symbol δ gave it the efficacy of a new calculus. He is thus justly regarded as the inventor of the "method of variations" —a name supplied by Euler in 1766.

By these performances Lagrange found himself, at the age of twenty six, on the summit of European fame. But such a height had not been reached without cost. Intense application during early youth had checked his growth, and weakened a constitution never robust. Accesses of feverish exaltation culminated, in the spring of 1761, in an attack of bilious hypochondria, which permanently lowered the tone of his nervous system, and rendered him liable, throughout his life, to recurrences of the same complaint at the same time of year. Rest and exercise, however, temporarily restored his health, and he gave proof of the undiminished vigor of his powers by carrying off, in 1764, the prize offered by the Paris Academy of Sciences for the best essay on the libration of the moon. His treatise was remarkable, not only as offering a satisfactory explanation of the coincidence between the lunar periods of rotation and revolution, but as containing the first employment of his radical formula of mechanics, obtained by combining with the principle of D'Alembert that of virtual velocities. His success encouraged the Academy to propose, in 1766, as a theme for competition, the hitherto unattemped theory of the Jovian system. The prize was again awarded to Lagrange; and he subsequently earned the same distinction with essays on the problem of three bodies in 1772, on the secular equation of the moon in 1774, and in 1778 on the theory of cometary perturbations.

He had in the meantime gratified a long felt desire by a visit to Paris, where he enjoyed the keen and stimulating delight of conversing with such mathematicians as Clairaut, D'Alembert, Condorcet, and the Abbé Marie. An attack of illness frustrated his design of extending his journey to London, and he returned, though not for long, to the comparative isolation of the Piedmontese capital. The post of director of the mathematical department of the Berlin Academy (of which he had been a member since 1759) becoming vacant by the removal of Euler to St. Petersburg, both he and D'Alembert united by unpremeditated concert to recommend Lagrange as his successor. Euler's eulogium was enhanced by his desire to quit Berlin, D'Alembert's by his dread of a royal command to repair thither; and the result was that an invitation, conveying the wish of the "greatest king in Europe" to have the "greatest mathematician" at his court, was sent to Turin. On November 6, 1766, Lagrange was installed in his new position, with a salary of 6000 francs, ample leisure for scientific research, and an amount of royal favor sufficient to secure him respect without exciting envy. The national jealousy of foreigners, it is true, was a first a source of annoyance to him; but such prejudices were gradually disarmed by the mild inoffensiveness of his demeanor, and by his strict adherence to a policy of non-intervention outside his own immediate domain. We are told that the universal example of his colleagues, rather than any desire for female society, impelled him to matrimony; an excess of home-sickness, however, probably directed his choice towards a lady of the Conti family (related to his own by a previous alliance), who, by his request, joined him at Berlin. The experiment was cut short by a lingering illness, during which he devoted all his time, and a considerable store of medical knowledge, to the care of the dying woman.

The long series of memoirs—some of them complete treatises of great moment in the history of science—communicated by Lagrange to the Berlin Academy between the years 1767 and 1787 were not the only fruits of his exile on the banks of the Spree. His *Mécanique Analytique*, the production in which his genius most fully and characteristically displayed itself, was due to the same period. This great work was the perfect realization of a design present to the mind of its author almost from boyhood, and of which he had given a clear though concise sketch in his first published essay.[1] Its scope may be briefly described as the reduction of the theory of mechanics to certain general formulæ, from the simple development of which should be derived the equations necessary for the solution of each separate problem.[2] From the fundamental principle of virtual velocities, which thus acquired a new significance, Lagrange deduced, with the aid of the calculus of variations, the whole system of mechanical truths, by processes so elegant, lucid, and harmonious as to constitute, in Sir William Hamilton's words "a kind of scientific poem." This unification of method was one of matter also. By his mode of regarding a liquid as a material system characterized by the unshackled mobility of its minutest parts, the separation between the mechanics of matter in different forms of aggregation finally disappeared, and the fundamental equation of forces was for the first time extended to hydrostatics and hydrodynamics.[3] Thus a universal science of matter and motion was derived, by an unbroken sequence of deduction, from one radical principle; and analytical mechanics assumed the clear and complete form of logical perfection which it now wears.

A publisher having with some difficulty been found, the book appeared in Paris, under the supervision of Legendre, in 1788. But before that time Lagrange himself was on the spot. After the death of Frederick the Great, his presence was competed for by the courts of France, Spain, and Naples, and a residence in Berlin having ceased to possess any attraction for him, he removed to Paris in 1787. His reception was most flattering. Marie Antoinette warmly patronized him. He was lodged in the Louvre, received the grant of an income equal to that hitherto enjoyed by him, and, with the title of "veteran pensioner" in lieu of that of "foreign associate" (conferred in 1772), the right of voting at the deliberations of the Academy. In the midst of these distinctions, a profound melancholy seized upon him. His mathematical enthusiasm, hitherto the happiness of his life, was for the time completely quenched, and during two years the printed volume of his *Mécanique*, which he had seen only in manuscript, lay unopened beside him. He relieved his dejection with miscellaneous studies, especially with that of chemistry, which in the new form given to it by Lavoisier, he found "aisée comme l'algèbre." The disastrous crisis of the Revolution roused him once more to activity and cheerfulness. Curiosity impelled him to remain and watch the progress of such a novel phenomenon; but curiosity was changed into dismay as the terrific character of the phenomenon unfolded itself. He now bitterly regretted his temerity in braving the danger. "Tu l'as voulu," he would repeat self-reproachfully. Even from revolutionary tribunals, however, the name of Lagrange uniformly commanded respect. His pension was continued by the National Assembly, and he was partially indemnified for the depreciation of the currency by remunerative appointments. Nominated president of the Academical commission for the reform of weights and measures, his services were retained when its "purification" by the Jacobins removed his most distinguished colleagues. He again sat on the commission of 1799 for the actual construction of the metrical system, and by his zealous advocacy of the decimal principle of subdivision largely contributed to its adoption.

The interval had, however, been marked by some of the most considerable events in the placid life of our mathematician. On the 31st of May, 1792, he married Mademoiselle Lemonnier, daughter of the astronomer of that name, a young and beautiful girl, whose devotion ignored disparity of years, and formed the one tie with life which Lagrange found it hard to break. He had no children by either marriage, and never regretted their absence. Although specially exempted from the operation of the decree of October, 1793, imposing banishment on foreign residents, he took alarm at the fate of Bailly and Lavoisier, and prepared to resume his former situation in Berlin. His design was frustrated by the establishment of and his official connection with the École Normale, and then the Ecole Polytechnique. The former institution had an ephemeral existence, and his lectures there were consequently few and elementary; but amongst the benefits derived from the foundation of the École Polytechnique one of the greatest, it has been observed,[4] was the restoration of Lagrange to mathematics. The remembrance of his teachings was long treasured by such of his auditors—amongst whom were Delambre and Lacroix—as were capable of appreciating them. In expounding the principles of the differential calculus, he started, as it were, from the level of his pupils, and ascended with them by almost insensible gradations from elementary to abstruse conceptions. He seemed, not a professor among students, but a learner amongst learners; pauses for thought alternated with luminous exposition; invention accompanied demonstration; and thus originated his *Théorie des fonctions analytiques* (Paris, 1797). The leading idea of this remarkable work was contained in a paper published in the *Berlin Memoirs* for 1772.[5] Its object was the elimination of the to some minds unsatisfactory conception of the infinite from the metaphysics of the higher mathematics, and the substitution for the differential and integral calculus of an analogous method depending wholly on the serial development of algebraical functions. By means of this "calculus of derived functions" Lagrange hoped to give to the solution of all analytical problems the utmost "rigor of the demonstrations of the ancients;"[6] but it cannot be said that the attempt was successful. The validity of his fundamental position was impaired by the absence of a well-constituted theory of series; the notation employed was inconvenient, and was abandoned by its inventor in the second edition of his *Mécanique;* while his scruples as to the admission into analytical investigations of the idea of limits or vanishing ratios have long since been laid aside as idle. Nowhere, however, were the keenness and clearness of his intellect more conspicuous than in this brilliant effort, which, if it failed in its immediate object, was highly effective in secondary results. His purely abstract mode of regarding functions, apart from any mechanical or geometrical considerations, led the way to a new and sharply characterized development of the higher analysis in the hands of Cauchy, Jacoby, and others.[1] The *Théorie des Fonctions* is divided into three parts, of which the first explains the general doctrine of functions, the second deals with its application to geometry, and the third with its bearings on mechanics.

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[1] *Œuvres*, i. p. 15.

[2] *Méc. An.*, Advertisement to 1st ed

[3] Dühring, *Kritische Gesch. der Mechanik*, pp. 220, 367; Lagrange, *Méc. An.*, i. pp. 166–72, 3d ed.

[4] Notice by Delambre, *Œuvres de Lagrange*, i. p. xlii.

[5] *Œuvres*, iii. p. 441.

[6] *Théorie des Fonctions*, p. 6.

On the establishment of the Institute, Lagrange was placed at the head of the section of geometry; he was one of the first members of the Bureau des Longitudes; and his name appeared in 1791 on the list of foreign members of the Royal Society. On the annexation of Piedmont to France in 1796, a touching compliment was paid to him in the person of his aged father. By direction of Talleyrand, then minister for foreign affairs, the French commissary repaired in state to the old man's residence in Turin, to congratulate him on the merits of his son, whom they declared "to have done honor to mankind by his genius, and whom Piedmont was proud to have produced and France to possess." Bonaparte, who styled him "la haute pyramide des sciences mathématiques," loaded him with personal favors and official distinctions. He became a senator, a count of the empire, a grand officer of the legion of honor, and just before his death received the grand cross of the order of reunion.

The preparation of a new edition of his *Mécanique*, to which he devoted himself with extraordinary zeal, exhausted his already failing powers. Frequent fainting fits gave presage of a speedy end, and on the 8th of April, 1813, he had a final interview with his friends Lacépède, Monge, and Chaptal. He spoke with the utmost calm of his approaching death; "c'est une dernière fonction," he said, "qui n'est ni pénible ni désagréable." He, however, looked forward to a future meeting, when he promised to complete the autobiographical details which weakness obliged him to interrupt. They remained untold, for he died two days later, April 10, at the age of seventy-seven, and was buried in the Pantheon, the funeral oration being pronounced by Laplace and Lacépède.

Lagrange would never allow his portrait to be painted, holding that a man's works, not his features, deserve remembrance. From a sketch, however, obtained by stealth at a meeting of the Institute, coupled with the descriptions of those who knew him, we can, in some sort, construct an image of his mild and venerable aspect. He was of the middle height, with a slight, well-proportioned figure. His head was finely formed, though not massive; his features strongly marked, with a stamp of grave and noble beauty; eyes ashy blue, habitually cast down in meditation, but when raised, clear and penetrating; complexion pale and faded. The whole physiognomy was more expressive of benignity than of strength, and his social attitude was one of deprecation rather than of self-assertion. He was timid and affable in conversation, slow to give his opinion, though frequently betraying, by his remarks even on subjects alien to his habitual studies, unexpected stores of information and depths of thought. The phrase "Je ne sais pas" became habitual with him, serving to express his sense of failure in the search for words to fit accurately with ideas always precise. Of music he used to say "Je l'aime, parce qu'elle m' isole;" and his most abstruse reasonings were frequently pursued under its soothing influence. The sight of suffering was intolerable to him; he abhorred controversy, tolerated—perhaps unduly—what he could not approve, and was emphatically, in his own phrase, "philosophe sans crier."

The delicacy of his health demanded precautions exaggerated, under the influence of nervous anxiety, into minute watchfulness. He observed a scrupulous regimen, living mainly on fruit and vegetables, and his temperance doubtless helped to keep his faculties unimpaired to the last. By self-imposed rules of study, he regulated his vast capability of work as strictly as if it had been a machine intrusted to his care. It was one of his maxims that the mind gains full command over its powers only by exercise and discipline. He had learned from Frederick the Great always to do the same things at the same hours, assigning the most difficult to the morning. Each day he set himself a task for the next, and from the first aimed at mastering certain points of his subject, with a view to inventing improvements. He always read with a pen in his hand, developing the methods of his author as he proceeded; and his own works were so profoundly meditated that they were usually written without erasures.

Amongst the brilliant group of mathematicians whose magnanimous rivalry contributed to accomplish the task of generalization and deduction reserved for the 18th century Lagrange occupies an eminent place. It is, however, by no means easy to distinguish and apportion the respective merits of the competitors. This is especially the case between Lagrange and Euler on the one side, and between Lagrange and Laplace on the other. The calculus of variations lay undeveloped in Euler's mode of treating isoperimetrical problems. The fruitful method, again, of the variation of elements was introduced by Euler, but adopted and perfected by Lagrange, who first recognized its supreme importance to the analytical investigation of the planetary movements. Finally, of the grand series of researches by which the stability of the solar system was ascertained the glory must be almost equally divided between Lagrange and Laplace. In analytical invention, and mastery over the calculus, the Turin mathematician was admittedly unrivalled. Laplace owned that he had despaired of effecting the integration of the differential equations relative to secular inequalities until Lagrange showed him the way. On the other hand, Laplace unquestionably surpassed his rival in practical sagacity, and the intuition of physical truth. Lagrange saw in the problems of nature so many occasions for analytical triumphs; Laplace regarded analytical triumphs as the means of solving the problems of nature. One mind seemed, as it were, the complement of the other; and both, united in honorable rivalry, formed an instrument of unexampled perfection for the investigation of the celestial machinery. What may be called Lagrange's first period of research into planetary perturbations extended from 1774 to 1784 (see ASTRONOMY, vol. ii. p. 664). The remarkable group of treatises communicated, 1781–84, to the Berlin Academy was designed, but did not prove, to be his final contribution to the theory of the planets. After an interval of twenty-four years the subject, having been reöpened by Poisson in a paper read June 20, 1808, was once more attacked by Lagrange with all his pristine vigor and fertility of invention. Resuming the inquiry into the invariability of mean motions, Poisson carried the approximation, with Lagrange's formulæ, as far as the squares of the disturbing forces, hitherto neglected, with the same result as to the stability of the system. He had not, however, attempted to include in his calculations the orbital variations of the disturbing bodies; but Lagrange, by the happy artifice of transferring the origin of co-ordinates from the centre of the sun to the centre of gravity of the sun and planets, obtained a simplification of the formulæ, by which the same analysis was rendered equally applicable to each of the planets severally. It deserves to be recorded as one of the numerous coincidences of discovery that Laplace, on being made acquainted by Lagrange with his new method, produced analogous expressions, to which his independent researches had led him. The final achievement of Lagrange in this direction was the extension of the method of the variation of arbitrary constants, successfully used by him in the investigation of periodical as well as of secular inequalities, to any system whatever of mutually interacting bodies.[2] "Not without astonishment," even to himself, regard being had to the great generality of the differential equations, he reached a result so wide as to include, as a particular case, the solution of the planetary problem recently obtained by him. He proposed to apply the same principles to the calculation of the disturbances produced in the rotation of the planets by external action on their equatorial protuberances, but was anticipated by Poisson, who gave formulæ for the variation of the elements of rotation strictly corresponding with those found by Lagrange for the variation of the elements of revolution. The revision of the *Mécanique Analytique* was undertaken mainly for the purpose of embodying in it these new methods and final results, but was interrupted, when two-thirds completed, by the death of its author.

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[1] Suter, *Geschichte der math. Wiss.*, ii. pp. 222–23.

[2] *Œuvres*, vi. p. 771.

In the advancement of almost every branch of pure mathematics Lagrange took a conspicuous part. The calculus of variations is indissolubly associated with his name. In the theory of numbers he furnished solutions of many of Fermat's theorems, and added some of his own. In algebra he discovered the method of approximating to the real roots of an equation by means of continued fractions, and imagined a general process of solving algebraical equations of every degree. The method indeed fails for equations of an order above the fourth, because it then involves the solution of an equation of higher dimensions than the proposed. It possesses, however, the great and characteristic merit of generalizing the solutions of his predecessors, exhibiting them all as modifications of one principle. To Lagrange, perhaps more than to any other, the theory of differential equations is indebted for its position as a science, rather than a collection of ingenious artifices for the solution of particular problems. To the calculus of finite differences he contributed the beautiful formulæ of interpolation which bears his name; although substantially the same result seemed to have been previously obtained by Euler. But it was in the application to mechanical questions of the instrument which he thus helped to form that his singular merit lay. It was his just boast to have transformed mechanics (defined by him as a "geometry of four dimensions") into a branch of analysis, and to have exhibited the so-called mechanical "principles" as simple results of the calculus. The method of "generalized co-ordinates," as it is now called,[1] by which he attained this result, is the most brilliant achievement of the analytical method. Instead of following the motion of each individual part of a material system, he showed that, if we determine its configuration by a sufficient number of variables, whose number is that of the degrees of freedom to move (there being as many equations as the system has degrees of freedom), the kinetic and potential energies of the system can be expressed in terms of these, and the differential equations of motion thence deduced by simple differentiation. Besides this most important contribution to the general fabric of dynamical science, we owe to Lagrange several minor theorems of great elegance—among which may be mentioned his theorem that the kinetic energy imparted by given impulses to a material system under given constraints is a maximum. To this entire branch of knowledge, in short, he successfully imparted that character of generality and completeness towards which his labors invariably tended.

His share in the gigantic task of verifying the Newtonian theory would alone suffice to immortalize his name. His co-operation was indeed more indispensable than at first sight appears. Much as was done *by* him, what was done *through* him was still more important. Some of his brilliant rival's most conspicuous discoveries were implicitly contained in his writings, and wanted but one step for completion. But that one step, from the abstract to the concrete, was precisely that which the character of Lagrange's mind indisposed him to make. As notable instances may be mentioned Laplace's discoveries relating to the velocity of sound and the secular acceleration of the moon, both of which were led close up to by Lagrange's analytical demonstrations. In the *Berlin Memoirs* for 1778 and 1783 Lagrange gave the first direct and theoretically perfect method of determining cometary orbits. It has not indeed proved practically available; but his system of calculating cometary perturbations by means of "mechanical quadratures" has formed the starting-point of all subsequent researches on the subject. His determination[2] of maximum and minimum values for the slowly varying planetary eccentricities was the earliest attempt to deal with the problem. Without a more accurate knowledge of the masses of the planets than was then possessed a satisfactory solution was indeed impossible; but the upper limits assigned by him agreed closely with those obtained later by Leverrier.[3] As a mathematical writer Lagrange has perhaps never been surpassed. His treatises are not only storehouses of ingenious methods, but models of symmetrical form. The clearness, elegance, and originality of his mode of presentation give lucidity to what is obscure, novelty to what is familiar, and simplicity to what is abstruse. His genius was one of generalization and abstraction; and the aspirations of the time towards unity and perfection received, by his serene labors, an embodiment denied to them in the troubled world of politics.

Lagrange's numerous scattered memoirs have been collected and published in seven handsome 4to volumes, under the title *Œuvres de Lagrange, publiées sous les soins de M. J. A. Serret*, Paris, 1867–77. The first, second, and third sections of this important publication comprise respectively the papers communicated by him to the Academies of Sciences of Turin, Berlin, and Paris; the fourth includes his miscellaneous contributions to other scientific collections, together with his additions to Euler's *Algebra*, and his *Leçons Élémentaires* at the École Normale in 1795. Delambre's notice of his life, extracted from the *Mém de l'Institut*, 1812, is prefixed to the first volume. Besides the separate works already named are *Résolution des Équations Numériques*, 1798 (2d ed. 1808, 3d ed. 1826), and *Leçons sur le Calcul des Fonctions*, 1805 (2d ed. 1806), designed as a commentary and supplement to the first part of the *Théorie des Fonctions*. The first volume of the enlarged edition of the *Mécanique* appeared in 1811, the second, of which the revision was completed by MM. Prony and Binet, in 1815. A third edition, in 2 vols. 4to, was issued in 1853–55, and a second of the *Théorie des Fonctions*, in 1813. See also Virey and Potel, *Précis Historique*, 1813; Thomson's *Annals of Philosophy*, 1813–20, vols. ii. and iv.; Suter, *Geschichte der Math. Wiss.*, 1873; Dühring, *Kritische Gesch. der allgemeinen Principien der Mechanik*, 1877 (2d ed.); Gautier, *Essai Historique sur le Problème des trois Corps*, 1817; Grant, *History of Physical Astronomy*, etc. (A. M. C.)

LAGRENÉE, Louis Jean François (1724–1805), French painter, was a pupil of Carle Vanloo. Born at Paris, 30th December, 1724, in 1755 he became a member of the Academy, presenting as his diploma picture the Rape of Deianira (Louvre). He visited St. Petersburg at the call of the empress Elizabeth, and on his return was named in 1781 director of the French Academy at Rome; he there painted the Indian Widow, one of his best-known works. His pictures, which have nearly all been engraved, are frequently to be met with out of France. In 1804 Napoleon conferred on him the cross of the legion of honor, and on the 19th of June, 1805, he died in the Louvre, of which he was honorary keeper.

LAHIRE, Laurent de (1606–1656), French painter, was born at Paris on 27th February, 1606. He became a pupil of Lallemand, studied the works of Primaticcio at Fontainebleau, but never visited Italy, and belongs wholly to that transition period which preceded the school of Simon Vouet. His picture of Nicolas V. opening the crypt in which he discovers the corpse of St. Francis of Assisi standing (Louvre), was executed in 1630 for the Capuchins of the Marais; it shows a gravity and sobriety of character which marked Lahire's best work, and seems not to have been without influence on Le Sueur. The Louvre contains eight other works, and paintings by Lahire may also be found in the museums of Strasburg, Rouen, and Mans. His drawings, of which the British Museum possesses a fine example, Presentation of the Virgin in the Temple, are treated as seriously as his paintings, and sometimes show simplicity and dignity of effect. The example of the Capuchins, for whom he executed several other works in Paris, Rouen, and Fécamp, was followed by the goldsmiths' company, for whom he produced in 1635 St. Peter healing the Sick (Louvre), and the Conversion of St. Paul in 1637. In 1646 he shared with eleven other artists the honor of founding the French Royal Academy of Painting and Sculpture. Richelieu called Lahire to the Palais Royal; Chancellor Séguier, Tallemant de Réaux, and many others intrusted him with important works of decoration; for the Gobelins he designed a series of large compositions. Lahire painted also a great number of portraits, and in 1654 united in one work for the town-hall of Paris those of the principal dignitaries of the municipality. Two years later, 28th December, 1656, he died. His works have been frequently engraved by his own pupil Chauveau, and by Lasne, Boulanger, De la Court, Rousselet, and Faithorne.

LAHORE, or **Lahór**, capital of the Punjáb, India, gives its name to a civil division of the British territory in that province, and to the headquarters district of the division.

Lahore Division.—This division, the most central of the ten into which British Punjáb is divided, is fourth in order of size, 8961 square miles, and fifth in respect of population, 1,889,495 (by the census of 1868), averaging 211 to the square mile. The Lahore division has three districts—Lahore, Fírózpúr, Gujránwála. The whole area is alluvial plain, for the most part devoid of trees, except such as have been planted since

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[1] We use the modern terms by which the functions introduced by Lagrange are now denoted.

[2] *Œuvres*, v. p. 211 *sq.*

[3] Grant, *History of Physical Astronomy*, p. 117.

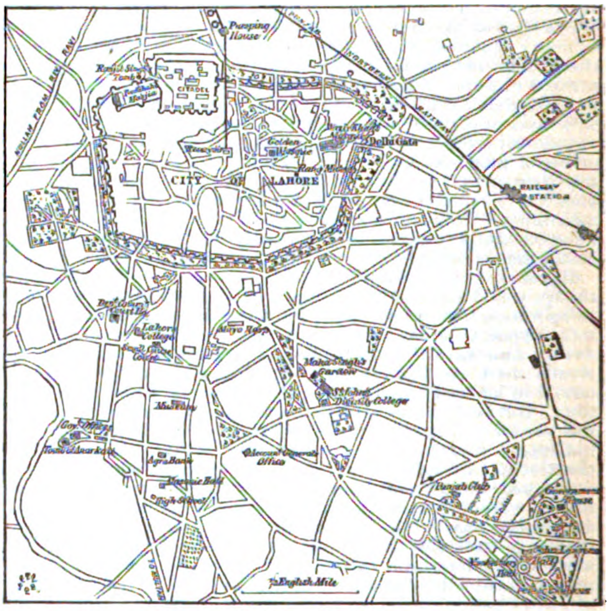
British occupation. It is intersected by the rivers Rávi and Sutlej, and the Bári Doáb canal drawn from the Rávi at the foot of the hills; also by the old bed of the Biás river, deserted about the middle of last century. The Chenáb river is the boundary on the northwest, between the Lahore and the Ráwal Pindi divisions. Of the towns in the division there are five which have over 10,000 inhabitants, namely, Lahore, Kasúr, Gujránwála, Wazirábád, Firózpúr. The common language of the rural population and of artisans is Punjábi. Urdu (Hindustani) is the language of the better educated classes, and is everywhere becoming more generally understood and used. In Government schools Punjábi is not taught.

So far from the seaboard, the range between extremes of winter and summer temperature is great. The mean temperature in the shade in June is about 92°, in January about 50°. In midsummer the thermometer sometimes rises to 115° in the shade, and remains (on rare occasions) as high as 105° throughout the night. In winter the morning temperature has sometimes been as low as 20°. The rainfall is uncertain as well as scanty: the annual average is about 15 inches; it is sometimes as low as 8″; a total of 25″ is exceptionally high. The harvests are greatly dependent on irrigation. The prevailing winds are westerly (N.W. and S.W.) in the hot weather, and easterly (E. and N.E.) in the cold season. The Lahore division became British territory in March, 1849, on the annexation of the part of the Punjáb west of the Biás river, at the close of the second Sikh war.

Lahore District has an area of 3648 square miles, with a population of 789,666 (438,335 males and 351,331 females;—Sikhs, 119,268; Hindus, 116,287; Mohammedans, 470,216; others, 83,895). Of this number about 3000 are Europeans and Eurasians, residing chiefly at Lahore and its cantonment of Mián Mír. The district contains 1455 villages, with an agricultural population of 354,012. The gross revenue is £110,518—£74,353 being derived from the land. Of the area 1,165,440 acres are under cultivation, 811,520 uncultivated, and 357,760 uncultivable. Of the uncultivated area nearly 237,000 acres are unappropriated cultivable waste land, the property of the Government. Irrigation is supplied to upwards of 180,000 acres by the Bári Doáb canal and three inundation canals from the Sutlej (filled for a certain time each year by the rise of the river), which are Government works, and about 267,000 acres are watered by private wells.

The chief crops are—wheat, about 436,000 acres; *gram* (chick-pea, for cattle), 230,000; barley, 58,000; maize, 25,000; rice, 18,000; various food grains, 85,000; sugar cane, 2500; vegetables, 7000; capsicum, 1500; tobacco, 5000; poppy, 1000; cotton, 40,000; oil seeds, 15,000. Indigo, now only grown on a small scale in this part of India, was formerly one of the important products of the country round Lahore, which had the reputation of great fertility. The traders on the part of the East India Company in the 17th century paid much attention to the indigo of Lahore. The court minutes of the Company, July 19, 1614, notice the proposal of Captain Newport at Surat for "a voyage to the river Syndus, whence the Lahore indigo comes." Captain Downton, writing to the Company in November of the same year regarding the opposition which the English merchants met with at Surat, expresses a wish that they had some hope of being able "to transport their goods by that fair river of Sinde to and from that goodly country round Lahore." And another trader speaks in 1615 of the great store of indigo to be had both at Ahmadabad and at Lahore. No doubt what was reckoned Lahore indigo may have been in great part indigo from elsewhere, passing through Lahore as the trade centre of that part of India,—just as, at the present day, the rock salt of the Punjáb is in other provinces commonly called *Lahori*, though it comes from the salt hills west of the Jhelum. The importance of Lahore as a centre of trade at the time above referred to, is shown also in some of Sir T. Roe's letters. Lahore now receives indigo from Bengal. The rent per acre of good wheat land in the Lahore district is about 5 rupees. The selling price of wheat in ordinary years is about 26 *seers* (52 ℔) for a rupee. The water-level in the neighborhood of Lahore is at a depth of 30 to 36 feet from the surface of the ground. In the tract between the Rávi and the Chenáb it is from 15 to 30 feet. In the south and southwest parts of the district, between the Rávi and the Sutlej, the depth is from 40 to 70 feet, except in some strips of low land. After the opening of the Bári Doáb canal, the water-level in wells of village lands on both sides of the canal was permanently raised, in some cases as much as 12 feet. The Lahore district has 107 miles of metalled roads and 688 miles unmetalled, 97 miles of railway, and 104 miles of navigable rivers.

Lahore City lies in 31° 34′ N. lat. and 74° 21′ E. long., on the left bank of the river Rávi, about 900 feet above the sea-level. It is a walled town, about 1¼ miles in length from west to east, and about ¾ mile in breadth from north to south. The intramural population is 98,924; with the suburbs Anarkali, Muzang, and Ichra, the number is 128,441. The city walls, rebuilt in the time of Akbar, towards the end of the 16th century, were of great height, in some parts upwards of 36 feet, and higher at the gateways and parts adjoining. Ranjít Singh added a deep ditch, with a broad faussebraie (*raunt*) between the ditch and the walls, and large outworks, shielding with a massive defence each of the city gates. The fort or citadel, in which was the palace, is on high ground on the north face of the city, and has three gates, one direct to the open plain on the north, and one on each side, east and west, into the city. Only the north gate of the fort is now open. The city gate next the fort on the west, called the *Roshnái* or bright gate, leads into the small inclosure called the Huzúri Bagh or Court Garden, from which on the one side rises the great flight of steps to the terrace of the imperial mosque, and on the other the ascent through a fine gateway (now closed) to the palace in the fort. The fort and palace, with the conspicuous *Saman Burj* (properly *musamman*, octagonal tower; it is a half octagon), present a striking appearance viewed from the open plain on the north.



Plan of Lahore.

The site of the present city has been occupied from early times, and much of it stands high above the level of the country outside, raised on the remains of many successive series of former habitations. Some of the old buildings which have been preserved when changes were going on around, stand now below the surface of the ground about them. This is well seen in the mosque now called Masjid *Níwín* (or sunken), built 1560, the mosque of Mullah Rahmat, 7 feet below, and the *Shiwála* (Hindu temple), a very old building near the revenue office, about 12 feet below the surrounding ground. The houses are of brick, irregular in construction, three and more stories in height, many of them with projecting balconies and lattice windows ornamented with varieties of carved woodwork. The streets, narrow and winding, were, under the Sikh Government, and at the time of the first British occupation of the city in 1846, extremely unregulated and dirty. The water supply from numerous wells throughout the city, was for the most part exceedingly impure. A cleansing and draining of the streets had to be taken in hand at once, when the city was held by British troops. The governor-general of India, Lord Hardinge, having, after the defeat of the Sikh army at Sabráon, advanced to Lahore and concluded a treaty with the Sikh Government, a British force was left, to hold Lahore for that year (1846), the fort being reserved for the maharaja. But the occupation of Lahore was prolonged. A British resident was appointed, and barracks were built for the troops in the Anarkali suburb. After the annexation of the Punjáb in 1849 the government of the country was placed in the hands of a board of administration. The fort was held by the British troops, the rest of the force assigned to Lahore being quartered outside the city in the cantonment of Anarkali. Subsequently a site for a permanent cantonment was selected at Mián Mír, about five miles southeast of the city; and all the troops, British and native, are now quartered there, except the small garrison of the fort.

In 1852 the lofty walls, which greatly impeded the free airing of the interior of the city, were reduced to a height of from 14 to 20 feet, and the whole of the massive outworks were removed. In 1863 the ditch was filled in and the faussebraie levelled; and on this broad strip of new land immediately outside the city walls public gardens were laid out, and supplied with a watercourse from the Bári Doáb canal. This work of improvement was carried out under the immediate direction of the native gentlemen of the Lahore municipal committee.

The municipality now includes within its limits the greater part of the civil station of Lahore, which covers, in addition to the ground occupied by the old Anarkali cantonment, a large area south and southeast of the city. All new public buildings have been erected in this civil station outside the walls. The principal of these are the deputy commissioner's court-house, the Government college, the Mayo hospital, the senate hall of the Punjáb University College (the gift of the nawáb of Bahawalpúr). The Lahore Industrial and Antiquarian Museum is in the building erected for the "Punjáb Exhibition" of 1864. A building for the school of art in connection with the museum is in progress. The medical school, at first held in a disused barrack of the Anarkali cantonment, and then in hired houses, is now about to be provided with a suitable building at the Mayo hospital. The block of buildings erected for the British residency and offices, and used for this purpose up to the time of annexation, is now occupied by the chief court, the Government secretariat offices, civil and military, and the offices of the financial commissioner of the Punjáb, and of the commissioner of the Lahore division. A new building for the chief court is about to be erected. A large building for the Government telegraph department has lately been finished. The post-office occupies one of the barracks of the old cantonment, and others of them continue to be occupied by the offices of various government departments —public works, public instruction, prisons, etc. The central jail stands on the site of the British camp of 1846; and in the large public grounds which contain the botanical and zoological gardens stands the John Lawrence Hall and the Montgomery Hall, erected in honor of the first two lieutenant-governors of the Punjáb. Of native buildings applied to new purposes there are, in the palace (1630–1640) the Diwan-i-ám (or hall of audience), serving as a barrack for the fort garrison; the two buildings called *Khwáb-gah* (or sleeping apartments), used as the Protestant and Roman Catholic places of worship for the troops in the fort; the vaults of the *Kála Burj* and *Lal Burj* (black and red towers) used as commissariat store-rooms; the *Móti Masjid* (pearl mosque), which Ranjít Singh made his treasury, still used for the same purpose. The armory, in an adjoining building, contains an interesting collection of arms and armor of the Mughal and Sikh times.

In the city, the mansion of Raja Dhyan Singh, Ranjit's prime minister (which was the British artillery mess house in 1846), contains the Government district school, the Oriental college, and the hall of the *Anjuman-i-Panjab*, an active literary and educational society. The quadrangle of the *Huzúri Bagh* (or royal garden) contains the Government normal school. In the *Rang Mahal* is the large high school of the American Presbyterian mission.

Outside the city, half way between the civil and military stations is Government House, the official residence of the lieutenant-governor of the Punjáb, formerly the house of the Jamadar Khush-hál Singh, a Brahman who, with varied fortunes, held high offices under Ranjít Singh. The original building round which the present large house was erected was the tomb of Sayid Nur-ud-dín, called also Nur-ul-Alam, of Bokhara (1616), which is the lofty square apartment in the middle of the present building. The tomb of Nádirah Begam was fitted up in the early days of British rule at the station church, and continues to be used for this purpose. (A large new church has been commenced, which will now be the cathedral of the lately-constituted diocese of Lahore.) The tomb of Shah Chirágh (1660 A.D.) is, with large additions made from time to time, the office of the accountant-general of the province. The *báradari* or summer-house (commonly called *chau-burji*, the building with four turrets) of Nawab Wazir Khan (1631), long occupied by the museum, is now the station library and reading-room.

Educational and other Institutions.—The Punjáb University College, established in 1869 to give special encouragement to the cultivation of Oriental learning, and instruction in European science through the vernacular languages, is supported with much zeal by the chiefs and native gentlemen of the Punjáb. It is now about to be raised to the status of a university, with power to confer degrees. The other educational institutions of Lahore are the Government college, the normal school, the Oriental college, the district Anglo-vernacular school, the high school for boys of European parentage, the Anarkali school for girls, another girls' school of the same class near the railway station, chiefly for the children of the railway employés, St. James's orphanage and free school, for poorer children, European and Eurasian. The large and prosperous school of the American Presbyterian mission in the city has been mentioned above. The medical school, established in 1860, gives a five years' course, in the English language, qualifying for a diploma as licentiate in medicine, and for employment in the Government service in the grade of assistant-surgeon. A three years' course, in the Urdu language, trains a lower class of students for the grade of hospital assistant or native doctor. The number of students in the upper class is between fifty and sixty, in the lower from eighty to one hundred. The Mayo school of industrial art has in view mainly the cultivation of Oriental art as applied to decoration and manufactures, and, in aid of this purpose, instruction in drawing, modelling, etc. Among other works on which the trained pupils have been employed is the production of plaster casts of the Buddhist sculptures in the museum, obtained from explorations in the northwest districts of the Punjáb. St. John's Divinity College (Church Missionary Society) gives theological instruction, in the Urdu language, to native Christian students, ten of whom are now pastors of native congregations in different parts of Northern India.

There is a Government book depot for the sale of educational and other books; and from the depository of the Punjáb Religious Book Society there is a large and increasing sale of books of religious and general literature in English and in the vernacular languages. A large number of books in the native languages are issued annually from the local presses. Nine newspapers in Indian languages are published at Lahore—seven in Urdu, one in Hindi, and one in Arabic. One of the Lahore Urdu papers has the largest circulation of any native paper published out of Bengal. There is one daily English paper, and one under native editorship and management in the English language.

In the Lahore central jail, which is capable of receiving 2000 inmates, many useful manufactures are carried on by the prisoners. For the carpets made in this jail there is a large demand in the English market. Besides the two smaller jails, the district jail and the female jail, there is a *Thaggi* jail and school of industry, in which the few remaining *Thags* (or Thugs—highway stranglers and robbers) are taught useful work, chiefly tent making. A large lunatic asylum occupies the inclosed buildings of one of the old Sikh cantonments.

Trade.—The Lahore municipality has an annual income of nearly 170,000 rupees, the chief source of which is the octroi. Lahore imports from other parts of the Punjab, and the hill countries beyond, tobacco, dyes, bamboos, hides, Kashmir paper, felts, and silk fabrics; from Bengal and the southern provinces, indigo, spices, English piece goods, and other foreign products and manufactures; from Bombay, metals and metal work, cutlery, etc., and drugs. The chief manufactures of Lahore—but they are none of them on a great scale—are woollen and silk fabrics for clothing, carpets (cotton and woollen), embroidery on leather, ivory carving, toys, pottery, turnery, metal work of various kinds, arms, jewellery, etc. Lahore has long been noted for its carpets. One of the travelling agents of the East India Company in 1617, writing from Agra, reports the purchase of various articles, including thirty Lahore carpets. Soon after he writes from the same place, "It requires a long time to get well-chosen carpets. True Lahore carpets are not suddenly to be gotten." Two years later, December, 1619, another, writing from Sirhind about carpets, says, "Lahore is the chief place for that commodity." A little later in the same century it is observed that from Lahore were obtained fine muslins, flowered and embroidered silks, woollen drapery, and all sorts of carpets.

Health.—The general health of Lahore is good, but the city and civil station, as well as the cantonment of Mián Mír, have suffered from occasional severe visitations of cholera and fever, as well as of small-pox. A large amount of rain within a short space of time, though the total of the year may be under the average, is usually followed by malarious fever, while a larger rainfall, more distributed, is healthy. Of much importance to the health of Lahore is the large work which the municipality has executed for the supply of water to the city and suburbs. The water is pumped from wells in the bed of the river Rávi to a covered reservoir in a high part of the city, from which it is distributed. A scheme of drainage and sewerage works, dependent on this supply of water, is about to be carried out. For the military station of Mián Mír water has been brought in by a cut from the Bári Doáb canal.

Communication.—Lahore is in railway communication with the most important places in the Punjáb, and with the other provinces of India. Its distance from Delhi is 323 miles (Sind, Punjáb, and Delhi Railway); from Calcutta, 1277 miles (East India Railway); from Bombay by Delhi and Allahabad (East India Railway and Great Indian Peninsular), 1558 miles; from Bombay by Delhi and Ajmír (Rajputana State Railway), 1230; from Multan (Sind, Punjáb, and Delhi Railway), 207; from Kurrachee, the nearest point on the sea-coast (Sind, Punjáb, and Delhi Railway and Indus Valley State Railway), 814; and from the Afghan frontier at Peshawar (Punjáb Northern State Railway), 271 miles. This last line still wants, to complete it, the great bridge across the Indus at Attok, now in course of construction. A narrow-gauge branch, from this line, for the salt traffic, is open to the bank of the Jhelum river, opposite Pind Dadan Khan. At Lahore there is one central railway station for all the lines, a short distance east of the Delhi gate.

History and Antiquities.—To this account of Lahore under British rule will now be added a short sketch of its previous history, and the works of former days which still remain.

Lahore is said to have been founded by *Láva* or *Loh*, one of the sons of Ráma; and it has borne the names Lavapúr, Loh-púr, Lóh-kót, Loháwar, Láhawar. The city of Lava is probably the *Laulaha* of the *Raja Tarangini*, or history of the kings of Kashmir. To Kashmir belonged for a long time the country (Lavana or Lavanya) as far south as Lahore, and beyond. Lavana, which also means salt, may have taken its name from the salt region west of Jhelum. Captain Wilford (*As. Res.*, ix. 53) recognized Lahore in the *Λάβακα* and *Λάβοκλα* of Ptolemy. Labaka is placed in the country of the Pandús about the Jhelum, and Labokla in Kashmir territory, which in reality embraced the other. Cunningham (*Ancient Geography of India*) suggests that Labokla should be read Labolka=Láva-laha or Láva-lók. There appears to be no mention of Lahore by the historians of Alexander; it used to be supposed that it was *Sangala* or *Sagala*, in the country of the Cathæ, but this place is better represented by the hill still called Sangala, to the west of Lahore, between the Rávi and the Chenáb.

At the time of the first Mohammedan invasion of India, in the 7th century, Lahore was in the possession of a Chauhán Rajpút prince of Ajmir. Towards the end of the 10th century Raja Jaipál, the ruler of the Lahore territory, was driven back after an encounter, on the frontier (978), with Sabaktagín, who had just risen to the throne of Ghazni. In 1001 Jaipál had to meet the first incursion of Sabaktagín's son Mahmúd. In his third invasion of the Punjab Mahmúd advanced as far as Bhera on the Jhelum, which used to be the raja's place of residence alternately with Lahore, and which had been for a time the Hindu capital. The sixth time Mahmúd came (1008), a great battle was fought near the Indus with the raja of Lahore, Anangpál, the successor of Jaipál. At length, on his fourteenth invasion of India (1023), Mahmúd took possession of Lahore, and appointed a governor, the raja, Jaipál II., having fled to Ajmir.

Under Mahmúd and seven successors Lahore continued to be ruled by governors appointed by them. When the kings of Ghazni were fully occupied in war with the Seljúks, their Indian subjects were roused to revolt, and, with the aid of the raja of Delhi, attacked Lahore. But the city was successfully held against them, and in the reign of Masaúd II., the eighth from Mahmúd, it was for a time made the seat of the government (1110). His successor Bahram went back to Ghazni; but his son, Khusrú Shah, after repeated defeats by the prince of Ghor, was driven to take refuge in the Punjáb, and again made Lahore the capital. When Ghaiás-ud-dín and Shaháb-ud-dín of Ghor were ruling jointly at Ghazni, the latter proceeded to follow up the defeat of their Ghaznavi predecessors by an invasion of the Punjáb, and, capturing Khusrú Malik, son of Khusrú Shah, took possession of Lahore (1186). It was next seized by the *Gakkars*, an ancient tribe of the hill country in the northwest of the Punjáb. Shaháb-ud-dín succeeded in expelling them, but they murdered him on his way back to Ghazni, in 1206. Kutb-ud-dín, a Turki slave originally, who had held the chief command in India during these troubled times of his late master's reign, succeeded to the sovereignty of the Indian provinces, which ceased from this time to be dependent on Ghazni. He had to fight for the possession of Lahore, which had been seized by a rival, and the seat of government was then transferred from Lahore to Delhi.

The buildings at Lahore of the Hindu times, and of this first Mohammedan period, are few in number. To the former probably belongs the Shivala or temple of Shiva in the middle of the city, now surrounded by more modern additions. It is ascribed to the time of Loh, the founder of the city. The temple of Bhairava (a form of Shiva), about a mile south of Lahore, is generally ascribed to a later period, but Lahore is said by the author of the *Raja Tarangini* to have been addicted in early times to the worship of Bhairava. To the Ghaznavi times belongs the tomb of Malik Ayáz, governor of Lahore. It is in the heart of the city, and was built about 1046. Hazrat Ganj Bakhsh, who also came with Mahmúd to Lahore, is buried outside the Bhati gate, and at his tomb (built 1073) a weekly fair is now held, resorted to by Hindus as well as Mohammedans. About the same time were built the tomb of Pír Ali Makhdúm of Baghdad, and the tomb of Saiad Isháк, near Wazír Khan's mosque in the city.

The Mughal army sent into India by Jenghiz Khan in 1224 and subsequent years swept over the middle of the Punjab and in 1241 captured the old capital, Bhera, and laid waste Lahore and Multan. In 1269 the king of Delhi, Ghaiás-ud-dín Balban, visited Lahore, and rebuilt the fort which the Mughal invaders had destroyed. His eldest son Muhammad Sultan, the khan of Multan, came to Lahore in 1285, to oppose another invasion under Samar, one of the Mughal generals. The fight in which the young prince fell at Lahore is further memorable from the capture of his friend Amír Khusrú, the Persian poet.

After more than a hundred years, during which the history of Lahore is comparatively unimportant, though it was not untroubled, it suffered like other wealthy places in North India from Timúr's invasion in the end of the 14th century. On his return from the sack of Delhi, Timúr sent a force to Lahore, with instructions to raise a large contribution there, to which was afterwards added an order for the plunder of the city and the country around. And then Lahore had a time of repose. In 1450, when Bahlól, the first of the Lódi dynasty, had been raised to the sovereignty at Delhi, and the charge of the several divisions of his territory was assigned to different officers, Lahore was reserved for himself.

The 14th and 15th centuries have left no known buildings at Lahore, though some of the following century are marked by the Pathan style belonging to the earlier period.

The next change in the fortunes of Lahore was a great and important one. In 1522 it passed into the hands of Timúr's descendant Baber (Bábar), the first of a line of new masters who were to give it new life, though it gained little under Baber himself. Invited by the governor of Lahore, who had become disaffected to the Lodi king, Baber came on with an army, and, having defeated the Lodi forces, he gave up the city to plunder. On his departure for Cabul in 1524 he left Lahore in charge of his relative Abd'ul Aziz. Baber lived occasionally at Lahore, but his reign of frequent contests gave him little rest at any permanent seat of government. Humáyún, who succeeded his father Baber in 1530, did not long retain Lahore undisturbed. His brother Kámrán, governor of Kandahar and Cabul, who laid claim to the Indian sovereignty, came to Lahore, and by artifice succeeded in gaining the city without bloodshed. Five years later Kámrán had to march to the relief of Kandahar, and during his absence an attempt was made upon Lahore, which was defeated by his rapid return. In 1540 the Afghans made another endeavor to recover power in India, under Shír Shah Súr, who took possession of Lahore and the Bhéra, the other old capital, which still retained some importance.

Kámrán lived long enough at Lahore to make his mark there in three pieces of work of which there are still remains, but altered and added to by others since, so that of his part there is not much to be seen. One of these was the *báradari* or summer house of the Dil-Kusha garden on the bank of the Rávi opposite Lahore, on which now stands the house built over it by Ranjít Singh. Kámrán's garden of Shalamár was the beginning of the grander work completed by Shah Jahán. Of his palace at Naulakka, east of the city, only the gateway now remains. Other buildings at Lahore of this earliest Mughal period are the tomb of Khojah Salár Khan and the Khojah Masjid, the mosque now called *Niwín*, and the *Shíranwali* Masjid.

In the time of Humáyún's son and successor, Akbar (1556–1605), Lahore rose to a condition of prosperity unknown at any previous time. To his reign belongs the commencement of its architectural greatness, which increased in the two following reigns. He made the city the royal residence, rebuilt the fort, and began the palace buildings. He rebuilt also the walls which, altered and added to by his successors and now reduced, still surround the city. To this time belong many of the well-known buildings now to be seen at Lahore. The mosque near the Masti gate (opposite the Poor House of the present day) is said to have been built by the emperor's mother. Of the same date are the tombs of Abd'ul Ishák at Muzang, of Kasim Khan, of Mauj Darya (a saint whose prayers procured Akbar's success in his attack on Chitór), and of Shah Músa. This last, called *Sabz Gumbaz*, is the earliest of the Lahore buildings colored with the glazed tile-work commonly called *káshi*. The tomb of Nádirah Bégam, called also Sharíf-un-nissa, a slave of Akbar's, whom he named Anarkali, was built about the end of his reign; it is the building now used as the station church. To this period belongs also the mosque of Mullah Rahmat as well as the earliest work of the Sikhs in the city. The *báoli* or masonry tank in the middle of the city was built in 1584 by Rám Dás, the *gurú* or spiritual leader of the Sikhs, fourth in order from Nának the founder of the sect.

A curious and special interest attaches to Lahore in the time of Akbar, in connection with the first teaching of Christianity in Northern India by the Jesuit missionaries whom the emperor had invited to Lahore from Goa, after receiving the visit of Antony Capral at Agra in 1578. They were first Rodolph Aquaviva, Antony Manserrat, and Francis Heneric. Afterwards came Edward Leighton and Christopher Vega in 1589. When they, like the others, had gone away disappointed, and the emperor's invitation was repeated, two others were sent,—Jerome Xavier (nephew of Francis) and Emanuel Pinnero. Akbar built a church for them in Lahore. He then for a time shut up the Lahore mosques. The church of the Jesuits was thronged with Mohammedans. On the day of Pentecost, 1599, a number of converts walked in procession through the streets of Lahore to the church, and were publicly baptized by Pinnero. Benedict Goes passed through Lahore in 1603, on his journey to solve the question of the identity of China and Cathay, and was kindly received and helped by Akbar. Lastly, a new missionary, Father D'Acosta, came to Lahore soon after the beginning of Jahángir's reign. The marks of Christian work and success at Lahore at this period remained on some of the buildings there when the men who had been brought under its influence passed away and no traces remained with their children. De Laet says that in 1630 (three years after Jahángir's death) he saw over one of the palace gates at Lahore figures of our Saviour and of the Virgin. They are described also by Thevenot, who visited Lahore in 1666; he says they had been put up by Jahángir to please the Portuguese. Remains of the Jesuit church also were to be seen when Thevenot was at Lahore. Some traces of Christian art are still to be seen, which may be referred to the same period,—the winged heads on the principal gate of the fort and of the Gola sarái (1622).

When Jahángir succeeded to the throne of Akbar, Lahore was immediately the scene of one of those family contests which so often marked the Mughal reigns. His son Khusrú aimed at power, and attempted, unsuccessfully, to obtain possession of the city. Among those on whom the emperor's displeasure fell was the Sikh leader, Arjun Mal, fifth *guru*, compiler of the *Adi Granth*, who had succeeded his father Rám Dás in 1581. Having offered up prayers for Khusrú he was imprisoned by Jahángir, and died the same year, 1606. His little tomb stands just outside the fort.

The buildings at Lahore of Jahángir's time are numerous. The most important and the best preserved are—the *Saman Burj*, and some other parts of the palace in the fort, built during several successive years (1606, etc.); the sarái at Shahdara (1612); the tomb of Saiad Nur-ud-dín, Nur ul Alam, Bukhári (1616), now Government House; the tomb of Shah Abu'l Maali, and the mosque beside it (1616); the masjid of Dái Sádhu-wali (1621); the tomb, near Shalamar, of Madhu Lál Hussein, a converted Hindu (1621); the little tomb, covered with many colored *káshi*, of Faríd Pakkiwala, a pupil of Mauj Darya (1621); and the Gola sarái (1622), which retains some fine specimens of the same kind of ornamentation.

Shah Jahan's reign was, at Lahore as elsewhere, the greatest and most vigorous period of Mughal architecture. Lahore as well as Delhi testifies, though in a minor degree, to the power and taste which seem to have inspired others besides the emperor to raise the many monuments that still remain of the grandeur of his time. The first place is due to the splendid tomb of Jahángir, erected by his widow Nur Jahán, at Shahdara, on the bank of the Rávi opposite Lahore (1630), near which was afterwards built (1632) the tomb of her brother Asaf Khan, Jahángir's commander-in-chief, and then (1650) that of the widowed queen herself. Before these, in order of time, were the gate and ascent called *háthi páon* to the fort (1629), and then, in 1630 and following years, the series of fine palace buildings within the fort, which have since been altered and added to by the emperor's Mughal successors and by Ranjít Singh.

Two of Shah Jahán's principal officers of state were his chief supporters and followers in the construction of the great works of his time at Lahore. One of these was Ali Mardan Khan, a Persian, formerly governor of Kandahar, then successively governor of Kashmir and of the Punjáb, who was also an eminent engineer and architect. The other was the court physician and afterwards prime minister, Hakím Alam-ud-dín, better known as the Nawáb Wazír Khan. Ali Mardan Khan built, under Shah Jahán's orders, the finest of the great saráis for travellers on the imperial road from Delhi to Lahore and Lahore to Kashmir. He proposed and carried out (1639) the canal from the Rávi at the foot of the hills, which was called the Lahore canal. Other canals of the same kind he executed elsewhere. His chief work at Lahore is the tomb of his mother (1627), where he himself also was buried (1657), and which is known as the tomb of Ali Mardan Khan. Wazír Khan's chief works at Lahore are his own *baradari* or summer house (1631), the sarái and *hammám* (baths) in the street now called Hira Mandi (1635), the *Rang Mahal* or painted palace (1635), and the *Pari Mahal* or fairy palace (1638). Prince Dára Shiko, the emperor's son, who made Lahore his place of residence, built (1640) the tomb of Mián Mír, his religious teacher. Of the other works at Lahore of Shah Jahán's time the principal are the tombs of Nawáb Jáfar Khan (1631), of Shah Biláwal (1636), of Abu'l Hassan Khan (1641), of Shah Jamál (1651) and of the emperor's son, Prince Parvíz (1651),—also the tombs of two notable literary men, Muhammad Sálah, author of *Bahár Dánish*, and Sheikh Ináyat-Ullah, author of the historical work called *Shahjahán-námah*. The mosque in the city called Wazír Khan's was built (1641) by the emperor in honor of his faithful servant whose name it bears. It is faced with beautiful *káshi* work of various colors, a kind of ornamentation largely used in the buildings of this time at Lahore. Decorated in the same manner is the gateway of the *Gulábi Bagh* made by Sultan Beg, the emperor's son-in-law. The Shalamar garden, restored and largely extended by Shah Jahán (1640), is one of the finest works at Lahore of his time. During Shah Jahán's reign Lahore was visited (1626) by two English travellers, Mr. Crowther and Mr. Still; in 1638 by Mandelslo, a member of the Holstein embassy to Persia; and three years later by Manriquez, a Spaniard.

Aurangzíb (1658–1707), though he lived little at Lahore, contributed to it one of the largest and most important of the existing buildings, the *Bádsháhi Masjid*, or imperial mosque, built 1673–80. Two buildings at Lahore are connected with the name of Aurangzíb's daughter, Zíb-un-nissa, authoress of a book of poems called the *Díwán-i-*

Makhfi. One is the gateway of her garden (1665) called *Chau-burji* (four towered) and now *Si-burji* (three towered), one of the corner minarets having been cut away by the water of a neighboring nullah. The other is her tomb, built 1670. The tombs of Shah Chirágh (1658), of Sultana Begam, daughter of Shah Jahán, wife of Sultan Beg (1660), and of Abd'ur Rizák Makki (1673), which is known as the *Nila gumbaz*, or blue dome,—are the best of the other remains at Lahore of the work of Aurangzíb's reign.

From the reign of Aurangzíb's successor, Bahadur Shah (Shah Alam I.), Lahore has little to show except two small buildings of 1710, one Hindu and one Mohammedan—the Chaubara, or hall, of Chajjú Bhagat, and the tomb of Pír Ain-ul-Kamál. One of the city gates bears the name of Shah Alam. In the reign of Mohammed Shah, the third from Shah Alam (1719–48), Lahore came in the path of another of the ruthless invaders from the west, Nádir Kuli Khan, better known as Nadir Shah (1737), who rapidly swept over the plains of the Punjáb to the chief city. He was met but not actively resisted by the governor of Lahore, and Nadir's army encamped for a time at Shálamár. Again, in the repeated invasions of Ahmad Shah Abdáli (1748–1767), in the reigns of his namesake Ahmad Shah and of Alamgir II., Lahore had to take its part, with varied fortunes, but with no important permanent result. To the reign of Ahmad Shah (1748–54) belongs one little building which makes some show in the city, the Masjid *Tilái*, or golden (now commonly called *Sunahri* which has the same meaning), having its domes covered with gilt plates of copper (1750). This is the latest work of the kind at Lahore before the Mohammedan power in the Punjáb was subverted by the Sikhs, who obtained temporary possession of the city eight years later, and, with rapidly growing influence as well as numbers, soon became a formidable enemy of the nominal rulers, till, finally, they became masters of Lahore, under Ranjít Singh. Lahore was conferred upon Ranjít in the end of last century by the last of the invaders of India from the west, Zamán Shah, when the last of the reigning Mughals, Shah Alam II., had lost all real hold of this northern part of his empire. The long, vigorous, and expansive rule of Ranjít Singh brings Lahore within the general history of the Sikhs and of the Punjáb, and connects the Punjáb directly with the history of British India.

Except the additions which Ranjít Singh made to the defences of the city little work of usefulness or adornment was done in his days at Lahore which did not owe something very directly to works of earlier times. Ranjít built a large summer house, which he called *Tar-ghar*, on the remains of prince Kámrán's *Dil-kusha*, or country palace, on the bank of the Rávi opposite Lahore. The fine marble *báradari* which he set up in the middle of the Huzúri Bagh was taken from Jahángir's tomb at Shahdara.

Lahore in the time of Ranjít Singh has been the subject of many descriptions and narratives from many pens. Very interesting are the accounts in Victor Jacquemont's[1] *Letters* and Sir Henry Lawrence's *Adventurer in the Punjáb*. The pictures of Ranjít's court at Lahore introduce also the figures of men whose names became very familiar to English ears in the later days of Ranjít's reign: the Hindu brothers Dhyán Singh and Ghuláb Singh, the men of action and intrigue; the Mussulman brothers Azíz-ud-dín and Nur-ud-dín (of the *Fakir* family as it is called), the men of business; the sagacious counsellor Dína Nath; the French military officers Allard, Ventura, Court; and others. But the great figure always in these Lahore pictures is the small, one-eyed maharaja himself. Uneducated, but full of knowledge, which was power,—of a feeble frame worse enfeebled by himself, but of astonishing energy and indomitable will,—he made the whole Punjáb his own, and created for his own use an army the most powerful and best organized that Britain has ever encountered in India. Ranjít Singh died in 1839, leaving to his successors this dangerous legacy, consisting of sixty regiments of regular infantry and a larger force of irregulars, numbering in all 92,000; cavalry, 31,800; artillery, 171 garrison guns and 384 field pieces,

Immediately after the close of his life began the wild anarchy and bloodshed of which Lahore was the constant scene for years following. Within four months Ranjít's son and successor Kharak Singh was removed by death, in what way is not clearly known. The reign of Nan Nihál Singh, who came after him, lasted a few days only. A longer time of power was enjoyed by Shír Singh, who at length was murdered in 1843. After a time of worse confusion, constant fighting, and more murders, Dhalíp Singh, a young son of Ranjít, became maharaja,—the government, such as it was, being in the hands of his mother, and of the vizier Lál Singh. Seven years after Ranjít Singh's death a great part of his great army, which had come to feel its strength and make it felt, when no longer held in the iron grasp of its only master, crossed the Sutlej into British territory, and took thus the first step towards its own destruction. The result, after four great conflicts, one of them a conflict of unexampled peril to the British power in India, was the first occupation of Lahore by English troops in March, 1846. Of Lahore in British hands an account has been given above.

The tomb of Ranjít Singh, a building of no great architectural merit, which stands just outside the Roshnai gate, was in progress when the city was taken possession of in 1846, and was completed after the annexation of the Punjáb in 1849.

See *Á'in-i-Akbari*; Elliot, *Historians of India*; *Calcutta Review*, vols. i., ii., vi., viii., ix., xxvi., etc.; *Lahore*, by T. H. Thornton and J. L. Kipling; Bernier's *Travels*; D. J. Martin Honigberger, *Thirty-five Years in the East*; Thevenot's *Travels*; Joannes de Laet, *De Imperio Magni Mogolis*; Manouchi, *General History of the Mogul Empire*; Victor Jacquemont, *Journey in India*: *Adventurer in the Punjáb* (republished as *Adventures of Bellasis*); Annual Administration Reports of the Punjáb, etc. (R. M'L.*)

LAHR, chief town of an official district in the circle of Offenburg, Baden, is situated on the Schutter, about 9 miles south of Offenburg. As one of the busiest towns in Baden, it carries on manufactures of tobacco and cigars, woollen goods, chicory, leather, pasteboard, hats, and numerous other articles, and has besides considerable trade. The population in 1875 was 8491.

LAIBACH, or **LAYBACH** (Slovenian *Ljubljana*), capital of the duchy of Carniola, Austria, is situated on the Laibach near its influx into the Save, and on the Crown Prince Rudolph and Austrian Southern Railways, 45 miles northeast of Trieste, in 46° 3′ N. lat., 14° 31′ E. long. It consists of the town proper and eight suburbs, and possesses a cathedral in the Italian style, ten churches, the palaces of the prince and count of Auersperg, an ancient castle on the Schlossberg now used as a military depot and prison, besides the usual public buildings and educational establishments of a provincial capital and episcopal see. There are manufactories of earthenware, linen and woollen cloth, silk, fire-hose, and cigars; oil, paper, and chicory mills; a sugar refinery, and a bell-foundry. On the 31st December, 1880, the civil population was 24,618 (11,185 males, 13,433 females); together with the military it was 26,284. The native tongue is Slovenian, but the educated classes speak German or Italian.

Laibach occupies the site of the ancient Emona or Æmona. In 388 A.D. Emona was visited by the emperor Theodosius; in 400 it was besieged by Alaric; and in 451 it was desolated by the Huns. In 900 Laibach suffered much from the Magyars, who were, however, defeated there in 914. In the 12th century the town passed into the hands of the dukes of Carinthia; in 1270 it was taken by Ottocar of Bohemia; and in 1277 it came under the sway of the Hapsburgs. In the early part of the 15th century the town was several times besieged by the Turks. The bishopric was founded in 1461. On the 17th March, 1797, and again 3d June, 1809, Laibach was taken by the French, and from 1809 to 1813 it became the seat of their general government of the Illyrian provinces. From 1816 to 1849 Laibach was the capital of the kingdom of Illyria. For the congress of Laibach (January to May, 1821) see vol. xiii. p. 496.

LAING, ALEXANDER GORDON (1793–1826), an African explorer, was born at Edinburgh, 27th December, 1793. At first it seemed that he would follow his father's profession, that of a teacher of the classics; but, his fancy being fired with the military ardor of the time, he set out for Barbados, where his maternal uncle Colonel Gordon was then stationed. Here he met with Sir George Beckwith, who procured him a commission in the York light infantry. His career as a traveller began in 1822, when he was sent on a mission to the country of the Sulimas and advanced as far as the sources of the Rokelle. By ascertaining that the source of the Quorra or Niger was not more than 1600 feet above the sea, he dispelled the idea that it was connected with the Nile. The further elucidation of the other questions that were then connected with this great river formed the principal object of his next journey, undertaken in 1825 under the auspices of

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[1] [A French traveller and botanist (1801-1830), who penetrated Tibet and died at Bombay.—AM. ED.]

Lord Bathurst. From a letter sent May 10, 1826, from Blad Sidi Mohammed to Consul Warrington at Tripoli we know that he had barely escaped with his life from an attack in which he had received twenty-four wounds. He managed to reach Timbuctoo by August 18th, but shortly afterwards fell a victim to the treachery of his servant. The history of the vain attempt to recover the traveller's journals will be found in the *Quarterly Review*, vol. xlii. (1830). The narrative of his first journey was published in 1825.

LAING, DAVID (1793–1878), a distinguished Scottish antiquary, especially eminent for his bibliographical knowledge, was the son of William Laing, a bookseller in Edinburgh, and was born in that city in 1793. He was brought up to his father's business, and continued for many years in partnership with him. Shortly after the death of the latter, however, a vacancy having occurred in the librarianship of the Signet Library, Laing was elected to that office in 1837, and continued to hold it till the time of his death. In addition to, it is believed, an almost unexampled knowledge of the titles and value of books, Laing possessed an intimate acquaintance with the early literary history of Scotland. His knowledge of Scottish art was also very extensive; and the ecclesiastical history of his native country, particularly during the 16th and 17th centuries, had long been the subject of his profound investigation. It is perhaps to be regretted that with all this knowledge he never produced any large independent work, but confined himself to the editing of the works of others. Of these, the chief are—*Dunbar's Works*, 2 vols., 1834, with a supplement added in 1865; *Robert Baillie's Letters and Journals*, 3 vols. 1841–42; *John Knox's Works*, 6 vols., 1846–64; *Poems and Fables of Robert Henryson*, 1865; *Andrew of Wyntoun's Orygynale Cronykil of Scotland*; 3 vols., 1872–79; *Sir David Lyndsay's Poetical Works*, 3 vols., 1879. Laing was for more than fifty years an active member of the Society of Antiquaries of Scotland, and during that period he contributed upwards of a hundred separate papers to their *Proceedings*. He was also for more than forty years secretary to the Bannatyne Club, many of the publications of which were carefully edited by him, and few of them we believe failed to benefit by his assistance. A complete list of his productions would occupy many pages. His literary activity ended only with his life. He was struck with paralysis when attending to his duties in the Signet Library, and it is touchingly recorded of him that, on awakening out of the fit, he looked about him and asked if a proof of Wyntoun had been sent up from the printers. He died a few days afterwards on October 18, 1878, at the age of eighty-six years. Perhaps few men that ever lived possessed so much recondite knowledge on subjects connected with Scottish history and literature, and no one could be more ready to communicate whatever he knew to those who were engaged in investigations similar to his own. In 1864 the university of Edinburgh conferred on him the degree of LL.D. In the course of his long life Laing had collected an immense library, a large portion of the books being illustrative of the literature or history of Scotland, and many of them being of extraordinary rarity. It was dispersed by auction in London soon after his death, and the enormous prices obtained for many of the books were such as had hardly ever been known even in the most celebrated of previous book sales. A valuable collection of MSS., chiefly relating to Scotland, was bequeathed by him to the library of Edinburgh university.

LAING, MALCOLM (1762–1818), a Scottish historian, was born at his paternal estate on the Mainland of Orkney in 1762. Having studied at the grammar school of Kirkwall and the university of Edinburgh, he was called to the bar in 1785, but never obtained an extensive practice as advocate. In 1793 he completed the last volume of Henry's *History of Great Britain*, the portion which he wrote being, in its strongly liberal tone, at signal variance with the preceding tenor of the work. In 1800 he published a *History of Scotland from the Accession of James VI. to the Reign of Queen Anne*, a work of considerable research. In a dissertation prefixed to an edition of his *History* published in 1804, he endeavored to prove the participation of Queen Mary in the murder of Darnley. In the same year he published an edition of the *Historie and Life of King James the Sext*. His only other publication is an edition of the *Poems of Ossian*. For a short period in 1807 Laing represented his native county in parliament. He died in November, 1818.

LAI-YANG, a city in the Chinese province of Shan-tung, situated in 37° N. lat. and 120° 55′ E. long., about the middle of the eastern peninsula, on the highway running south from Che-foo to Kin-Kea or Teng-tsi harbor. It is surrounded by well-kept walls of great antiquity, and its main streets are spanned by large pailows or monumental arches, some of which date from the time of the emperor Tai-ting-te of the Yuen dynasty (1324). There are extensive suburbs both in the north and south, and the total population is estimated at 50,000. The so-called Ailanthus silk produced by *Saturnia cynthia* is woven at Lai-yang into a strong fabric; and the manufacture of the peculiar kind of wax obtained from the la-shoo or wax-tree insect is largely carried on in the vicinity.

LAKE. When a stream in its course meets with a depression in the land it flows into it and tends to fill it up to the lip of its lowest exit. Whether it succeeds in doing this or not depends on the climate. In the British Islands, and in most temperate and equatorial regions, the stream would fill the depression and run over, and the surplus water would flow on towards the sea. Such a depression, with its contents of practically stagnant water, constitutes a lake, and its water would be fresh. In warm dry regions, however, such as are frequently met with in tropical latitudes, it might easily happen that the evaporation from the surface of the depression, supposed filled with water, might be greater than the supply from the feeding stream and from rain falling on its surface. The level of the waters in the depression would then stand at such a height that the evaporation from its surface would exactly balance the supply from streams and rain. We should have as the result a lake whose waters would be salt. Lakes of the first kind may be considered as enlargements of rivers, those of the second kind as isolated portions of the ocean; indeed salt lakes are very frequently called seas, as the Caspian Sea and the Dead Sea. The occurrence of freshwater lakes and salt lakes in the same drainage system is not uncommon. In this case the salt lake forms the termination. Well-known examples of this are Lake Titicaca and the Desguadero in South America, and Lake Tiberias and the Dead Sea on the Jordan.

Distribution of Lakes.—Although there are few countries where lakes are entirely absent, still it requires little study to see that they are much more thickly grouped in some places than in others. Of the larger lakes, for instance, we have the remarkable group in North America, which together form the greatest extent of fresh water in the world. A similar group of immense lakes is found in Central Africa:—Lakes Victoria Nyanza and Albert Nyanza, whose overflow waters go to form the Nile; Lake Tanganyika, at the source of the Congo; and Lake Nyassa, on a tributary to the Zambesi. In Asia the largest freshwater lake is Lake Baikal, on the upper waters of the Lena. All these freshwater lakes of great size are at the sources of large and important rivers; the salt lakes in which Asia also abounds are at the mouths of large rivers, as the Caspian at the mouth of the Volga, and Aral Sea at the mouth of the Oxus.

Passing from the consideration of these larger lakes, which from their size may be considered inland oceans, and which therefore necessarily occur in small number, we find large numbers of lakes of comparatively small dimensions, and when we consider them attentively we find that they are reducible to a small number of species, and, as in the case of plants and animals, the distribution of these species is regulated chiefly by climate, but also by geological conditions. Perhaps the most important and remarkable species of lakes is that to which the Scottish lakes belong. They are generally characterized by occupying long narrow depressions in the valleys of a mountainous country in the neighborhood of the sea, and in a temperate climate. On the sea-coast, lakes of this character are found in Norway, Scotland, Newfoundland, Canada, the southern extremity of South America, and the south end of the middle island of New Zealand; somewhat removed from the sea we have the Alpine lakes of Switzerland and Tyrol, and the great Italian lakes, all of which display the same features as those of Scotland or of Norway. In many flat countries lakes are extraordinarily abundant, as for instance in the north part of Russia and Finland, in the southern part of Sweden, in the northern parts of Canada, and on a small scale in the Hebrides.

Lagoons, found on all low sandy coasts, owe their origin to the shifting of the sand under the influence of the wind and tide. They are found at the mouths of large rivers, as on the Baltic and at the mouth of the Garonne.

In volcanic regions lakes are not uncommon, generally of a more or less circular form, and either occupying the site of extinct craters or due to subsidences consequent on volcanic eruptions; such are the Maare of the Eifel in Germany, and many lakes in Italy and in the Azores.

Lakes are not only widely distributed in latitude and longitude, they also occur at all elevations. Indeed, as a certain elevation above the sea produces an effect as regards climate equivalent to a certain increase of latitude, we find lakes existing in the centre of continents, and on high plateaus and mountain ranges, in latitudes where they would be speedily dried up if at the level of the sea. Many of the lakes in Scotland (as Lochs Lomond, Morar, Coruisk), of Norway, of British Columbia, and of Southern Chili are raised only by a few feet above the level of the sea, and are separated from it often by only a few hundred yards of land, while in the Cordilleras of South America we have Lake Titicaca 12,500 feet, and in Asia Lake Kokonor 10,500 feet above the sea. Many lakes whose surface is raised high above the level of the sea are so deep that their bottom reaches considerably below that level.

Dimensions of Lakes.—The principal measurements connected with a number of lakes in different parts of the world, presented in the following table, will give a more precise idea of the size of the lakes than could be given by description alone:

Name of Lake.	Mean Latitude.	Length.	Breadth (Max.).	Depth (Max.).	Height in Feet above the Sea of		Temperature of Water at Bottom.
					Surface.	Bottom.	
		Miles.	Miles.	Feet.			° F.
Superior	47° 45′ N.	350	100	978	627	−351	38.8
Michigan	44° N.	320	80	840	594	−246	...
St. Clair	42° 30′ N.	18	22	20	570	+550	...
Erie	42° N.	220	48	204	564	+360	...
Titicaca	16° 30′ S.	90	30	924	12,500	+11,576	54.6
Kokonor	37° N.	91	42	...	10,500	...	...
Baikal	53° N.	330	40	4,080	1,360	−2,720	...
Balkash	46° N.	280	25	238	72	+166	...
Caspian	42° N.	600	50	3,600	−85	−3,685	44.6
Dead Sea	31° 30′ N.	45	10	1,308	−1,272	−2,580	...
Tanganyika	6° S.	330	40	1,000	2,700	...	...
Como	46° N.	48	2.5	1,356	670	−686	...
Geneva	46° 25′ N.	45	8.7	1,092	1,218	+126	41.7 to 43.5
Constance	47° 40′ N.	35	8	394	1,300	+906	39.6
Lomond	56° to 57° 30′ N.	20	4	630	25	−605	41.4 to 42
Morar		11	1.5	1,020	30	−990	40.8 to 41.4
Ness		23	1.3	774	50	−724	41.2 to 42.4
Lochy		10	1	480	93	−387	42 to 44
Katrine		7	0.8	480	364	−116	41.4
Tay		14.5	1	450	390	−60	43.9
Rannoch		9.4	1	378	668	+290	43.9
Ericht		14.5	0.8	330	1,153	+823	44.7
Tummel		2.5	0.5	120	450	+330	45.5
Garry		2.5	0.3	102	1,330	+1,228	53.9

From this table it will be seen that by far the largest continuous sheet of fresh water is the group of North American lakes, and of these Lake Superior is more than double the size of any of the others; this is principally due to its great breadth, as it is very little longer than Lake Michigan. Lake Superior communicates with Lakes Michigan and Huron, which are really branches of one and the same lake, by the St. Mary's river, the fall being 49 feet from Superior to Huron. Huron empties itself into Erie by the St. Clair river, Lake St. Clair, and finally the Detroit river. Lake Erie overflows by the Niagara river and falls into Lake Ontario, whence the water finally is conveyed to the sea by the St. Lawrence. The area of the lakes together is in round numbers 100,000 square miles, and, if that of the St. Lawrence and its estuary be added, the water area will be about 150,000 square miles, while the whole drainage area is only 537,000 square miles. Hence of the water conveyed by the St. Lawrence to the sea, rather more than one-fourth falls on the surface of the water itself. Looking to their great extent, we should have suspected them to be much deeper than is found to be the case. The deepest, Lake Superior,[1] is no deeper than Loch Morar in Inverness-shire. Comparatively shallow, however, as they are, the bottoms of them all, with the exception of Erie, are several hundred feet below the level of the sea. It has been supposed that in former times this chain of lakes formed an arm of the sea similar to the Baltic in Europe, and in support of this view we have the fact of the discovery of marine forms in Lake Michigan.

In Asia Lake Baikal is in every way comparable to the great Canadian lakes as regards size. Its area of over 9000 square miles makes it about equal to Erie in superficial extent, while its enormous depth of over 4000 feet makes the volume of its waters almost equal to that of Lake Superior. Although its surface is 1360 feet above the sea-level, its bottom is 2720 feet below it. A former connection with the ocean has been claimed for this lake, owing to the fact that seals inhabit its waters. Other large lakes in Asia are mostly salt, and some lie wholly below the level of the sea. Thus the Caspian lies 85 feet below the Black Sea, and the bottom at its greatest depth is 3600 feet deeper. The Dead Sea is over 1300 feet deep, and its surface is 1272 feet below the Mediterranean, so that its bottom is 2580 feet below the level of the sea. In the Caspian seals are found. A former connection with the Red Sea has been claimed for the Dead Sea, but this is disallowed by Peschel and others. The Jordan valley, with the Sea of Tiberias and the Dead Sea, lie on the line of an extensive fault, and it is claimed that this depression in the surface occurred with the production of the fault. Further evidence in support of the statement that the Dead Sea was never connected with the sea is of a negative character, and consists chiefly in the fact that marine forms have not been found in the waters of the Jordan or of Lake Tiberias, and that silver is absent from the waters of the Dead Sea.

A former connection with the ocean is claimed for a number of the Swiss and Italian lakes by Dr. Forel and Professor Pavesi, and the Norwegian lakes by Loven and Sars, on the ground of the occurrence of marine forms of the crustaceans and other classes. For a summarized account of these researches see Pavesi, *Arch. de Genève*, 1880, iii. 1.

Temperature of Lakes.—The earliest reliable temperature observations in lakes or seas are those of Saussure, and they are to be found in his charming *Voyage dans les Alpes*. He was the first to obtain thoroughly trustworthy observations in the deeper waters of the lakes. He used for this purpose an ordinary thermometer whose bulb was covered over with several thicknesses of cloth and wax, so as to render it very slowly conducting. He was in the habit of leaving it down fourteen hours, and then bringing it up as quickly as possible and immediately reading the temperature. He did not, however, trust to his thermometer not changing its reading while being brought up, but by an elaborate series of experiments he obtained corrections, to be applied when the thermometer had to be drawn through more or less water of higher temperature. His observations are collected in the following table along with those of Jardine in some of the Scottish lakes, at the beginning of the century:

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[1] [Lakes Michigan and Huron are claimed to be deeper. See Vol. XXI. pp. 186–7.—Am. Ed.]

Name of Lake.	Date.	Temperature of		Depth.	Height above Sea.
		Surface.	Bottom.		
		° F.	° F.	Feet.	Feet.
Geneva........	February.	42.1	41.6	1013	1230
Neuchâtel...	17th July.	73.7	41.4	346	1304
Bourget.......	October, 1784.	64.0	42.1	256	......
Annecy	14th May, 1780.	57.9	42.1	174	1426
Joux	......	55.6	51.3	85	350
Bienne........	......	69.3	44.4	231	1419
Constance ...	25th July, 1784.	64.6	39.6	394	1250
Lucerne	23th July.	68.4	40.3	640	1380
Thun...........	7th July, 1783.	66.2	41.0	378	1896
Briens.........	8th July, 1783.	68.0	40.5	533	......
Maggiore.....	19th July, 1783.	78.1	44.1	357	......
Lomond.......	8th Sept., 1812.	59.5	41.5	600	25
Katrine.....	7th Sept., 1812.	57.3	41.0	480	364
	3d Sept., 1814.	56.4	41.3	.....	......

An exceedingly important and valuable series of observations was made by Fischer and Brunner[1] in the Lake of Thun throughout the course of a whole year (March, 1848, to February, 1849). They used, after Saussure's method, thermometers protected by non-conducting envelopes, which were pulled up as quickly as possible. The depth of the water where they observed was 540 feet, and they made a series of observations of the temperature at that depth, at the surface, and at eleven intermediate depths, and repeated the series of observations at eight different dates over the year. From these series, which afford the first information of the yearly march of temperature at different depths, we learn that the lake as a whole gains heat till the end of September, then loses it until the month of February, when it begins to warm again, though slowly. The maximum temperature occurs in October at depths from the surface to 70 feet, in November at depths from 70 to 120 feet, in December from 120 to 200 feet, and in February at 500 feet. As the whole yearly variation of the temperature at 200 feet is less than a degree, the epoch at which the greater depths attain their maximum and minimum temperatures cannot be certainly deduced from one year's observations. The minimum temperature of depths from the surface to 80 feet is attained in the month of February, at greater depths in the month of March. During the course of the whole year the temperature at the bottom varied between 40.7° and 40.9° Fahr., and in the month of February the whole of the water from the surface to the bottom was between 40.7° and 41° Fahr.

These and other observations showed that from depths of 400 feet the variation of temperature with increasing depth is quite insignificant, so that even though the lake might be 1000 feet deep the temperature at 400 feet is only one or two-tenths of a degree different from that of the bottom; further, on many of the thermometers recently used, it is impossible to distinguish with certainty temperatures differing by less than half a degree, consequently it was not difficult to believe that in all deep lakes there is a considerable stratum of water which remains constantly at the same temperature, all the year and every year, and that in winter this stratum thickens so as often to fill the lake, and gets thinner again in summer. By the improvement of the instruments both of these suppositions have been shown to be erroneous. In summer and in temperate latitudes, however deep the lake may be, its temperature falls as the depth increases, first rapidly and then very slowly, and the bottom temperature observed in any summer depends on the nature of the winter which preceded it, and may vary from year to year by one to two degrees. It was also believed that the deep water of a lake preserved constantly the mean winter temperature or the mean temperature of the six coldest months of the year in the locality. This was deduced from some observations by Sir Robert Christison in Loch Lomond, who found the bottom temperature at Tarbet to be 41.4° Fahr., agreeing with the mean of the six winter months as observed at Balloch Castle, which, however, is about 15 miles distant. Although the theorem may be accidentally true for Loch Lomond, it has been proved not to hold for other lakes. Thus Simony (*Wien. Sitz. Ber.*, 1875, lxxi. p. 435) gives the following table, comparing the temperature of the bottom water in the Gmünder See with the winter (October to March) air temperature:[3]

	Winter Period. Mean Temperature.			Summer Period. Mean Tem.	Bottom Tem. Gmünder See.	Date of Observation of Bottom Temperature.
	Oct.-Mar.	Dec.-Feb.				
	° F.	° F.		° F.	° F.	
1867-68	37.5	32.9	1868	64.4	40.5	6th Oct., 1868.
1868-69	40.1	36.8	1869	63.1	40.5	1st Oct., 1869.
1869-70	35.0	29.3	1870	60.8	40.2	26th Sept., 1870.
1871-72	35.2	27.3	1872	62.2	40.0	3d Oct., 1872.
1872-73	41.0	36.0	1873	60.2	40.5	5th Oct., 1873.
1873-74	39.0	32.7	1874	61.9	40.4	25th Sept., 1874.
1874-75	33.8	28.2	...	...	39.1	10th April, 1875.

It will be seen that, with the exception of the end of 1872, the mean winter temperature is below that of the bottom water, and generally very markedly so.

During 1877-81 observations have been made by the present writer on the distribution of temperature in lakes forming part of the Caledonian Canal. The monthly mean temperatures at Culloden and at Corran Ferry lighthouse, which cannot differ much in climate from Loch Ness and Loch Lochy respectively, have been supplied by Mr. Buchan of the Scottish Meteorological Society. The bottom temperatures are thus observed in the deepest part of the lakes, namely, 120 fathoms in Loch Ness, and 80 fathoms in Loch Lochy. The connection between bottom temperature (as observed in the second week of August) and winter temperature can be judged of from the following table, where the mean temperatures of October to March, and also of November to April, are given:

	Loch Ness.		Culloden.		Loch Lochy		Corran.	
	Surface.	Bottom.	Oct. to March.	Nov. to April.	Surface.	Bottom.	Oct. to March.	Nov. to April.
	°	°	°	°	°	°	°	°
1877	58.0	42.4	40.2	40.0	55.0	44.0	42.3	40.3
1878	59.0	42.3	41.6	40.9	61.0	43.7	42.7	42.5
1879	51.4	41.2	37.2	35.8	54.0	42.0	38.9	37.5
1880	57.0	42.4	41.0	40.3	57.6	43.3	42.0	41.9
1881	53.1	41.45	36.1	36.2	54.0	42.25	38.6	38.7

From this table it is apparent that the bottom temperature, even of lakes as deep as Loch Ness, is subject to considerable variation from year to year, that it depends on the temperature of the previous winter, and that it is usually higher than that temperature. The difference between the bottom temperature and the mean winter temperature is greater the lower the winter temperature is. It is further interesting to notice that the mean winter temperature of 1878-79 was about one degree higher than that of 1880-81, yet the bottom temperatures were 0.25° lower in 1879 than in 188., and this is no doubt due to the fact that the cold of 1878-79 was more continuous than that of 1880-81, when the actual temperatures observed were much lower. The temperature of the bottom water depends not only on the temperature of the previous winter, and on the depth of the lake; it also depends on the nature of the country where it lies, and especially on its exposure to winds. Winds drive the surface water before them, and if there were no return current it would be heaped up at the further end. The effect is to accumulate surface water at one end, and to draw on deeper water to make up the deficiency at the other end. Hence the prevailing direction of the wind impresses itself on the distribution of temperature in the water; and this is well shown in the distribution of temperature as determined from observations at five stations on the same day in Loch Ness in a summer after a warm winter, and in one after a cold winter. In Scotland, warm weather is associated with southerly and westerly winds, and cold weather with northerly and easterly winds. In the warm years we have accumulation of surface water at the northeastern end, and of bottom water at the southwestern end, producing in summer a higher mean temperature of water at the northeast, and a lower mean temperature of water at the southwest end. In cold years the reverse is observed. Thus in 1879, after a cold winter, the mean temperature of the first 300 feet of water at the southwest end of Loch Ness was 48.8°, and at the northeast end 44.96°, a difference of nearly four degrees. In 1880, after a comparatively mild winter, it was 48.13° at the southwest end, and 47.95° at the northeast end, or nearly identical temperatures. Even at stations a few hundred yards from each other, great differences are often observed in the temperatures observed at the same depth, and it is evident that the difference of density so produced must cause a certain amount of circulation. There can be but little doubt that, under the influence of the varying temperature of the seasons, and of the winds, the water of a lake is thoroughly mixed once a year. In lakes which do not consist of a single long trough like Loch Ness, but of several basins as Loch Lomond, the bottom temperature is different in the different basins, even when the depth is the same. Loch Lomond consists of three principal basins of very unequal depth:—the large expanse of water studded with islands at the lower end, the Balloch basin; the middle or Luss basin; and the upper and deepest or Tarbet basin. In the last we have 600 feet of water, in the Luss basin 200 feet, and in the Balloch basin a maximum of 72 feet of water. On the 23d September, 1876, the bottom temperature in the Tarbet basin was 41.4°, and in the Luss basin 46.4°. Loch Tummel, a much smaller lake, consists of three basins, each of them being from 100 to 120 feet deep, and in them we have bottom temperatures of 46.3°, 46.9°, and 45.2°, the lowest temperature being nearest the outlet.

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[1] *Mém. Soc. Phys. Genève*, xii. p. 255.

[3] These air temperatures are those of the observatory at Vienna, corrected for difference of level.

It might have been expected that the bottom temperature in lakes similar as regards size and depth would be lower at greater elevations and higher nearer the sea-level. This does not, however, hold universally; thus Lochs Tummel and Garry are very similar in size and depth; they are only 12 miles from each other, but Loch Tummel is 450 feet and Loch Garry 1330 feet above the sea; yet at 102 feet in Loch Garry the temperature on the 18th August, 1876, was 53.9°, and in Loch Tummel at the same depth on the 16th August, 1876, it was 45.4°. The difference of elevation is nearly 900 feet, and, instead of the higher lake holding the colder water, its water is 8.5° warmer than that of the lower one. Similarly in Loch Ericht, 1153 feet above the sea, the bottom temperature at 324 feet was 44.7°, and in Loch Rannoch, 668 feet above the sea, at the same depth it was 44.0°. These examples will suffice to show that many circumstances concur in determining the temperatures of the waters of lakes. There is one factor which is often neglected, namely, the amount of change of water. This depends on the drainage area of its tributary streams, and necessarily varies greatly.

In comparing the bottom temperature in lakes with the mean temperature of the coldest half of the year, we find that the two approach each other more nearly the higher these temperatures are. When the temperature of the air falls for a lengthened period below the temperature of maximum density of water (39.2° Fahr.), then the mechanical effect produced is much the same as if the temperature had been raised. For, in virtue of the cooling above, the water will have no tendency to sink; it will rather tend to float as a cold layer on the surface of the warmer and denser water below. Were a lake comparable with a glass of water, that is, were its depth equal to or greater than its length or breadth, it would be possible to realize this ideal condition of things, which, until recently, was supposed to represent what really takes place when a lake is covered with ice, namely, that after the water has all been cooled to a uniform temperature of 39.2° Fahr. further cooling affects only a small surface layer, which consequently rapidly freezes. If this were the case, we should expect to find the temperature of the water below the ice of a frozen lake increasing rapidly from 32° where it is in contact with the ice to 39.2° at a short distance from it, and we should expect to find the remainder of the water down to the bottom at the same temperature. In fact, however, the depth of even the deepest lakes bears an insignificant proportion to their superficial dimensions, and temperature observations in summer show that the effective climate, that is, the climate in so far as it is effective for the purpose under consideration, varies much over the surface of even very small lakes. The variations in distribution of temperature produce variations in density which of themselves are sufficient to produce convection currents. Then, as a factor of climate, there are the winds, which are the main mixing agents, and also the movement in the waters caused by the inflow of water at different points and the removal of the excess at one point. The effect of these mechanical agents, winds and currents, is to propagate the air temperature at the surface to a greater depth than would otherwise be the case. At the same time it must be remembered that in seasons of great cold there is rarely much wind. If we reflect, however, on what must take place when there is a large expanse of open water in the middle of a country covered with snow, and exposed to the rigors of a winter night, we see that the air in contact with the surface of the water must get warmed and form an ascending current, its place being taken by fresh air drafted from the cold land surface, which not only cools the water but forces it out towards the middle, thus establishing a circulation consisting in broad lines of a surface movement from the sides to the middle of the lake, and a movement in the opposite direction below the surface. Even if the current of air were not sufficient of itself to produce a surface current in the water, it would do it indirectly. For, as it first strikes the water at the edges, the water there would get cooled most rapidly, and under suitable circumstances would form a fringe of ice; the water so cooled would be lighter than the warmer water farther out, and would have a tendency to flow off towards the middle, or with the current of air. Now, although, when compared with other seasons, there is in a hard frosty winter not much wind, still, even in the calmest weather there is almost always sufficient motion in the atmosphere to enable the meteorologist to state that the wind is from a particular quarter; this will assist the circulation which has just been described as taking place in a calm lake, though it will somewhat distort its effects. It will produce excessive cooling at the side nearest the wind, and when the lake freezes, it will have a tendency to begin at the windward side.

The extent to which this circulation affects the deeper waters of a lake depends on local circumstances, and generally we may say that the more confined a lake is the more easily will it freeze, and the higher will be the mean temperature of its waters. In the very cold winter 1878–79 the writer was able to make observations on the temperature of the water under the ice in Linlithgow Loch and in Loch Lomond. In the following winter, which, though mild in Scotland, was excessively severe in Switzerland, Dr. Forel made observations in the Lakes of Morat and Zürich, confirming the writer's observations of the unexpectedly low temperature of the water. The freezing of so deep a lake as that of Zürich was a fortunate circumstance, because in it the bottom is actually at the temperature of maximum density. The majority of the lakes which freeze are so shallow as to admit of the whole of their water being cooled considerably below the temperature of maximum density.

The distribution of temperature in frozen lakes will be apparent from the table given below. Of the Lakes of Zürich and Morat and Loch Lomond the mean temperatures are in the order of their depth. Linlithgow is altogether peculiar. Its high temperature, which increased steadily all the time it was covered with ice, was due to chemical action amongst the filth which has been allowed to accumulate at its bottom. When the ice broke up the dead fish were taken away in carts.

Dr. Forel gives the following particulars about the frozen Swiss lakes. "The Lake of Morat has a surface of 27.4 square kilometres and a maximum depth of 45 metres (147 feet); it is 1425 feet above the sea; and its mean latitude is 49° 56′ N. The ice overspread its whole surface suddenly in the night of the 17th to the 18th December, and it remained frozen till the 8th March. The Lake of Zürich has a superficies of 87.8 square kilometres, a maximum depth of 468 feet, an altitude of 1338 feet, and a mean latitude of 47° 16′ N. Its congelation was gradual, and not sudden like that of the Lake of Morat. First the upper part of the lake was covered with ice between Männedorf and Wädensweil. At the end of December, the 28th, the ice covered it entirely, but only for a single day. On the 29th it thawed, and the lake remained partially free of ice until the middle of January. It froze over completely on the 22d January, and on the 25th the ice was 4 inches thick in the centre of the lake." Of the larger Swiss lakes, Morat, Zürich, Zug, Neuchâtel, Constance, and Annecy were frozen in 1880; Thun is known to have been frozen four times, namely, in 1363, 1435, 1685, and 1695; Brienz has only once been frozen, in 1363; Lucerne freezes partially in very severe winters, and Geneva in its western and shallower part, whilst Wallenstadt and Bourget are not known to have ever been frozen.

Table of Temperatures in Frozen Lakes.

Depth (in feet).	Temperature in Degrees, Fahr.				
	Zürich, 25th Jan., 1880.	Morat, 23d Dec., 1879.	Lomond. 29th Jan., 1879.	Linlithgow. 11th Jan., 1879.	Linlithgow. 25th Jan., 1879.
3	......	......	33.00	35.90	36.00
6	......	......	33.50	36.30	36.80
18	......	35.06	33.95	36.90	37.80
(Bottom) 48	36.95	36.14	35.20	39.85	42.05
(Bottom) 65	37.25	36.30	36.30	......	......
100	37.76	36.68	......	......	......
(Bottom) 150	38.39	37.04	......	......	......
200	38.66	......	......	......	......
300	38.84	......	......	......	......
(Bottom) 435	39.20	......	......	......	......
Mean.......	38.40	36.00	34.46	37.22	38.28

For further information on the temperature of frozen lakes, see Buchanan, *Nature*, March 6, 1879; Forel, *Arch. de Genève*, 1880, iv. 1; Nichols, *Proc. Boston Soc. of Nat. Hist.*, 1881, xxi. p. 53.

Changes of Level.—As the water supply of lakes depends on the rainfall, and as this varies much with the season, and from year to year, we should expect, and indeed we find, fluctuation of level in all lakes. There are, however, other changes of level which are independent of the water supply, and which resemble tides in their rhythmic periods. They have long been known and observed in Switzerland, and especially on the Lake of Geneva, where they are known by the name of "seiches." The level of the lake is observed to rise slowly during twenty or thirty minutes to a height which varies from a few centimetres to as many decimetres; it then falls again slowly to a corresponding depth, and rises again slowly, and so on. These movements were observed and much studied at the end of last century by Jallabert, Bertrand, and Saussure, and at the beginning of this century they formed the subject of an instructive memoir by Vaucher, who enunciated the following law connecting the seiches with the movements of the barometer. "The amplitude of seiches is small when the atmosphere is at rest; the seiches are greater the more variable is the atmosphere's pressure; they are the greatest when the barometer is falling." Vaucher recognized the existence of seiches in the Lakes of Geneva, Neuchâtel, Zürich, Constance, Annecy, and Lugano; and Dr. Forel of Morges, from whose papers, published principally in the *Bibliothèque Universelle et Revue Suisse* during the last five years, the facts regarding the seiches have been taken, has observed them in every lake where he had looked for them. It is in every way likely that they are to be found in all lakes of notable extent and depth. They have been studied principally on the Lake of Geneva, where Dr. Forel, at Morges, about the middle of the lake on the north shore, and M. Plantamour, at Sécheron, about a mile from Geneva on the north shore, have had self-registering tide gauges in operation for a number of years. In the writings of the Swiss observers the seiche is the complete movement of rise above and fall below the mean level, the amplitude is the extreme difference of level so produced, and the duration of the seiche is the time in seconds measured from the moment when the water is at the mean level until it is again at the mean level, after having risen to the crest and sunk to the trough of the wave. The amplitude of the seiches is very variable. At the same station and on the same day successive seiches are similar. When the seiches are small they are all small, when they are large they are all large. At the same station and on different days the amplitudes of the seiches may vary enormously. For instance, at Geneva, where the highest seiches have been observed, they are usually of such a size as to be imperceptible without special instruments; yet on the 3d August, 1763, Saussure measured seiches of 1.48 metres, and on the 2d and 3d October, 1841, the seiches observed by Vénié were as much as 2.15 metres. They are greater at the extremities than at the middle of lakes, at the head of long gulfs whose sides converge gently than at stations in the middle of a long straight coast, and in shallow as compared with deep lakes or parts of a lake. They also appear to increase with the size of the lake. The duration of the seiches is found to vary considerably, but the mean deduced from a sufficient number of observations is fairly constant at the same locality. Thus, for Morges, Dr. Forel has found it to be for the half seiche 315 ± 9 seconds. At different stations, however, on the same lake and on different lakes it varies considerably. Thus on the Lake of Geneva it is, for the complete seiche, 630 seconds at Morges, and 1783 seconds at Veytaux; on Lake Neuchâtel it is 2840 seconds at Yverdon, and 264 at Saint Aubin.

The curves traced by the gauge at Geneva have been subjected to a preliminary harmonic analysis by Professor Soret, and he has decomposed them into two undulations, the one with a period, from crest to crest, of seventy-two minutes, and the other with a period of thirty-five minutes, or a little less than half the larger period. As the amplitudes of the composing curves vary much, there is great variety in the resultant curves. Besides these two principal components, there are others which have not yet been investigated.

With regard to the cause of the phenomenon, Dr. Forel attributes the ordinary seiches to local variations of atmospheric pressure, giving an impulse the effect of which would be apparent for a long time as a series of oscillations. The greater seiches, such as those of 1.5 metres, he attributed to earthquake shocks; but, as a very sensible earthquake passed over Switzerland quite recently without leaving the slightest trace on the gauge, he has abandoned this explanation, and is inclined to attribute them to pulsation set agoing by violent downward gusts of wind, especially at the upper end of the lake. M. Plantamour, who has devoted much attention to the same subject, assured the writer, in the summer of 1881, that he was completely at a loss for a satisfactory explanation of them.

Seiches have not been observed on the Scottish lakes, though there is little doubt that they would be found if sought for. There are, however, records of disturbances of some of the lakes, especially in Perthshire, of which the following may be cited as an instance:

> A violent disturbance of the level of Loch Tay is reported in the *Statistical Account of Scotland* (1796), xvii. p. 458, to have occurred at Kenmore on 12th September, 1784, continuing in a modified degree for four days, and again on 13th July, 1794. Kenmore lies at the northeastern end of the lake, where the river Tay issues from it. It lies at the end of a shallow bay. "At the extremity of this bay the water was observed to retire about 5 yards within its ordinary boundary, and in four or five minutes to flow out again. In this manner it ebbed and flowed successively three or four times during the space of a quarter of an hour, when all at once the water rushed from the east and west in opposite currents, . . . rose in the form of a great wave, to the height of five feet above the ordinary level, leaving the bottom of the bay dry to the distance of between 90 and 100 yards from its natural boundary. When the opposite currents met they made a clashing noise and foamed; and, the stronger impulse being from the east, the wave, after rising to its greatest height, rolled westward, but slowly diminishing as it went, for the space of five minutes, when it wholly disappeared. As the wave subsided it flowed back with some force, and exceeded its original boundary 4 or 5 yards; then it ebbed again about 10 yards, and again returned, and continued to ebb and flow in this manner for the space of two hours, the ebbings succeeding each other, at the distance of about seven minutes, and gradually lessening, till the water settled into its ordinary level. During the whole time that this phenomenon was observed the weather was calm. On the next and four succeeding days an ebbing and flowing was observed nearly about the same time and for the same length of time, but not at all in the same degree as on the first day."
>
> The above is the account given by the Rev. Thomas Fleming, at the time minister of Kenmore, who was an eyewitness. It resembles in all essential particulars the descriptions of waves which accompany actual earthquakes, yet in his account he goes on to say—"I have not heard (although I have made particular inquiry) that any motion of the earth was felt in this neighborhood, or that the agitation of the wave was observed elsewhere but about the village of Kenmore." It is well known that there were great seismic movements observed in Perthshire at the time of the Lisbon earthquake, and there is a tradition in the neighborhood that Loch Lubnaig near Callander was largely increased in extent by the dislocations which took place.

In all lakes there are changes of level corresponding with periods of rain and of drought. They are the more considerable the greater the extent of country draining into them, and the more constrained the outflow. In the great American lakes, which occupy nearly one-third of their drainage area, the fluctuations of level are quite insignificant; in Lake Michigan the U. S. surveyors give as the maximum and minimum yearly range 1.64 and 0.65 feet. In the Lake of Geneva the mean annual oscillation is 5 feet, and the difference between the highest and the lowest waters of this century is 9.3 feet. The most rapid rise has been 3.23 inches (82 mm.) in twenty-four hours. A very remarkable exception to the rule that large freshwater lakes are subject to small variations of level is furnished by Lake Tanganyika in Central Africa. Since its discovery travellers have been much perplexed by the evidence and reports of considerable oscillations of level of uncertain period, and also by the apparent absence of visible outlet, while the freshness of its waters was of itself convincing evidence of the existence of an outlet. By the careful observations of successive explorers the nature of this phenomenon has been fully explained, and is very instructive. It has recently been visited by Captain Hore of the London Missionary Society, and it appears from his reports that the peculiar phenomena observed depend on the fact that the area of country draining into the lake is very limited, so that in dry seasons the streams running into it dry up altogether, and its outlet gets choked by the rapid growth of vegetation in an equatorial climate. A dam or dyke is thus formed which is not broken down until the waters of the lake have risen to a considerable height. A catastrophe of this kind happened whilst Captain Hore was in the neighborhood, and he noted the height of the water at different times, near his station near Ujiji, and observed it fall 2 feet in two months. It continued to fall until in seventeen months it had fallen over 10 feet. Taking the length of the lake at 330 miles, and the mean breadth at 30 miles, its surface is 9900 square nautical miles. If this surface be reduced 2 feet in sixty days, the water will have to escape at the rate of 137,500 cubic feet per second. The mean rate of discharge of the Danube is 207,000 cubic feet per second. Hence, without taking into account water which would be brought into the lake by tributaries during the two months, we require for outlet a river at least two-thirds of the size of the Danube, and in the Lukuga such a river is found. When Stanley visited it the Lukuga was quite stopped up with dense growth, and no water was issuing; the lake was then rising; when Captain Hore visited it the lake was falling rapidly, and the Lukuga was a rapid river of great volume. One of the chief affluents to the lake was found to be discharging at the rate of 18,750 cubic feet of water per second; a few months later it was dry and the mouth closed with vegetation. During the dry season too the lake, with its 10,000 square miles of surface, is exposed to the evaporating action of the southeast trade wind, and when the supply is so insignificant this must be sufficient of itself to sensibly lower the level. Ordinarily then we might expect the lake to be subject to a yearly ebb and flow corresponding to the periods of drought and rains; and, from what we learn of the great fluctuations of rainfall one year with another, we should expect that during a series of dry years the obstructions to the outflow would gain such a head that the rains of several wet seasons would have to accumulate before forcing a passage. The result would be a tide of a period corresponding to the recurrence of series of wet or dry years. Were the lake situated at or near the level of the ocean, its equatorial position would give it such a preponderance of rain over the whole year as to keep its outlet constantly open; but its actual position, 2700 feet above the sea, produces an alteration in climate equivalent to an increase of latitude, which would place it in the trade wind region rather than in that of equatorial calms and rains. That such is actually the effect is shown by the range of temperature, which is moderate (59° to 83° Fahr.), and the rainfall (27 to 30 inches), which is almost exactly that of London. The Central African lakes, from their immense size and from their equatorial position, possess a peculiar interest for the physical geographer, and it is to be hoped that before long we shall have sufficient soundings to give a general idea of the size of their basins, and also temperature observations to show the effect of a vertical sun on large bodies of water at a moderate elevation, and removed from the disturbing influence of oceanic circulation.

As might be expected, in salt lakes which have no overflow, the yearly rise and fall is often considerable. In the Great Salt Lake in Utah, the greatest depth of which is 56 feet, changes of level are accompanied by great changes in water surface, and also in saltness of water. In the rainy season the Dead Sea stands 10 or

12 feet higher than in the dry season. The following table shows the chemical composition of the waters of various salt lakes, that of the sea-water in the Suez Canal being added for comparison:

	Kokonor Sea.	Aral Sea.	Caspian Sea.		Urumieh Sea.	Dead Sea.	Van Sea.	Suez Canal, Ismailia.
			Open.	Karabugas.				
Specific gravity	1.00907	……	1.01106	1.26217	1.17500	……	1.01800	1.03898
Percentage of salt	1.11	1.09	1.30	28.5	22.28	22.13	1.73	5.1
Name of Salt.	*Grammes Salt in* 1000 *Grammes Water.*							
Bicarbonate of lime	0.6804	0.2185	0.1123	……	……	……	……	0.0072
" iron	0.0058	……	0.0014	……	……	……	……	0.0069
" magnesia	0.6598	……	……	……	……	……	0.4031	……
Carbonate of soda	……	……	……	……	……	……	5.3976	……
Phosphate of lime	0.0028	……	0.0021	……	……	……	……	0.0029
Sulphate of lime	……	1.3499	0.9004	……	0.7570	0.8600	……	1.8593
" magnesia	0.9824	2.9799	3.0855	61.9850	18.5460	……	0.2595	3.2231
" soda	1.7241	……	……	……	……	……	2.5678	……
" potash	……	……	……	……	……	……	0.5863	……
Chloride of sodium	6.9008	6.2356	8.1163	83.2840	192.4100	76.5000	8.0500	40.4336
" potassium	0.2209	0.1145	0.1339	9.9560	……	23.8000	……	0.6231
" rubidium	0.0055	……	0.0084	0.2510	……	……	……	0.0265
" magnesium	……	0.0008	0.6115	129.3770	15.4610	95.6000	……	4.7632
" calcium	……	……	……	……	0.5990	22.4500	……	……
Bromide of magnesium	0.0045	……	0.0081	0.1980	……	2.3100	……	0.0779
Silica	0.0098	……	0.0024	……	……	0.2400	0.0761	0.0027
Total solid matter	11.1463	10.8987	12.9778	284.9960	222.7730	221.2600	17.2899	51.0264

This table embraces examples of several types of salt lake. In the Kokonor, Aral, and open Caspian seas we have examples of the moderately salt, non-saturated waters. In the Karabugas, a branch gulf of the Caspian, the Urumieh, and the Dead Sea we have examples of saturated waters containing principally chlorides. The Van Sea is an example of the alkaline seas which also occur in Egypt, Hungary, and other countries. Their peculiarity consists in the quantity of carbonate of soda dissolved in their waters, which is collected by the inhabitants for domestic and for commercial purposes. The chemical reader will be struck by the quantity of magnesia salt dissolved in water which contains so much carbonate of soda. The analysis in the table is by Abich, quoted by Schmidt in his interesting "Études Hydrologiques," published in the *Bulletin de l'Académie de St. Petersbourg.* Another analysis by De Chancourt, quoted by Bischof, omits all mention of sulphate of magnesia, but inserts the carbonate.

The limits of this article do not admit of the discussion of the many interesting phenomena connected with salt lakes. With regard, however, to a former connection of the Caspian with the Black Sea, which has been so often suggested, it seems improbable, both on chemical and on physical grounds, that they were ever connected as seas, that is, in the same way as the Black Sea is connected with the Mediterranean; but, if we consider the topography of the Caucasus district, we see that the lowest summit level of the land between the two seas is in the Manytsch valley, 86 feet above the Black Sea. Were the climate of the Caspian to change only very slightly for the moister, its waters might easily rise the 196 feet which would enable it to overflow towards the Mediterranean, while a relapse towards dryness would be followed by the retreat of the waters, which would be then confined as they are now to the basin of the sea. It is important, therefore, to bear in mind that no terrestrial dislocations are required to produce enormous changes in the level of salt lakes; we require only changes of climate, and these very slight. There can be little doubt that, if the climate of the Black Sea extended across the isthmus to the Caspian, the latter would now stand 200 feet higher, would be fresh, and would overflow into the Sea of Azoff.

For other aspects of the subject see GEOLOGY.

(J. Y. B.)

LAKE DWELLINGS, as their name implies, are habitations constructed, not on the dry land, but within the margins of lakes or creeks at some distance from the shore. The villages of the Guajiros in the Gulf of Maracaibo are described by Goering as composed of houses with low sloping roofs perched on lofty piles and connected with each other by bridges of planks. Each house consisted of two apartments; the floor was formed of split stems of trees set close together and covered with mats; they were reached from the shore by dug-out canoes poled over the shallow waters; a notched tree trunk served as a ladder; and the piles were so firmly driven that no shakiness was perceptible even when the houses were crowded with people. In such a climate the advantages of dwelling in houses so situated are obvious. The custom is common both in the Gulf of Maracaibo and in the estuaries of the Orinoco and Amazon; indeed the name of the province of Venezuela was given to it from the prevalence of these pile-dwellings along its shores. A similar system prevails in New Guinea. D'Urville describes four such villages in the Bay of Dorei, containing from eight to fifteen blocks or clusters of houses, each block separately built on piles, and consisting of a row of distinct dwellings accommodating a number of families. Cameron describes three villages thus built on piles in Lake Mohrya in Central Africa, the motive here being to prevent surprises by bands of slave-catchers. Similar constructions have been described by travellers, among the Dyaks of Borneo, in Celebes, in the Caroline Islands, on the Gold Coast of Africa, and in other places. Historians have referred to the former existence of the custom in Europe and Asia. Hippocrates, writing in the 5th century B.C., says of the people of the Phasis that their country is hot and marshy and subject to frequent inundations, and that they live in houses of timber and reeds constructed in the midst of the waters, and use boats of a single tree trunk. Herodotus, writing also in the 5th century B.C., describes the people of Lake Prasias as living in houses constructed on platforms supported on piles in the middle of the lake, which are approached from the land by a single narrow bridge. Abulfeda the geographer, writing in the 13th century, notices the fact that part of the Apamæan Lake was then called the Lake of the Christians, because it was inhabited by Christian fishermen who lived on the lake in wooden huts built on piles. Fishermen's huts roughly constructed of branches of trees and supported on piles placed saltire-wise existed in the shallows of the bays on the European side of the Bosphorus not many years ago, and Sir John Lubbock mentions that the Roumelian fishermen on Lake Prasias "still inhabit wooden cottages built over the water, as in the time of Herodotus." The records of the wars in Ireland in the 16th century show that the petty chieftains of that time had their defensive strongholds constructed in the "freshwater lochs" of the country, and there is record evidence of a similar system in the western parts of Scotland. The archæological researches of the past few years have shown that such artificial constructions in lakes were used as defensive dwellings by the Celtic people of post-Roman and mediæval times (See CRANNOGS). Similar researches on the Continent have also established the fact that in prehistoric times nearly all the shallow lakes of Switzerland, and many in the adjoining countries—in Savoy and the north of Italy, in Austria and Hungary, and in Mecklenburg and Pomerania—were peopled, so to speak, by lake-dwelling communities, living in villages constructed on platforms supported by piles at varying distances from the shores. The principal groups are those in the Lakes of Bourget, Geneva, Neuchâtel, Bienne, Zurich, and Constance, lying to the north of the Alps, and in the lakes Maggiore, Varese, Iseo, and Garda, lying to the south of that mountain range. Many smaller lakes, however, contain them, and they are also found in peat moors on the sites of ancient lakes now drained or silted up. In some of the larger lakes the number of settlements has been very great. Fifty are enumerated in the Lake of Neuchâtel, thirty-two in the Lake of Constance, twenty-four in the Lake of Geneva, and twenty in the Lake of Bienne. Some of these settlements have been of considerable size. The site of the lake dwelling of Wangen, in the Untersee, Lake of Constance, forms a parallelogram more than 700 paces in length by about 120 paces in breadth. The settlement at Morges, which is one of the largest in the Lake of Geneva, is 1200 feet long by 150 feet in breadth. The settlement of Sutz, one of the largest in the Lake of Bienne, extends over an area of 6 English acres, and was connected with the shore by a gangway nearly 100 yards long and about 40 feet wide. The substructure which supported the platforms on which the dwellings were placed was most frequently of piles driven into the bottom of the lake. Less frequently it consisted of a stack of brushwood or fascines built up from the bottom and strengthened by stakes penetrating the mass so as to keep it from spreading. When piles were used they were simply the rough stems of trees of a length proportioned to the depth of the water, sharpened sometimes by fire and at other times chopped to a point by hatchets. On their level tops the beams supporting the platforms were laid and fastened by wooden pins, or inserted in mortices cut in the heads of the piles. In some cases the whole construction was further steadied and strengthened by cross beams, notched into the piles below the supports of the platform. The platform itself was usually composed of rough layers of unbarked stems, but occasionally it was formed more regularly of boards split from larger stems. When the mud was too soft to afford foothold for the piles, they were mortised into a framework of tree trunks placed horizontally on the bottom of the lake. On the other hand, when the bottom was rocky so that the piles could not be driven, they were steadied at their bases by being enveloped in a mound of loose stones, deposited around and among them, exactly in the manner in which the foundations of piers and breakwaters are now constructed. In cases where piles have not been used, as at Niederwyl and Wauwyl, the substructure is a mass of fascines or fagots laid parallel and crosswise upon one another with layers of brushwood or of clay and gravel separating the beds of the wooden material, which is steadied and kept in position by upright stakes not driven into the lake bottom, a few piles here and there being occasionally fixed throughout the mass to serve as guides or stays. At Niederwyl the platform was formed of split boards, many of which were 2 feet broad and two or three inches in thickness. On these substructures were placed the groups of huts composing the settlement; for the peculiarity of these lake dwellings is that they were pile villages, or clusters of huts occupying a common platform. The huts themselves were quadrilateral in form. The size of each separate dwelling is in some cases marked by boards resting edgeways on the platform, like the skirting boards over the flooring of the rooms in a modern house. The walls, which were supported by posts, or by piles of greater length, were formed of wattle-work, coated with clay. The floors were of clay, and in each floor there was a hearth constructed of flat slabs of stone. The roofs were thatched with bark, straw, reeds, or rushes. As the superstructures are in all cases gone, there is no evidence as to the position and form of the doorways, or the size, number, and position of the windows if there were any. In some cases the remains of the gangways or bridges connecting the settlements with the shore have been discovered, but in others the village appears to have been practically insular and accessible only by canoes. Several of these single-tree canoes have been found, one of which is 43 feet in length and 4 feet 4 inches in its greatest width. It is impossible to estimate with any degree of certainty the number of separate dwellings of which any of these villages may have consisted, but at Niederwyl they stood almost contiguously on the platform, the space between them not exceeding three feet in width. The size of the huts also varied considerably. At Niederwyl they were 20 feet long and 12 feet wide, while at Robenhausen they were 27 feet long by about 22 feet wide. The character of the relics associated with the sites of the various settlements discloses the fact that in some cases they have been the dwellings of a people using no materials but stone, bone, and wood for their implements, ornaments, and weapons; in others, of a people using bronze as well as stone and bone; and in others again iron and bronze were used. But though the character of the associated relics is thus changed, there is no corresponding change in the construction and arrangements of the dwellings. The settlement in the Lake of Moosseedorf, near Bern, affords the most perfect example of a lake dwelling of the Stone age. It was a parallelogram 70 feet long by 50 feet wide, supported on piles, and having a gangway built on fagots connecting it with the land. The superstructure had been destroyed by fire. The implements found in the relic bed under it were celts or axe-heads of stone, with their haftings of stag's horn and wood; a flint saw, set in a handle of fir wood and fastened with asphalt; flint-flakes and arrow-heads; harpoons of stag's horn with barbs; awls, needles, chisels, fish-hooks, and other implements of bone; a comb of yew wood 5 inches long; and a skate made out of the leg bone of a horse. The pottery consisted chiefly of roughly made vessels, some of which were of large size, others had holes under the rims for suspension, and many were covered with an incrustation of soot, the result of their use as culinary vessels. Burnt wheat, barley, and linseed, with many varieties of seeds and fruits, were plentifully mingled with the bones of the stag, the ox, the swine, the sheep, and the goat, representing the ordinary food of the inhabitants, while remains of the beaver, the fox, the hare, the dog, the bear, the horse, the elk, and the bison were also found. The settlement of Robenhausen, in the moor which was formerly the bed of the ancient Lake of Pfäffikon, seems to have continued in occupation after the introduction of bronze. The site covers an area of nearly 3 acres, and is estimated to have contained 100,000 piles. In some parts three distinct successions of inhabited platforms have been traced. The first had been destroyed by fire. It is represented at the bottom of the lake by a layer of charcoal mixed with implements of stone and bone, and other relics highly carbonized. The second is represented above the bottom by a series of piles with burnt heads, and in the bottom by a layer of charcoal mixed with corn apples, cloth, bones, pottery, and implements of ston and bone, separated from the first layer of charcoal by 3 feet of peaty sediment intermixed with relics of the occupation of the platform. The piles of the third settlement do not reach down to the shell marl, but are fixed in the layers representing the first and second settlements. They are formed of split oak trunks, while those of the first two settlements are round stems chiefly of soft wood. The huts of this last settlement appear to have had cattle stalls placed between them, the droppings and litter forming heaps at the lake bottom. The bones of the animals consumed as food at this station were found in such numbers that 5 tons were collected in the construction of a watercourse which crossed the site. Among the wooden objects recovered from the relic beds were tubs, plates, ladles, and spoons, a flail for threshing corn, a last for stretching shoes of hide, celt handles, clubs, long-bows of yew, floats, and implements of fishing, and a dug-out canoe 12 feet long. No spindle-whorls were found, but there were many varieties of cloth, platted and woven, bundles of yarn, and balls of string. Among the tools of bone and stag's horn were awls, needles, harpoons, scraping tools, and haftings for stone axe-heads. The implements of stone were chiefly axe-heads and arrow-heads. Of clay and earthenware there were many varieties of domestic dishes, cups and pipkins, and crucibles or melting pots made of clay and horse dung and still retaining the drossy coating of the melted metal. No bronze objects have yet been found at Robenhausen, although the presence of the crucibles attests the fact of the use of that metal. The settlement of Auvernier in the Lake of Neuchâtel is the richest and most considerable station of the Bronze age. It has yielded four bronze swords, ten socketed spear-heads, forty celts or axe-heads and sickles, fifty knives, twenty socketed chisels, four hammers and an anvil, sixty rings for the arms and legs, several highly ornate torques or twisted neck rings, and upwards of two hundred hair pins of various sizes up to 16 inches in length, some having spherical heads in which plates of gold were set. Moulds for sickles, lance-heads, and bracelets were found cut in stone or made in baked clay. From four to five hundred vessels of pottery finely made and elegantly shaped are indicated by the fragments recovered from the relic bed at this station. In the settlement at Marin in the Lake of Neuchâtel iron takes the place of whatever in the older lake dwellings was made either of stone, bone, or bronze. The swords are well forged, of a peculiarly fibrous iron, and furnished with iron sheaths. The spear-heads are large, sometimes as much as 18½ inches in length, with blades indented by segmental curves. Shield mountings, horse trappings, and personal ornaments such as fibulæ are here made of iron instead of bronze, and Roman and Gallic coins found in the relic bed bring the occupation of the settlement distinctly within the historic period. The antiquity of the earlier settlements of the Stone and Bronze ages is not capable of being deduced from existing evidence. "We may venture to place them," says Dr. Keller, "in an age when iron and bronze had been long known, but had not come into our districts in such plenty as to be used for the common purposes of household life, at a time when amber had already taken its place as an ornament and had become an object of traffic." It is now established that the people who erected the lake dwellings in Switzerland were also the people who were spread over the mainland. The forms and the ornamentation of the implements and weapons of stone and bronze which are found in the lake dwellings are the same as those of the implements and weapons in these materials which are found in the soil of the adjacent regions, and both groups of relics must therefore be ascribed to the industry of one and the same people. Whether dwelling on the land or dwelling in the lake, they have exhibited so many indications of capacity, intelligence, industry, and social organization that they cannot be considered as presenting, even in their Stone age, a low condition of culture or civilization. Their axes were made of tough stones, sawn from the block by flint, and ground to the fitting shape. They were fixed by the butt in the socket of stag's horn, mortised into a handle of wood. Their knives and saws of flint were mounted in wooden handles and fixed with asphalt. They made and used an endless variety of bone tools. Their pottery, though roughly finished, is well made, the vessels often of large size and capable of standing the fire as cooking utensils. For domestic dishes they also made wooden tubs, plates, spoons, ladles, and the like. The industries of spinning and weaving were largely practised. They made nets and fishing lines, and used canoes. They practised agriculture, cultivating several varieties of wheat and barley, besides millet and flax. They kept horses, cattle, sheep, goats, and swine. Their clothing was partly of linen and partly of woollen fabrics, and skins of their beasts. Their food was nutritious and varied, their dwellings neither unhealthy nor incommodious. They lived in the security and comfort obtained by social organization, and were apparently intelligent, industrious, and prosperous communities.

The materials for the investigation of this singular phase of prehistoric life were first collected and systematized by the late Dr. Ferdinand Keller, who died at Zürich, July 21, 1881, in the eighty-first year of his age. They were submitted in a series of seven successive reports to the Society of Antiquaries of Zürich, of which he was president, and printed in the Society's Transactions, *Mittheilungen der Antiquarischen Gesellschaft in Zürich*, vols. i.–xix., 4to, 1855–76. The substance of these reports has also been issued as a separate work in England, *The Lake Dwellings of Switzerland and other parts of Europe*, by Dr. Ferdinand Keller, translated and arranged by John Edward Lee, 2d ed., 2 vols. 8vo., London, 1878. Other works on the same subject are Frédéric Troyon, *Habitations Lacustres des temps anciens et modernes*, 8vo., Lausanne, 1860; E. Desor, *Les Palafittes ou Constructions Lacustres du Lac de Neuchâtel*, 8vo., Paris, 1865; E. Desor and L. Fayre, *Le Bel Âge du Bronze Lacustre en Suisse*, folio, Paris, 1874; A. Perrin, *Étude préhistorique sur la Savoie specialement a l'époque lacustre* (*Les Palafittes du Lac de Bourget*), 4to, Paris, 1870; Ernest Chantre, *Les Palafittes ou Constructions Lacustres du Lac de Paladru*, folio, Chambery, 1871; Bartolomeo Gastaldi, *Lake Habitations and Prehistoric Remains in the Turbaries and Marl-beds of Northern and Central Italy*, translated by C. H. Chambers, 8vo., London, 1865; Sir John Lubbock, *Prehistoric Times*, 4th ed., 8vo., London, 1878. (J. AN.)

LAKHIMPUR, or LUCKIMPOOR, a British district in the extreme east of the province of Assam, extending from 26° 51′ to 27° 54′ N. lat., and from 93° 49′ to 96° 4′ E. long. It lies along both banks of the Brahmaputra, which belongs to the district for about 400 miles of its course; and it is bounded N. by the Daphla, Miri, Abar, and Mishmi hills, E. by the Mishmi and Singpho hills, S. by the watershed of the Patkai range and the Lohit branch of the Brahmaputra, and W. by the districts of Darrang and Sibsagar. To the north and northeast the frontier is undefined. The Brahmaputra is navigable for steamers in all seasons as far as Dibrugarh, in the rainy season as far as Sadiya; its navigable tributaries within the district are the Subansiri, Dibru, and Buri Dihing. The greater part of the area (11,500 square miles) is sparsely occupied by independent hill tribes, and only 3200 square miles are directly under British administration. The elephant, rhinoceros, bear, buffalo, wild cattle, and deer are abundant; the capturing of elephants is a Government monopoly worth from £3000 to £4500 annually. Coal and petroleum (both worked for a short time about 1866), building stone, limestone, and ironclay exist in the district; and gold has been washed in the hill streams from time immemorial. Rice was grown on 39,460 acres in 1871. Tea is grown with European capital and under European supervision, and has in recent years made great progress, the plantations in 1874 covering over 89,370 acres. Silk cloth is made from the cocoons of the *mugá* worm (*Saturnia assamungis*), which feeds on the *súm* tree; but the manufacture has greatly fallen off. A thousand cocoons yield 6 or 8 oz. of thread, worth 10s. to 11s. per pound. The exports of Lakhimpur are tea, muga silk, india-rubber, beeswax, ivory, and mustard seed; the imports rice, opium, tobacco, salt, oil, and cotton cloth. The annual fair established by the Government at Sadiya is less of commercial than of political importance.

The population of the settled district in 1871–72 was 121,267, residing in 125 villages, and including 28,368 aborigines, 68,388 semi-Hinduized aborigines, 19,748 caste Hindus, 3826 Mohammedans. The most numerous Hindu caste was the Kolitá (3406), the former priests of the aboriginal kings of Assam; they have now taken to agriculture, and rank as pure Súdras. Of the semi-Hinduized aborigines the most numerous tribe is the Aham, the former rulers of the country (43,942). The hill tribes of the unsettled district are broadly distinguished into a Shan group (Khamtis and Singphos) and an Indo-Chinese group (Mishmis, Abars, Miris, Daphlas, etc.). Most, if not all of them, have sent out little colonies who settle on the borders of the plains. There are no towns in the Lakhimpur district. Dibrugarh, on the Dibru, a few miles above its junction with the Brahmaputra, is the chief civil station, with a population of 3870 in 1872. Lakhimpur figures largely in the annals of Assam as the region where successive invaders from the east first reached the Brahmaputra. The Bara Bhuiyas, originally from the western provinces of India, were driven out by the Chutias (a Shan race), and these in their turn gave place to their more powerful brethren, the Ahams, in the 13th century. The Burmese, who had ruined the native kingdoms, were expelled by the British in 1825; but it was not till 1839 that the country was taken under direct British management.

LALANDE, Joseph Jérôme Lefrançais de (1732–1807), a noted astronomer, was born at Bourg (department of Ain), July 11, 1732. His parents, who were in easy circumstances, sent him to Paris to study the law; but the accident of lodging in the Hôtel Cluny, where Delisle had his observatory, determined his astronomical vocation, and he became the zealous and favored pupil of both Delisle and Lemonnier. He, however, completed his legal studies, and was on the point of returning to Bourg to practise there as an advocate, when Lemonnier obtained permission to send him, in his own place, to Berlin, for the purpose of making observations on the lunar parallax in concert with those of Lacaille at the Cape of Good Hope. The successful execution of his task procured for him, before he was twenty-one, admission to the Academy of Berlin, and the post of adjunct astronomer to that of Paris. He now devoted himself to the improvement of the planetary theory, publishing in 1759 a corrected edition of Halley's tables, with a history of the celebrated comet whose return in that year he had aided Clairaut to calculate. In 1762, Delisle resigned in his favor the chair of astronomy in the Collége de France, the duties of which were discharged by Lalande with *éclat* during forty-six years. His house became an astronomical seminary, and amongst his pupils were Delambre, Piazzi, Mechain, and his own nephew, Michel Lalande. By his publications in connection with the transit of 1769 he won great and, in some respects, deserved fame. But his love of notoriety fully equalled his scientific zeal, and earned for him as much ridicule as his impetuous temper did hostility. These faults were partially outweighed by his generosity and benevolence. A strict adherence to hygienic rules long preserved his health, but eventually shortened his life. He died April 4, 1807, of consumption aggravated by systematic exposure to cold.

Although his investigations were conducted with diligence rather than genius, the career of Lalande must be regarded as of eminent service to astronomy. By his talents as a lecturer and writer he gave to the science unexampled popularity; his planetary tables, into which he introduced corrections for mutual perturbations, were the best available up to the end of the last century; and the Lalande prize, instituted by him in 1802 for the chief astronomical performance of each year, still testifies to his enthusiasm for his favorite pursuit. Amongst his voluminous works are *Traité d'Astronomie*, 2 vols. 4to, 1764 (enlarged edition, 4 vols., 1771–81, 3d edition, 3 vols., 1792); *Histoire céleste Française*, 1801, giving the places of 50,000 stars; *Bibliographie astronomique*, 1803, with a history of astronomy from 1781 to 1802; *Astronomie des Dames*, 1785; *Abrégé de Navigation*, 1793; *Voyage d'un François en Italie*, 1769, a valuable record of his travels in 1765–66. He communicated above one hundred and fifty papers to the Paris Academy of Sciences, edited the *Connoissance des Temps*, 1759–1774, and again 1794–1807, and wrote the concluding 2 vols. of the 2d edition of Montucla's *Histoire des Mathématiques*, 1802.

LALITPUR, or **Lullitpoor**, a British district in the lieutenant-governorship of the Northwestern Provinces, India, extending from 24° 9′ to 25° 14′ N. lat., and from 78° 12′ to 79° 2′ E. long., with an area of 1947 square miles. It is bounded N. and W. by the river Betwa, S.W. by the Narayan, S. by the Vindhyachal Ghâts and the Ságar (Saugor) district of the Central Provinces, S.E. and E. by Orchha state and the Dhasan. The district is an undulating plain about 1500 feet on an average above the sea-level, in the hill country of Bundelkhand, sloping gradually northwards from the Vindhya range to the Betwa and Jumna. It is drained by several important tributaries of the Jumna, and an immense number of smaller streams; but their rapid and frequently swollen currents, instead of fertilizing, impoverish the land and sweep away embankments and bridges. The general condition of the district is far from prosperous. A large proportion of the area is covered with jungle, and the poor-looking villages are few and far between. Only 366 square miles were under tillage in 1872. The food stuffs (mainly wheat, grain, barley, and millet) are never produced in much greater quantity than is necessary for local consumption, and a bad year results in scarcity, if not famine. As but little is done in the way of irrigation, the spring harvest is a very poor one; and if the rainfall sinks much below its average of 40 inches the autumn harvest is also scanty.

In 1865 the population was 248,146; in 1872 it was only 212,661, while the number of villages had fallen from 759 to 646. About 98 per cent. (207,788) of the inhabitants in 1872 were Hindus—the Brahmans numbering 20,657, Rajputs 20,985, Banias 11,356. The Rajput Bundelas are the most important socially, the Banias commercially. A few Gonds are found in the south, and about 10,000 Sahariyas, a degraded body of savages known to the police throughout India as professional thieves, are scattered throughout the jungle. The district is administered on the non-regulation system by a deputy-commissioner. The only municipality is Lalitpur town (population 8976 in 1872). The Gonds are the earliest known inhabitants of Lalitpur; they have left traces of their ultimato high state of civilization in temples and reservoirs. They were succeeded by the Chandel princes of Máhoba, who in their turn gave place to a number of petty independent rulers. In the 14th century the Bundelas invaded the country, and Lalitpur finally became a part of the state of Chanderi, which continued for the most part practically independent till the beginning of the 19th century, when Sindhia, provoked by raids into Gwalior, sent Colonel Baptiste against Lalitpur, and took the government under his direct control. In 1829 two-thirds of his territory was restored to the Chanderi sovereign. The remainder of the country, which was retained by Sindhia, was in 1844 made over to the British Government. The Bundela chiefs of Lalitpur were among those who most eagerly joined the mutiny, and it was only after a severe struggle that the district was again pacified.

LALLY, Thomas Arthur, Baron de Tollendal, Count de (1702–1766), French general, descended from an old Irish family, who emigrated to France along with the Stuarts, was born in Dauphiné in January, 1702. His father, colonel in an Irish-French regiment, familiarized him with active service from his boyhood, and he rose step by step in a career distinguished for bravery and conduct till in 1744 he was created a brigadier by Louis XV. on the field of Fontenoy. Previous to this he had been engaged in several plots for the restoration of the Stuarts, and in 1745 he accompanied Charles Edward to Scotland, serving as aide-de-camp at the battle of Falkirk. Escaping in disguise to France, he joined the army of Marshal Saxe in the Low Countries, and for his conduct at the capture of Maestricht in 1748 received the grade of marshal of the camp. When the French in 1756 resolved to fit out an expedition to recover their power in India, Lally was appointed to the chief command. Arriving at Pondicherri in 1758, he alarmed the English by his first successes, and even laid siege to Madras. But he was ill supported by his countrymen, his military chest was empty, and his bravery and zeal were not combined with the qualities necessary for success in Indian administration. Madras was relieved by a British fleet, and the English under Coote assumed the offensive, and inflicted a severe defeat on Lally at Wandiwash. He still made a long and stubborn resistance, but was ultimately besieged in Pondicherri and compelled to surrender in January, 1761. Returning to France on parole, he was thrown into prison. Popular indignation at the collapse of French power in India demanded a victim, and the Parliament of Paris sentenced him to death on a vague and frivolous accusation. The judicial murder of Lally (9th May, 1766) was exposed by Voltaire, and his son Lally-Tollendal obtained in 1778 the formal reversal of the sentence.

LĀMĀISM is partly religious, partly political. Religiously it is the corrupt form of Buddhism prevalent in Tibet and Mongolia. It stands in a relationship to primitive Buddhism similar to that in which Roman Catholicism, so long as the temporal power of the pope was still in existence, stood to primitive Christianity. The ethical and metaphysical ideas most conspicuous in the doctrines of Lāmāism are not confined to the highlands of Central Asia, they are accepted in great measure also in Japan and China. It is the union of these ideas with a hierarchical system, and with the temporal sovereignty of the head of that system in Tibet, which constitutes what is distinctively understood by the term Lāmāism. Lāmāism is hardly calculated to attract much attention for its own sake. Tibetan superstitions and Tibetan politics are alike repugnant to Western minds. But, as so many unfounded beliefs and curious customs have a special value of their own to the student of folklore, so Lāmāism has acquired a special interest to the student of comparative history through the instructive parallel which its history presents to that of the Church of Rome.

The central point of primitive Buddhism was the doctrine of "Arahatship,"—a system of ethical and mental self-culture, in which deliverance was found from all the mysteries and sorrows of life in a change of heart to be reached here on earth. This doctrine seems to have been held very nearly in its original points from the time when it was propounded by Gotama in the 5th century B.C., down to the period in which Northern India was invaded and conquered by the Huns at about the commencement of the Christian era. At that time there had arisen a school of Buddhist teachers who called their doctrine the "Great Vehicle." It was not in any contradiction to the older doctrine, which they contemptuously called the "Little Vehicle," but included it all, and was based upon it. The distinguishing characteristic of the newer school was the importance it attached to "Bodisatship." The older school had taught that Gotama, who had propounded the doctrine of Arahatship, was a Buddha, that only a Buddha is capable of discovering that doctrine, and that a Buddha is a man who by self-denying efforts, continued through many hundreds of different births, has acquired the so-called *Ten Pāramitās* or cardinal virtues in such perfection that he is able, when sin and ignorance have gained the upper hand throughout the world, to save the human race from impending ruin.[1] But until the process of perfection has been completed, until the moment when at last the sage, sitting under the Bo tree, acquires that particular insight or wisdom which is called Enlightenment or Buddhahood, he is still only a Bodisat. And the link of connection between the various Bodisats in the future Buddha's successive births is not a soul which is transferred from body to body, but the *karma*, or character, which each successive Bodisat inherits from his predecessors in the long chain of existences. Now the older school also held, in the first place, that, when a man had, in this life, attained to Arahatship, his karma would not pass on to any other individual in another life,—or in other words, that after Arahatship there would be no rebirth; and, secondly, that four thousand years after the Buddha had proclaimed the *Dhamma* or doctrine of Arahatship his teaching would have died away, wickedness and ignorance would have increased in the world, and another Buddha would be required to bring mankind once more to a knowledge of the truth. The leaders of the Great Vehicle urged their followers to seek to attain, not so much to Arahatship, which would involve only their own salvation, but to Bodisatship, by the attainment of which they would be conferring the blessings of the Dhamma upon countless multitudes in the long ages of the future. By thus laying stress upon Bodisatship, rather than upon Arahatship, the new school, though they doubtless merely thought themselves to be carrying the older orthodox doctrines to their logical conclusion, were really changing the central point of Buddhism, and were altering the direction of their mental vision. It was of no avail that they adhered in other respects in the main to the older teaching, that they professed to hold to the same ethical system, that they adhered, except in a few unimportant details, to the old regulations of the order of the Buddhist mendicant recluses. The ancient books still preserved to us in the *Pāli Pitakas*, being mainly occupied with the details of Arahatship, lost their exclusive value in the eyes of those whose attention was being directed to the details of Bodisatship. And the opinion that every leader in their religious circles, every teacher distinguished among them for his sanctity of life, or for his extensive learning, was a Bodisat, who might have and who probably had inherited the karma of some great teacher of old, opened the door to a flood of superstitious fancies.

It is worthy of note that the new school found its earliest professors and its greatest expounders in a part of India which lay outside the districts to which the personal influence of Gotama himself and of his immediate followers had been confined. The home of early Buddhism was round about Kosala and Magadha; in the district, that is to say, north and south of the Ganges, between where Allahabad now lies on the west, and Rajgir on the east. The home of the Great Vehicle was, at first, in the countries farther to the north and west. Buddhism arose in countries subject indeed to Brāhman influence, but where the sacred language of the Brāhmans was never more than a learned tongue, and where the exclusive claims of the Brāhmans had never been universally admitted. The Great Vehicle arose in the very stronghold of Brāhmanism, and among a people to whom Sanskrit was a familiar tongue. The new literature therefore, which the new movement called forth, was written and has been preserved in Sanskrit,—its principal books of *Dharma*, or doctrine, being the following nine:—(1) *Prajñā-pāramitā*; (2) *Gaṇḍa-vyūha*; (3) *Daṣa-bhūmeṣ-vara*; (4) *Samādhi-rāja*; (5) *Laṅkāvatāra*; (6) *Sad-dharma-puṇḍarīka*; (7) *Tathāgata-guhyaka*; (8) *Lalita-vistara*; (9) *Śuvarna-prabhāsa*. The date of none of these works is known with any certainty, but it is highly improbable that any one of them is older than the 6th century after the death of Gotama. Copies of all of them were brought to Europe by Mr. B. H. Hodgson, and other copies have been received since then; but none of them have as yet been published in Europe (the *Lalita Vistara* has been published by Rājendra Lāl Mitra in Calcutta), and only two have been translated into any European language. These are the *Lalita Vistara*, translated into French, through the Tibetan, by M. Foucaux, and the *Sad-dharma Puṇḍarīka*, translated into French by M. Eugène Burnouf. The former of these two is a legendary work, partly in verse, on the life of Gotama, the historical Buddha; and the latter, also partly in verse, is devoted to proving the essential identity of the Great and the Little Vehicle and the equal authenticity of both as doctrines enunciated by the master himself.

Of the authors of these nine works, as indeed of all the older Buddhist works with one or two exceptions, nothing has as yet been ascertained. The founder of the system of the Great Vehicle is, however, often referred to under the name of Nagarjuna or Nāgasena, a personage celebrated even in the countries to which the Greater Vehicle has never penetrated as the contemporary and religious instructor of the Yavana king Milinda, and as the answerer of the famous *Questions of Milinda*, a work still preserved in its Pāli form.[1] As Milinda may with all probability be identified with the Greek king Menander, who was one of the followers of Alexander the Great in Bactria, this tradition would imply that the origin of the Great Vehicle must be assigned to as early a date as the 2d century B. C. But the work itself was probably composed at least some centuries afterwards; and it would be hazardous to attach too much importance to any chronological data drawn from it. We must be content at present to settle a certain historical sequence in the principal doctrines of the system which developed into Lāmāism, without pretending to fix any actual dates.

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[1] See, for instance, the *Buddhist Birth Stories*, pp. 19-27 and 53-58.

Together with Nāgasena, other early teachers of the Great Vehicle whose names are known to us are Vasumitra or Vasubandhu, Āryadeva, Dharmapāla and Gunamati—all of whom were looked upon as Bodisats. As the newer school did not venture so far as to claim as Bodisats the disciples stated in the older books to have been the contemporaries of Gotama (they being precisely the persons known as Arahats), they attempted to give the appearance of age to the Bodisat theory by representing the Buddha as being surrounded, not only by his human companions the Arahats, but also by fabulous beings, whom they represented as the Bodisats existing at that time. In the opening words of each Mahāyāna treatise a list is given of such Bodisats, who were beginning, together with the historical Bodisats, to occupy a position in the Buddhist church of those times similar to that occupied by the saints in the corresponding period of the history of Christianity in the Church of Rome. And these lists of fabulous Bodisats have now a distinct historical importance. For they grow in length in the later works; and it is often possible by comparing them one with another to fix, not the date, but the comparative age of the books in which they occur. Thus it is a fair inference to draw from the shortness of the list in the opening words of the *Lalita Vistara*, as compared with that in the first sections of the *Saddharma Puṇḍarīka*, that the latter work is much the younger of the two, a conclusion supported also by other considerations.

Among the Bodisats mentioned in the *Saddharma Puṇḍarīka*, and not mentioned in the *Lalita Vistara*, as attendant on the Buddha are Mañju-çrī and Avalokiteçvara. That these saints were already acknowledged by the followers of the Great Vehicle at the beginning of the 5th century is clear from the fact that Fa Hian, who visited India about that time, says that "men of the Great Vehicle" were then worshipping them at Mathura, not far from Delhi (F. H. chap. xvi.). These were supposed to be celestial beings who, inspired by love of the human race, had taken the so-called Great Resolve to become future Buddhas, and who therefore, very naturally, descended from heaven when the actual Buddha was on earth, to pay reverence to him, and to learn of him. The belief in them probably arose out of the doctrine of the older school, which did not deny the existence of the various creations of Brahmanical mythology and speculation, but allowed of their actual existence as spiritual beings, and only deprived them of all power over the lives of men, and declared them to be temporary beings liable like men to sin and ignorance, and requiring like men the salvation of Arahatship. Among them the later Buddhists seem to have placed their numerous Bodisats; and to have paid especial reverence to Mañju-çrī as the personification of wisdom, and to Avalokiteçwara as the personification of overruling love. The latter indeed occupies in the Mahāyāna very much the position which the old Brahmanical god Brahma, the First Cause of the Brahmanical speculation, had been allowed to retain in primitive Buddhism. The former was afterwards identified with the mythical first Buddhist missionary, who is supposed in the legend to have introduced civilization into Tibet about two hundred and fifty years after the death of the Buddha.

The way was now open to a rapid fall from the simplicity of early Buddhism, in which men's attention was directed to the various parts of the system of self-culture which men could themselves practise, to a belief in a whole pantheon of saints or angels, which appealed more strongly to the half-civilized races among whom the Great Vehicle was now professed. A theory sprang up which was supposed to explain the marvellous powers of the Buddhas by representing them as only the outward appearance, the reflection, as it were, or emanation, of ethereal Buddhas dwelling in the skies. These were called *Dhyāni Buddhas*, and their number was supposed to be, like that of the Buddhas, innumerable. Only five of them, however, occupied any space in the speculative world in which the ideas of the later Buddhists had now begun to move. But, being Buddhas, they were supposed of course to have their Bodisats; and thus out of the five last Buddhas of the earlier teaching there grew up five mystic trinities, each group consisting of one of these five Buddhas, his prototype in heaven the Dhyāni Buddha, and his celestial Bodisat. Among these hypothetical beings, the creations of a sickly scholasticism, hollow abstractions without life or reality, the particular trinity in which the historical Gotama was assigned a subordinate place naturally occupied the most exalted rank. Amitābha, the Dhyāni-Buddha of this trinity, soon began to fill the largest place in the minds of the new school; and Avalokiteçwara, his Bodisat, was looked upon with a reverence somewhat less than his former glory. It is needless to add, that, under the overpowering influence of these vain imaginations, the earnest moral teachings of Gotama became more and more hid from view. The imaginary saints grew and flourished. Each new creation, each new step in the theory, demanded another, until the whole sky was filled with forgeries of the brain, and the nobler and simpler lessons of the founder of the religion were hidden beneath the glittering stream of metaphysical subtleties.

Still worse results followed on the change of the earlier point of view. The acute minds of the Buddhist pandits, no longer occupied with the practical lessons of Arahatship, turned their attention, as far as it was not engaged upon their hierarchy of mythological beings, to questions of philosophical speculation, which, in the earliest Buddhism, are not only discouraged but forbidden. We find long treatises on the nature of being, idealistic dreams which have as little to do with the Bodisatship that is concerned with the salvation of the world as with the Arahatship that is concerned with the perfect life. Only one lower step was possible, and that was not long in being taken. The animism common alike to the untaught Huns and to their Hindu conquerors, but condemned in early Buddhism, was allowed to revive. As the stronger side of Gotama's teaching was neglected, the debasing belief in rites and ceremonies, and charms and incantations, which had been the especial object of his scorn, began to live again, and to grow vigorously, and to spread like the Bīrana weed warmed by a tropical sun in marsh and muddy soil. As in India, after the expulsion of Buddhism, the degrading worship of Siva and his dusky bride had been incorporated into Brahmanism from the wild and savage devil worship of Āryan and of non-Āryan tribes, so, as pure Buddhism died away in the north, the *Tantra* system, a mixture of magic and witchcraft and sorcery, was incorporated into the corrupted Buddhism.

The founder of this system seems to have been

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[1] Edited by Dr. V. Trenckner, London, 1880.

Asanga, an influential monk of Peshāwar, in the Punjab, who lived and wrote the first text-book of the creed, the *Yogāchchāra Bhūmi Ṣāstra*, about the 6th century of our era. Hwen Tsang, who travelled in the first half of the 7th, found the monastery where Asanga had lived in ruins, and says that he had lived one thousand years after the Buddha.[1] He managed with great dexterity to reconcile the two opposing systems by placing a number of Saivite gods or devils, both male and female, in the inferior heavens of the then prevalent Buddhism, and by representing them as worshippers and supporters of the Buddha and of Avalokiteṣvara. He thus made it possible for the half-converted and rude tribes to remain Buddhists while they brought offerings, and even bloody offerings, to these more congenial shrines, and while their practical belief had no relation at all to the Truths or the Noble Eightfold Path, but busied itself almost wholly with obtaining magic powers (*Siddhi*), by means of magic phrases (*Dhārani*), and magic circles (*Maṇdala*). Asanga's happy idea bore but too ample fruit. In his own country and Nepāl the new wine, sweet and luscious to the taste of savages, completely disqualified them from enjoying any purer drink; and now in both countries Saivism is supreme, and Buddhism is even nominally extinct, except in some outlying districts of Nepāl. But this full effect has only been worked out in the lapse of ages; the Tantra literature has also had its growth and its development, and some unhappy scholar of a future age may have to trace its loathsome history. The nauseous taste repelled even the self-sacrificing industry of Burnouf, when he found the later Tantra books to be as immoral as they are absurd. "The pen," he says, "refuses to transcribe doctrines as miserable in respect of form as they are odious and degrading in respect of meaning."[2]

Such had been the decline and fall of Buddhism considered as an ethical system before its introduction into Tibet. The manner in which its order of mendicant recluses, at first founded to afford better opportunities to those who wished to carry out that system in practical life, developed at last into a hierarchical monarchy will best be understood by a sketch of the history of Tibet.

In Tibet as elsewhere the beginnings of the accounts found in the old historians are merely a recapitulation of legends in which popular tradition has explained by miraculous and mythological fancies the origins of its civilization. Its real history commences with Srong Tsan Gampo, who was born a little after 600 A. D., and who is said in the Chinese chronicles to have entered, in 634 after Christ, into diplomatic relationship with Thai Tsung, one of the emperors of the Thung dynasty. He was the founder of the present capital of Tibet, now known as Lhasa; and in the year 622 (the same year as that in which Mohammed fled from Mecca) he began the formal introduction of Buddhism into Tibet. For this purpose he sent the minister Thumi Sambhota, afterwards looked upon as an incarnation of Mañju-ṣrī, to India, there to collect the sacred books, and to learn and translate them. Thumi Sambhota accordingly invented an alphabet for the Tibetan language on the model of the Indian alphabets then in use. And, aided by the king himself, who is represented to have been an industrious student and translator, he wrote the first books by which Buddhism became known in his native land. The most famous of all the works ascribed to him is the *Mani Kambum*, "the Myriad of Precious Words,"—a treatise chiefly on religion, but which also contains an account of the introduction of Buddhism into Tibet, and of the closing part of the life of king Srong Tsan Gampo. He is also very probably the author of another very ancient standard work of Tibetan Buddhism, the *Samatog*, a short digest of Buddhist morality, on which the civil laws of Tibet have been founded. It is said in the *Mani Kambum* to have fallen down from heaven in a casket (Tibetan, *samatog*), and, like the last-mentioned work, is unfortunately only known to us in meagre abstract.

King Srong Tsan Gampo's zeal for Buddhism was shared and supported by his two queens, the one named Bribsun, a princess from Nepāl, the other named Wen Ching, a princess from China. They are related in the chronicles to have brought with them sacred relics, books, and pictures, for whose better preservation and honor two large monasteries were erected, and opened and dedicated with much ceremony. These are the cloisters of La Brang and Ra Mochay, still, though much changed and enlarged, the most famous and sacred abbeys in Tibet, and the glory of Lhasa. In after times the two queens have become semi-divine personages, and are worshipped under the name of the two *Dārā-Eke*, the "glorious mothers," being regarded as incarnations of the wife of Siva, representing respectively two of the qualities which she personifies, divine vengeance and divine love. The former of the two is worshipped by the Mongolians as *Okkin Tengri*, "the Virgin Goddess;" but in Tibet and China the rôle of the divine virgin is filled by *Kwan Yin*, a personification of Avalokiteṣvara as the heavenly word, who is often represented with a child in her arms. Srong Tsan Gampo has also become a saint, being looked upon as an incarnation of Avalokiteṣvara; and the description in the ecclesiastical historians of the measures he took for the welfare of his subjects do great credit to their ideal of the perfect Buddhist king. He is said to have spent his long reign in the building of reservoirs, bridges, and canals; in the promotion of agriculture, horticulture, and manufactures; in the establishment of schools and colleges; and in the maintenance of justice, and the encouragement of virtue. But the degree of his success must have been slight. For after the death of himself and of his wives Buddhism gradually decayed, and was subjected by succeeding kings to cruel persecutions; and it was not till more than half a century afterwards, under King Kir Song de Tsan,[3] who reigned 740–786, that true religion is acknowledged by the ecclesiastical historians to have become firmly established in the land.

This monarch again sent to India to replace the sacred books that had been lost, and to invite Buddhist pandits to translate them. The most distinguished of those who came were Ṣanta Rakshita, Padma Sambhava, and Kamala Ṣīla, for whom, and for their companions, the king built a splendid monastery still existing, at Samje, about three days' journey south-east of Lhasa. It was to them that the Tibetans owed the great collection of what are still regarded as their sacred books—the *Kandjur*. It consists of 100 volumes containing no less than 689 works, of which there are two or three complete sets in Europe, one of them in the Indian Office Library. A detailed analysis of these Scriptures has been published by the celebrated Hungarian scholar Csoma de Körös, whose authoritative work has lately been republished in French with complete indices and very useful notes by M. Léon Feer. These volumes contain about a dozen works of the oldest school of Buddhism, the Hīnayāna, and about 300 works, mostly very short, belonging to the Tantra school. But the great bulk of the collection consists of Mahāyāna books, belonging to all the previously existing varieties of that widely extended Buddhist sect; and, as the Sanskrit originals of many of these writings are now lost without hope of recovery, the Tibetan translations will be of great value, not only for the history of Lāmāism, but also for the history of the later forms of Indian Buddhism.

The last king's second son, Lang Darma, concluded in May, 822, a treaty with the then emperor of China (the twelfth of the Thang dynasty), a record of which was engraved on a stone put up in the above-mentioned great convent of La Brang, and is still to be seen there.[1] He is described in the church chronicles as an incarnation of the evil spirit, and is said to have tried his best to overthrow religion, and to have succeeded in suppressing Buddhism throughout the greater part of the land. The period from Srong Tsan Gampo down to the death of Lang Darma, who was eventually murdered about 850 A.D., in a civil war, is called in the Buddhist books, "the first introduction of religion." It was followed by more than a century of civil disorder and wars, during which the exiled Buddhist monks attempted unsuccessfully again and again to return. Many are the stories of martyrs and confessors who are believed to have lived in these troublous times, and their efforts were at last crowned with success, for in the century commencing with the reign of Bilamgur in 971 there took place "the second introduction of religion" into Tibet, more especially under the guidance of the Paṇḍita Atīsha, who came to Tibet in 1041, and of his famous native pupil and follower Brom Ston. The long period of depression seems not to have been without a beneficial influence on the persecuted Buddhist Church, for these teachers are reported to have placed the Tantra system more in the background, and to have adhered more strongly to the purer forms of the Mahāyāna development of the ancient faith.

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[1] Rémusat's translation, *Mémoires sur les Contrées Occidentales*, p. 270; and *La Vie de Hiouen Thsang*, p. 94.

[2] *Introduction*, etc., p. 558.

[3] [For other dates and fuller notice of this monarch, see Vol. XXIII. a 367.—Am. Ed.

For about three hundred years the Buddhist Church of Tibet was then left in peace, subjecting the country more and more completely to its control, and growing in power and in wealth. During this time it achieved its greatest victory, and underwent the most important change in its character and organization. After the reintroduction of Buddhism into the "kingdom of snow," the ancient dynasty never recovered its power. Its representatives continued for some time to claim the sovereignty; but the country was practically very much in the condition of Germany at about the same time—chieftains of almost independent power ruled from their castles on the hilltops over the adjacent valleys, engaged in petty wars, and conducted plundering expeditions against the neighboring tenants, whilst the great abbeys were places of refuge for the studious or religious, and their heads were the only rivals to the barons in social state, and in many respects the only protectors and friends of the people. Meanwhile Jenghiz Khān had founded the Mongol empire, and his grandson Kublai Khān, who ruled over the greatest empire which has ever owned the sway of a single man, became a convert to the Buddhism of the Tibetan Lāmas. He granted to the abbot of the Sakya monastery in Southern Tibet the title of tributary sovereign of the country, head of the Buddhist Church, and overlord over the numerous barons and abbots, and in return was officially crowned by the abbot as ruler over the extensive domain of the Mongol empire. Thus was the foundation laid at one and the same time of the temporal sovereignty of the Lāmas of Tibet, and of the suzerainty over Tibet of the emperors of China. One of the first acts of the "head of the church" was the printing of a carefully revised edition of the Tibetan Scriptures,—an undertaking which occupied altogether nearly thirty years, and was not completed till 1306.

Under Kublai's successor in China the Buddhist cause flourished greatly, and the Sākya Lāmas extended their power both at home and abroad. The dignity of abbot at Sākya became hereditary, the abbots breaking so far the Buddhist rule of celibacy that they remained married until they had begotten a son and heir. But rather more than half a century afterwards their power was threatened by a formidable rival at home, a Buddhist reformer.

Tsongkapa, the Luther of Tibet, was born about 1357 on the spot where the famous monastery of Kunbum now stands. He very early entered the order, and studied at Sākya, Brigung, and other monasteries. He then spent eight years as a hermit in Takpo in Southern Tibet, where the comparatively purer teaching of Atīsha (referred to above) was still prevalent. About 1390 he appeared as a public teacher and reformer in Lhasa itself, and before his death in 1419 there were three huge monasteries there containing 30,000 of his disciples, besides others in other parts of the country. His voluminous works, of which the most famous are the *Sumbun* and the *Lam Nim Tshenpo*, exist in printed Tibetan copies in Europe, but have not as yet been translated or analyzed. But the principal lines on which his reformation proceeded are sufficiently well attested. He insisted in the first place on the complete carrying out of the ancient rules of the order as to the celibacy of its members, and as to simplicity in dress. One result of the second of these two reforms was to make it necessary for every monk openly to declare himself either in favor of or against the new views. For Tsongkapa and his followers wore the yellow or orange-colored garments which had been the distinguishing mark of the order in the lifetime of its founder, and in support of the ancient rules Tsongkapa reinstated the fortnightly rehearsal of the *Pātimokkha* or "disburdenment" in regular assemblies of the order at Lhasa—a practice which had fallen into desuetude. He also restored the custom of the first disciples to hold the so-called *Vassa* or yearly retirement, and the public meeting of the order at its close. In all these respects he was simply following the directions of the Vinaya, or regulations of the order, as established probably in the time of Gotama himself, and as certainly handed down from the earliest times in the piṭakas or sacred books. Further, he set his face against the Tantra system, and against the whole crowd of animistic superstitions which had been allowed to creep into life again among the more ignorant of the monks and the people. He laid stress on the self-culture involved in the practice of the pāramitās or cardinal virtues, and established an annual national fast or week of prayer to be held during the first days of each year. This last institution indeed is not found in the ancient Vinaya, but was almost certainly modelled on the traditional account of the similar assemblies convoked by Asoka and other Buddhist sovereigns in India every fifth year. Laymen as well as monks take part in the proceedings, the details of which are entirely unknown to us except from the accounts of the Catholic missionaries, —Fathers Huc and Gabet,—who describe the principal ceremonial as, in outward appearance, wonderfully like the high mass. In doctrine the great Tibetan teacher, who had no access to the Pāli Piṭakas, adhered in the main to the purer forms of the Mahāyāna school; in questions of church government he took little part, and did not dispute the titular supremacy of the Sākya Lāmas, though in other matters he had raised the standard of revolt. But the effects of his teaching weakened their power. The "orange-hoods," as his followers were called, rapidly gained in numbers and influence, until they so overshadowed the "red-hoods," as the followers of the older sect were called, that in the middle of the 15th century the emperor of China acknowledged the two leaders of the new sect at that time as the titular overlords of the church and tributary rulers over the realm of Tibet. These two leaders were then known as the *Dalai Lāma* and the *Pantshen Lāma*, and were the abbots of the great monasteries at Gedun Dubpa, near Lhasa, and at Krashis Lunpo, in Further Tibet, respectively. Since that time the abbots of these monasteries have continued to exercise the sovereignty over Tibet,—their pretensions being supported, in the few cases in which an attempt has been made to dispute it, by the power of Mongolia and China.

As there has been no further change in the doctrine, and no further reformation in discipline, we may leave the ecclesiastical history of Lāmāism since that date unnoticed, and devote our little remaining space to the consideration of some principal points in the constitution of the Lāmāism of to-day. And first as to the mode of electing successors to the two Great Lāmas. It will have been noticed above that it was an old idea of the northern Buddhists to look upon distinguished members of the order as incarnations of Avalokiteçvara, of Mañju-çrī, or of Amitābha. These beings were supposed to possess the power, whilst they themselves continued to live in heaven, of appearing also on earth in a *Nirmāna-kāya*, or apparitional body. In the same way the Pantshen Lāma is looked upon as an incarnation, the Nirmāna-kāya, of Amitābha, who had previously appeared in that way under the outward form of Tshonkapa himself; and the Dalai Lāma is looked upon as an incarnation of Avalokiteçvara. Theoretically, therefore, the former, as the spiritual successor of the great teacher and also of Amitābha, who occupies the higher place in the mythology of the Great Vehicle, would be superior to the latter, as the spiritual representative of Avalokiteçvara. But practically the Dalai Lāma, owing to his position in the capital, has the political supremacy, and is actually called the *Gyalpo Rinpotshe*, "the glorious king,"—his companion being content with the title *Pantshen Rinpotshe*, "the glorious teacher." When either of them dies it is necessary for the other to ascertain in whose body the celestial being whose outward form has been dissolved has been pleased again to incarnate himself. For that purpose the names of all male children born just after the death of the deceased Great Lāma are laid before his survivor. He chooses three out of the whole number; their names are thrown into a golden casket provided for that purpose by a former emperor of China. The Chutuktus, or abbots of the great monasteries, then assemble, and after a week of prayer, the lots are drawn in their presence and in presence of the surviving Great Lāma and of the Chinese political resident. The child whose name is first drawn is the future Great Lāma; the other two receive each of them 500 pieces of silver. The Chutuktus just mentioned correspond in many respects to the Roman cardinals. Like the Great Lāmas, they bear the title of Rinpotshe or Glorious, and are looked upon as incarnations of one or other of the celestial Bodisats of the Great Vehicle mythology. Their number varies from ten to a hundred; and it is uncertain whether the honor is inherent in the abbacy of certain of the greatest cloisters, or whether the Dalai Lāma exercises the right of choosing them. Under these high officials of the Tibetan hierarchy there come the Chubil Khāns, who fill the post of abbot to the lesser monasteries, and are also incarnations. Their number is very large; and there are but few monasteries in Tibet or in Mongolia who do not claim to possess one of these living Buddhas. Besides these mystical persons there are in the Tibetan Church a number of other ranks and degrees, corresponding to the deacon, full priest, dean, and doctor of divinity in the West. At the great yearly festival at Lhasa they make in the cathedral an imposing array, not much less magnificent than that of the clergy in Rome; for the ancient simplicity of dress has quite disappeared in the growing differences of rank, and each division of the spiritual army is distinguished in Tibet, as in the West, by a special uniform. The political authority of the Dalai Lāma is confined to Tibet itself, but he is the acknowledged head also of the Buddhist Church throughout Mongolia and China. He has no supremacy over his co-religionists in Japan, and even in China there are many Buddhists who are not practically under his control or influence.

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[1] Published with fac-simile and translation and notes in the *Journal of the Royal Asiatic Society* for 1879-80, vol. xii.

The principal authorities for the history of Buddhism have already been given at the close of the article BUDDHISM. To these may now be added T. W. Rhys Davids's *Buddhism*, London, 1878; *Buddhist Birth Stories*, London, 1880; *Buddhist Suttas from the Pāli*, Oxford, 1881; and *Hibbert Lectures*, London, 1881; also Bushell, "The Early History of Tibet," in the *Journal of the Royal Asiatic Society*, 1879–80, vol. xii.; Sanang Setsen's *History of the East Mongols* in Mongolian, translated into German by J. Schmidt (*Geschichte der Ost-Mongolen*); "Analyse du Kandjur," by M. Léon Feer, in *Annales du Musée Gaimet*, 1881; Schott, *Ueber den Buddhismus in Hoch-Asien*; Gutzlaff, *Geschichte des Chinesischen Reiches*; Huc and Gabet, *Souvenirs d'un Voyage dans la Tartarie, le Tibet, et la Chine*, Paris, 1858; Pallas's *Sammlung historischer Nachrichten über die Mongolischen Völkerschaften*; and Bābu Sarat Chunder Das's "Contributions on the Religion and History of Tibet," in the *Journal of the Bengal Asiatic Society*, 1881. (T. W. R. D.)

LAMA-MIAU, or DOLANOR, one of the chief cities of Inner Mongolia, is situated 150 miles north of Peking, in a barren sandy plain watered by the Urtingol, a tributary of the Shandugol. The town proper, almost exclusively occupied by Chinese, is about a mile in length by half a mile in breadth, has narrow and dirty streets, and contains a large population for its extent. Unlike the ordinary Chinese town of the same rank, it is not walled. A busy trade is carried on between the Chinese and the Mongolians, who bring in their cattle, sheep, camels, hides, and wool to barter for tea, tobacco, cotton, and silk. At some distance from the Chinese town lies the Mongolian quarter, with two groups of lama temples and villages occupied by 2300 priests. Dr. Williamson (*Journeys in North China*) describes the chief temple as a huge oblong building with an interior not unlike a Gothic church. Lama-miau is the seat of a manufactory of bronze idols and other articles of ritual, which find their way to all parts of Mongolia and Tibet. The craftsmen work in their own houses. See Prejevalsky, *Mongolia*, 1876.

LAMARCK, JEAN BAPTISTE PIERRE ANTOINE DE MONET, CHEVALIER DE (1744–1829), a celebrated French naturalist, was born 1st August, 1744, at Bazantin, a village of Picardy. He was an eleventh child; and his father, lord of the manor and of old family, but of limited means, having already placed three sons in the army, destined this one for the church, and sent him to the Jesuits at Amiens, where he continued till his father's death. After this he would remain with the Jesuits no longer, and, not yet seventeen years of age, started for the seat of war at Bergen-op-Zoom, before which place one of his brothers had already been killed. Mounted on an old horse, with a boy from the village as attendant, and furnished by a lady with a letter of introduction to a colonel, he reached his destination on the evening before a battle. Next morning the colonel found that the new and very diminutive volunteer had posted himself in the front rank of a body of grenadiers, and could not be induced to quit the position. In the battle, the company which he had joined became exposed to the fire of the enemy's artillery, and in the confusion of retreat was forgotten. All the officers and subalterns were killed, and not more than fourteen men were left, when the oldest grenadier seeing there were no more French in sight proposed to the young volunteer so soon become commandant to withdraw his men. This he refused to do without orders. These at last arrived; and for his bravery he was made an officer on the spot, and soon after was named to a lieutenancy.

After the peace, the regiment was sent to Monaco. There it happened that one of his comrades playfully lifted him by the head, and to this it was imputed that he was seized with disease of the glands of the neck, so severe as to necessitate grave surgical interference, and put a stop to his military career.

The courage of Lamarck, so early exhibited, was in future to be shown by the maintenance of his opinions in the absence of any friendly support, and by fortitude amid many adversities; while his activity was to be displayed, not only in manifold speculation, but in copious and varied scientific work. He went to Paris and began the study of medicine, supporting himself by working in a banker's office. He early became interested in meteorology and in physical and chemical speculations of a chimerical kind, but happily threw his main strength into botany, and in 1778 published his *Flore Française*, a work in which by a dichotomous system of contrasting characters he enabled the student with facility to determine species. This work, which went through several editions and long kept the field, gained for its author immediate popularity as well as the honor of admission to the Academy of Sciences.

In 1781 and 1782, under the title of botanist to the king, an appointment obtained for him by Buffon, whose son accompanied him, he travelled through various countries of Europe, extending his knowledge of natural history; and on his return he began those elaborate contributions to botany on which his reputation in that science principally rests, namely, the *Dictionnaire de Botanique* and the *Illustrations de Genres*, voluminous works contributed to the *Encyclopédie Méthodique* (1785). In 1793, when he was already forty-nine years of age, in consequence of changes in the organization of the natural history department at the Jardin du Roi, where he had held a botanical appointment since 1788, Lamarck was presented to a zoological chair, and called on to lecture on the *Insecta* and *Vermes* of Linnæus, the animals for which he introduced the term *Invertebrata*, still employed. Thus driven, comparatively late in life, to devote his principal attention to zoology instead of botany, he had the misfortune soon after to suffer from impaired vision; and the malady progressing, resulted subsequently in total blindness. Yet his greatest zoological work, the *Histoire Naturelle des Animaux sans Vertèbres*, was published from 1815 to 1822, with the assistance, in the last two volumes, of his eldest daughter and of M. Latreille. A volume of plates of the fossil shells of the neighborhood of Paris was collected in 1823, from his memoirs in the *Annales des Muséum*. The later years of his blind old age were spent in straitened circumstances and accumulating infirmities, solaced, however, by the devotion of his family, and particularly of his eldest daughter, of whom Cuvier records that she never left the house from the time that he was confined to his room. He died 18th December, 1829.

The character of Lamarck as a naturalist is remarkable alike for its excellences and its defects. His excellences were width of scope, fertility of ideas, and a pre-eminent faculty of precise description, arising not only from a singularly terse style, but from a clear insight into both the distinctive features and the resemblances of forms. That part of his zoological work which still finds a large and important place in the science of the present day, and constitutes his solid claim to the highest honor as a zoologist, is to be found in his extensive and detailed labors in the departments of living and fossil *Invertebrata*. His endeavors at classification of the great groups were necessarily defective on account of the imperfect knowledge possessed in his time in regard to many of them, *e.g.*, echinoderms, ascidians, and intestinal worms; yet they are not without interest, particularly on account of the comprehensive attempt to unite in one great division as *Articulata* all those groups that appeared to present a segmented construction. Moreover, Lamarck was the first to distinguish vertebrate from invertebrate animals by the presence of a vertebral column, and among the Invertebrata to found the groups *Crustacea*, *Arachnida*, and *Annelida*. In 1785 (*Hist. de l'Acad.*) he evinced his appreciation of the necessity of natural orders in botany by an attempt at the classification of plants, interesting, though crude, and falling immeasurably short of the system which grew in the hands of his intimate friend Jussieu. The problem of taxonomy has never been put more philosophically than he subsequently put it in his *Animaux sans Vertèbres*: "What arrangement must be given to the general distribution of animals to make it conformable to the order of nature in the production of these beings?"

The most prominent defect in Lamarck must be admitted, quite apart from all consideration of the famous hypothesis which bears his name, to have been want of control in speculation. Doubtless the speculative tendency furnished a powerful incentive to work, but it outran the legitimate deductions from observation, and led him into the production of volumes of worthless chemistry without experimental basis, as well as into spending much time on fruitless meteorological predictions. His *Annuaires Météorologiques* were published yearly from 1800 to 1810, and were not discontinued until after an unnecessarily public and brutal tirade from Napoleon, administered on the occasion of being presented with one of his works on natural history.

To the general reader the name of Lamarck is chiefly interesting on account of his theory of the origin of life and of the diversities of animal forms. The idea, which appears to have been favored by Buffon before him, that species were not through all time unalterable, and that the more complex might have been developed from pre-existent simpler forms, became with Lamarck a belief or, as he imagined, a demonstration. Spontaneous generation, he considered, might be easily conceived as resulting from such agencies as heat and electricity causing in small gelatinous bodies a utricular structure, and inducing a "singular tension," a kind of "éréthisme" or "orgasme;" and, having thus accounted for the first appearance of life, he explained the whole organization of animals and formation of different organs by four laws:

"1. Life by its proper forces tends continually to increase the volume of every body possessing it, and to enlarge its parts, up to a limit which it brings about.

"2. The production of a new organ in an animal body results from the supervention of a new want (*besoin*) continuing to make itself felt, and a new movement which this want gives birth to and encourages.

"3. The development of organs and their force of action are constantly in ratio to the employment of these organs.

"4. All which has been acquired, laid down, or changed in the organization of individuals in the course of their life is conserved by generation and transmitted to the new individuals which proceed from those which have undergone those changes."

It is the second law which has been principally associated with Lamarck's name, and is often referred to as his hypothesis of the evolution of organs in animals by appetence or longing, although Lamarck does not teach that the animal's desires affect its conformation directly, but that altered wants lead to altered habits, which result in the formation of new organs as well as in modification, growth, or dwindling of those previously existing. Thus, he suggests that, ruminants being pursued by carnivora, their legs have grown slender; and, their legs being only fit for support, while their jaws are weak, they have made attack with the crown of the head, and the determination of fluids thither has led to the growth of horns. So also the stretching of the giraffe's neck to reach the foliage he supposes to have led to its elongation; and the kangaroo, sitting upright to support the young in its pouch, he imagines to have had its fore-limbs dwarfed by disuse, and its hind legs and tail exaggerated by using them in leaping. The length to which he carried such notions can be fairly estimated by the illustration which, long after the publication of his *Philosophie Zoologique*, he selected in the introduction to the *Hist. Nat. des Anim. sans Vert.* "I conceive that a gasteropod mollusc, which, as it crawls along, finds the need of touching the bodies in front of it, makes efforts to touch those bodies with some of the foremost parts of its head, and sends to these every time quantities of nervous fluids, as well as other liquids. I conceive, I say, that it must result from this reiterated afflux towards the points in question that the nerves which abut at these points will, by slow degrees, be extended. Now, as in the same circumstances other fluids of the animal flow also to the same places, and especially nourishing fluids, it must follow that two or more tentacles will appear and develop insensibly in those circumstances on the points referred to."

However absurd this may seem, it must be admitted that, unlimited time having been once granted for organs to be developed in series of generations, the objections to their being formed in the way here imagined are only such as equally apply to the theory of their origin by natural selection. Thus, for example, neither theory considers that it has to deal, not with crude heaps of mere functional organs, but with exquisitely orderly forms, nor accounts for the symmetrical first appearance of parts or for sex; nor though Lamarck tried hard, has he or any later writer reduced to physical law the rise of consciousness in association with structures which in their physical relations are mere mechanisms capable of reflex actions.

In judging the reasonableness of the second law of Lamarck as compared with more modern and now widely received theories, it must be observed that it is only an extension of his third law; and that third law is a fact. The strengthening of the blacksmith's arm by use is proverbially notorious. It is, therefore, only the sufficiency of the Lamarckian hypothesis to explain the first commencement of new organs which is in question, if evolution by the mere operation of forces acting in the inorganic world be granted; and surely the Darwinian theory is equally helpless to account for the beginnings of a new organ, while it demands as imperatively that every stage in the assumed hereditary development of an organ must have been useful.

Furthermore, to no writer more recent than Lamarck can be attributed the credit of first pointing attention to the repetition of acquired variations in the progeny, or the idea of weaving that fact into a theory of the origin of species. His words are:—"Everything which nature has caused individuals to acquire or lose by the influence of the circumstances to which their race is long exposed, and consequently by the influence of the predominant employment of such organ, or its constant disuse, she preserves by generation to the new individuals proceeding from them, provided that the changes are common to the two sexes, or to those which have produced these new individuals" (*Phil. Zool.*, i. 235). It is interesting to note in this passage that he hesitated to believe that peculiarities could become permanent unless possessed by both parents.

Notwithstanding his attempt to evolve all vital action from the forces at work in the inorganic world, Lamarck made a broad distinction between the "power of life," to which he attributed the production of "a real progression in the composition of the organization of animals," and the modifying effects of external circumstances. The existence of such a progression cannot now be doubted, and constitutes evolution in the only sense in which it is universally admitted. Lamarck, equally with Darwin, teaches the more speculative doctrine that the complex forms are descended from simpler ancestors. In the *modus operandi* by which they hold this to have been accomplished both have admitted the action of a variety of modifying circumstances. Lamarck gave great importance to the influence of new wants acting indirectly by stimulating growth and use. Darwin has given like importance to the effects of accidental variations acting indirectly by giving advantage in the struggle for existence. The speculative writings of Darwin have, however, been interwoven with a vast number of beautiful experiments and observations bearing on his speculations, though by no means proving his theory of evolution; while the speculations of Lamarck lie apart from his wonderful descriptive labors, unrelieved by intermixture with other matters capable of attracting the numerous class who, provided they have new facts set before them, are not careful to limit themselves to the conclusions strictly deducible therefrom. But those who read the *Philosophie Zoologique* will find how many truths often supposed to be far more modern are stated with abundant clearness in its pages. (J. CL.)

LAMARTINE, Alphonse Marie Louis de Prat de (1790–1869), poet, historian, and statesman, was born at Mâcon, France, on the 21st of October, 1790, and died at Passy on the 1st of March, 1869. The family of Lamartine was good, and the title of Prat was taken from an estate in Franche Comté. His father was imprisoned during the Terror, and only released owing to the events of the 9th Thermidor. Subsequently the family returned to the country. Lamartine's early education was received from his mother. He was sent to school at Lyons in 1805, but not being happy there, was transferred to the care of the Pères de la Foi at Belley, where he remained until 1809. For some time afterwards he lived at home, reading romantic and poetical literature, but in 1811, being then twenty years old, he set out on his travels for Italy, where he seems to have sojourned for nearly two years. His family having been steady royalists, he entered the Gardes du corps at the return of the Bourbons, and during the Hundred Days he sought refuge first in Switzerland and then at Aix en Savoie, where he fell in love, with abundant results of the poetical kind. After Waterloo he returned to Paris, and mixed a good deal in society. In 1818–1819 he revisited Switzerland, Savoy, and Italy, the death of his beloved affording him new subjects for verse. He had now got together a considerable body of poetry, and after some difficulties he got his first book, the *Méditations*, published (1820). It was exceedingly popular, and helped him to make a position. He had left the army for some time, and he now entered the diplomatic service and was appointed secretary to the embassy at Naples. On his way to his post he married at Geneva a young English lady, Marianne Birch, who had both money and beauty (1823), and in the same year his *Nouvelles Méditations* appeared. In 1824 he was transferred from Naples to Florence, where he remained for five years. His *Last Canto of Childe Harold* appeared in 1825, and he had to fight a duel with an Italian officer, Colonel Pepe, in consequence of a phrase in it. The *Harmonies Politiques et Religieuses* appeared in 1829, when he had left Florence. Having refused an appointment at Paris under the Polignac ministry (destined to be fatal to legitimism), he went on a special mission to Prince Leopold of Saxe-Coburg, who was not yet king of the Belgians, but was talked of as king of Greece. The next year he was elected to the Academy. Lamartine was in Switzerland, not in Paris, at the time of the revolution of July, and, though he put forth a pamphlet on *Rational Policy*, he did not take any active part in politics. In 1832 he set out with his wife and daughter for Palestine, having been unsuccessful in his candidature for a seat in the chamber. His daughter Julia died at Beyrout, and before long he received the news of his election by a constituency (Bergues) in the department of the Nord. He returned through Turkey and Germany, and made his first speech shortly after the beginning of 1834. Thereafter he spoke constantly, and acquired considerable reputation as an orator,—bringing out, moreover, many books in prose and verse. His Eastern travels (*Souvenirs d'Orient*) appeared in 1835, his *Jocelyn* in 1836, his *Chute d'un Ange* in 1838, and his *Recueillements*, the last remarkable volume of his poetry, in 1839. As the reign of Louis Philippe went on, Lamartine, who had previously been a liberal royalist, something after the fashion of Chateaubriand, became more and more democratic in his opinions. He set about his greatest prose work, the *Histoire des Girondins*, which at first appeared periodically, and was published as a whole in 1847. Like many other French histories, it was a pamphlet as well as a chronicle, and the subjects of Lamartine's pen became his models in politics. At the revolution of February Lamartine at once became one of the most important personages in France. He was one of the first to declare for a provisional government, and became a member of it himself, with the post of minister for foreign affairs. He was elected for the new constituent assembly in ten different departments, and was chosen one of the five members of the executive committee. For a few months indeed Lamartine, who for nearly thirty years had been a distinguished man of letters, an official of inferior rank in diplomacy, and an eloquent but unpractical speaker in parliament, became one of the foremost men in Europe. His own inexperience in the routine work of government, the utterly unpractical nature of his colleagues and of the constitution which they endeavored to carry out, and the turbulence of the Parisian mob proved fatal to his chances. During his brief tenure of office Lamartine gave some proofs of statesmanlike ability, notably in his reply to the deputation of United Irishmen who visited him in the hope that the new French democracy would take up the old hatred of the republic against England; and his eloquence was repeatedly called into requisition to pacify the Parisians. But no one can permanently carry on the government of a great country by speeches from the balcony of a house in the capital, and Lamartine found himself in a dilemma. So long as he held aloof from Ledru-Rollin and the more radical of his colleagues, the disunion resulting weakened the Government; as soon as he effected an approximation to them, the middle classes, who more in France than anywhere else were and are the arbiters of Governments, fell off from him. The quelling of the insurrection of the 15th May was his last successful act.

A month later the renewal of active disturbances brought on the fighting of June, and Lamartine's influence was extinguished in favor of Cavaignac. There is hardly another instance on record of so sudden an elevation and so rapid a fall. Before February, in 1848, Lamartine was, as has been said, a private person of talent and reputation; after June in the same year he was once more the same, except that his chance of political pre-eminence was gone. He had been tried and found wanting, having neither the virtues nor the vices of his situation. In January, 1849, though he was nominated for the presidency, only a few thousand votes were given to him, and three months later he was not even elected to the legislative assembly.

The remaining story of Lamartine's life is somewhat melancholy. He had never been a rich man, nor had he been a saving one, and during his period of popularity and office he had incurred great expenses. He now set to work to repair his fortune by unremitting literary labor. He brought out in the *Presse* a series of *Confidences*, and somewhat later a kind of autobiography, entitled *Raphael*, which treated his own experiences in romantic fashion. He began and finished several historical works of more or less importance, the *History of the Revolution of* 1848, *The History of the Restoration*, *The History of Turkey*, *The History of Russia*, besides a very large number of small biographical and miscellaneous works. In 1858 a subscription was opened for his benefit. Two years afterwards, following the example of Chateaubriand, he supervised an elaborate edition of his own works in forty-one volumes. This occupied five years, and while he was engaged on it his wife died (1863). He was now a man of more than seventy years old; his powers had deserted him, and even if they had not, the public taste had entirely changed, and was no longer disposed to welcome or enjoy his sentimental fashion of handling prose and poetry. His efforts had not succeeded in placing him in a position of comfort and independence; and at last, in 1867, the Government of the empire (from which he had perforce stood aloof, though he never considered it necessary to adopt the active protesting attitude of Quinet and Victor Hugo) came forward to his assistance, a vote of twenty thousand pounds being proposed in April of that year for his benefit by M. Emile Ollivier. In no other country than France would this have been anything but creditable to both parties, for Lamartine, both as a distinguished man of letters and as a past servant of the state, had every claim to the bounty of his country. But the bitter party feeling which animated the later years of the reign of Napoleon III. made the grant something of a party matter, and Lamartine was reproached for accepting it by the extreme republicans and irreconcilables. He did not enjoy it long, dying, as has been said, on the 1st of March, 1869, two years before the collapse of the empire.

As a statesman Lamartine was placed during his brief tenure of office in a position from which it would have been almost impossible for any man who was not prepared and able to play the dictator to emerge with credit. At no time in history, not even in the great revolution of sixty years earlier, were unpractical crotchets so rife in the heads of men as in 1848, and at no time was there such an absence of what may be called backbone in a nation as then in France. But Lamartine could hardly have guided the ship of state safely even in much calmer weather. Personally he was amiable and even estimable, the chief fault of his character being vanity and an incurable tendency towards theatrical effect, which makes his travels, memoirs, and other personal records, as well as his historical works, radically untrustworthy. Nor does it appear that he had any settled political ideas. He was first an ardent legitimist, then a liberal royalist, then a constitutionalist of an indefinite type, then a republican; and it does not appear that any of these phases was the result of reasoned conviction, but rather of a vague kind of sentiment and of the contagion of popular and prevalent ideas. In regard to money he was entirely disinterested, never obtaining or seeking any lucrative office. That he was quite so disinterested in the matter of personal vanity and ambition cannot perhaps be safely affirmed. He did good by moderating the revolutionary and destructive ardor of the Parisian populace in 1848; but he had been perhaps more responsible than any other single person for bringing about the events of that year by the vague and frothy republican declamation of his *Histoire des Girondins*. Altogether little more can be said of his political career than that he was the most striking if not the most successful instance of the French system, which has prevailed since the downfall of the first empire, of making literary success a direct road to political eminence.

More must be said of his literary position. Lamartine had the advantage of coming at a time when the literary field, at least in the departments of belles-lettres, was almost empty. The feeble school of descriptive writers, epic poets of the extreme decadence, fabulists, and miscellaneous verse-makers which the empire had nourished could satisfy no one, though its members still continued with unceasing fidelity to copy themselves and their models. Madame de Stael was dead; Chateaubriand, though alive, was something of a classic, and had not effected a full revolution. Lamartine did not himself go the complete length of the romantic revival, but he went far in that direction. He availed himself of the reviving interest in legitimism and Catholicism which was represented by Bonald and Joseph de Maistre. of the nature worship of Rousseau and Bernardin de St. Pierre, of the sentimentalism of Madame de Stael, of the mediævalism and the romance of Chateaubriand and Scott, of the *maladie du siècle* of Chateaubriand and Byron. Perhaps if his matter be very closely analyzed it will be found that he added hardly anything of his own. But if the parts of the mixture were like other things, the mixture itself was not. It seemed indeed to the immediate generation so original that tradition has it that the *Méditations* were refused by a publisher because they were in none of the accepted styles. They appeared, as has been said, in 1820, that is to say, when Lamartine was nearly thirty years old. The best of them and the best thing that Lamartine ever did is the famous *Lac*, describing his return to the little mountain tarn of Le Bourget after the death of his mistress, with whom he had visited it in other days. The verse is exquisitely harmonious, the sentiments conventional but refined and delicate, the imagery well chosen and gracefully expressed. There is indeed an unquestionable want of vigor, but to readers of that day the want of vigor was entirely compensated by the presence of freshness and grace. Lamartine's chief misfortune in poetry was that not only was his note a somewhat weak one, but that he could strike but one. The four volumes of the *Méditations*, the *Harmonies*, and the *Recueillements*, which contained the prime of his verse, are perhaps the most monotonous reading to be found anywhere in a work of equal bulk by a poet of equal talent. They contain nothing but meditative lyrical pieces, almost any one of which is typical of the whole, though there is of course considerable variation of merit. The two narrative poems which succeeded the early lyrics, *Jocelyn* and the *Chute d'un Ange*, were according to Lamartine's original plan, parts of a vast "Epic of the Ages," some further fragments of which survive, especially one of not a little merit which was published four years after the author's death in company with some youthful attempts at the classical tragedy and a few miscellanea. *Jocelyn* had at one time more popularity in England than most French verse. *La Chute d'un Ange*, in which the Byronic influence is more obvious than in any other of Lamartine's works, is more ambitious in theme and less regulated by scrupulous conditions of delicacy in handling than most of its author's poetry. It does, however, little more than prove that such audacities were not for him.

As a prose writer Lamartine was, as may be seen from what has been said (and many of his works have not been mentioned), very fertile. His characteristics in his prose fiction and descriptive work are not very different from those of his poetry. He is always and everywhere sentimental, though very frequently, as in his shorter prose tales (*The Stone Mason of St. Point*, *Grasiella*, etc.), he is graceful as well as sentimental. In his histories, the style being one for which he was radically unfitted, the effect is worse. It has been hinted that Lamartine's personal narratives are doubtfully trustworthy; indeed with regard to his Eastern travels some of the episodes were stigmatized as mere inventions by persons who had every reason to be well informed and none to bear false witness. In his histories proper the special motive for embellishment—falsification would be too rough a word—for the most part disappears, but the habit of inaccuracy remains. Lamartine as an historian belongs exclusively to the rhetorical school as distinguished from the philosophical on the one hand and the documentary on the other.

It is not surprising when these characteristics of Lamartine's work are appreciated to find that his fame has declined with singular rapidity in France. As a poet indeed he had lost his reputation many years before he died. He was entirely eclipsed by the brilliant and vigorous school who succeeded him, with Victor Hugo at their head. It is possible that the *Chute d'un Ange* was an effort to compete with them on their own ground; if so, it was an entire failure. Lamartine's power of initiative in poetry was very small, and the range of poetic ground which he could cover strictly limited. He did not attempt the great task of the day, the freeing of the Alexandrine from the restraints imposed upon it, and the devising or reviving of new lyric metres to refresh and invigorate French poetic style.. He could only carry the picturesque sentimentalism of Rousseau, Bernardin de St. Pierre, and Chateaubriand a little further, and clothe it in language and verse a little less antiquated than that of Chênedollé and Millevoye. He has been said to be a French Cowper, and the parallel holds good in respect of versification and of his relative position to the more daringly innovating school that followed, though not in respect of individual peculiarities. Lamartine in short occupied a kind of half-way house between the 18th century and the Romantic movement, and he never got any further. When a living English critic questioned his importance in conversation with Saint-Beuve, the answer was, "He is important to *us*," and it was a true answer; but his importance is now chiefly historical, even to Frenchmen.

The already mentioned edition is the most complete one of Lamartine, but there are many issues of his separate works. Since his death, besides the poems already mentioned, some *Mémoires Inédits* of his youth have been published, and also two volumes of correspondence. (G. SA.)

LAMB, CHARLES (1775–1834), an original and delightful English essayist and critic, was born in Crown Office Row, Inner Temple, London, February 10, 1775. His father, John Lamb, a Lincolnshire man, who filled the situation of clerk and servant companion to Mr. Salt, one of the benchers of the Inner Temple, was successful in obtaining for Charles, the youngest of three children, a presentation to Christ's Hospital, where the boy remained from his eighth to his fifteenth year (1782–1789). Here he was fortunate enough to have for a schoolfellow the afterwards famous Samuel Taylor Coleridge, his senior by rather more than two years, and a close and tender life-long friendship began which had a singularly great influence on the whole of his after career. When the time came for leaving school, where he had learned some Greek and acquired considerable facility in Latin composition, Lamb, after a brief stay at home (spent, as his school holidays had often been, over old English authors in the library of Mr. Salt), was condemned to the labors of the desk,—an "unconquerable impediment" in his speech disqualifying him for a school exhibition, and thus depriving him of the only means by which he could have obtained a university education. For a short time he held a clerkship in the South Sea House under his elder brother John, and in 1792 he entered the accountant's office in the East India House, where during the next three and thirty years the hundred folios of what he used to call his true "works" were produced. A dreadful calamity soon came upon him, which seemed to blight all his prospects in the very morning of life. There was insanity in the family, which in his twenty-first year had led to his own confinement for some weeks in a lunatic asylum; and, a few months afterwards, on the 22d of September, 1796, his sister Mary, "worn down to a state of extreme nervous misery by attention to needle-work by day and to her mother by night," was suddenly seized with acute mania, in which she stabbed her mother to the heart. The calm self-mastery and loving self-renunciation which Charles Lamb, by constitution excitable, nervous, and timid, displayed at this crisis in his own history and in that of those nearest him, will ever give him an imperishable claim to the reverence and affection of all who are capable of appreciating the heroisms of common life. His sister was of course immediately placed in confinement, and with the speedy return of comparative health came the knowledge of her fatal deed; himself calm and collected, he knew how to speak the words of soothing and comfort. With the help of friends he succeeded in obtaining her release from the life-long restraint to which she would otherwise have been doomed, on the express condition that he himself should undertake the responsibility for her safe keeping. It proved no light charge; for, though no one was capable of affording a more intelligent or affectionate companionship than Mary Lamb during her long periods of health, there was ever present the apprehension of the recurrence of her malady; and when from time to time the premonitory symptoms had become unmistakable, there was no alternative but her removal, which took place in quietness and tears. How deeply the whole course of Lamb's domestic life must have been affected by his singular loyalty as a brother need not be pointed out; for one thing, it rendered impossible his union with Alice Winterton, whom he appears to have truly loved, and to whom such touching reference was made long afterwards in *Dream Children, a Reverie*.

Lamb's first appearance as an author was made in the year of the great tragedy of his life (1796), when there were published in the volume of *Poems on Various Subjects* by Coleridge four sonnets by "Mr. Charles Lamb of the India House." In the following year he also contributed along with Charles Lloyd some pieces in blank verse to Coleridge's new volume of *Poems*. In 1798 he published a short and pathetic prose tale entitled *Rosamund Gray*, and in 1799 he was associated with Coleridge and Southey in the publication of the *Annual Anthology*, to which he had contributed a short religious poem in blank verse entitled "Living without God in the World;" the company in which he was thus found brought upon him the irrelevant and pointless ridicule of Canning and Gillray. His next public appearance was not more fortunate. His *John Woodvil* (1801), a slight dramatic piece, written in the style of the earlier Elizabethan period, and containing some genuine poetry and happy delineation of the gentler emotions, but as a whole deficient in plot, vigor, and character, was held up to ridicule by the *Edinburgh Review* as a specimen of the rudest condition of the drama, a work by "a man of the age of Thespis." The dramatic spirit, however, was not thus easily quenched in Lamb. His next effort (1806) was a farce, named *Mr. H.*, the point of which lay in the hero's anxiety to conceal his name, "Hogsflesh;" it has recently been put upon the boards with success in America, but in London it did not survive the first night of its appearance. Its author bore the failure with rare equanimity and good humor, and soon struck into new and more successful fields of literary exertion. In 1807 appeared *Tales founded on the Plays of Shakespeare*, written by Charles and Mary Lamb; and in 1808 *Specimens of English Dramatic Poets who lived about the time of Shakespeare*, with short but felicitous critical notes. In the same year Mary Lamb, assisted by her brother, also published *Poetry for Children* and a collection of short school-girl tales under the title *Mrs. Leicester's School;* and to the same date belongs the *Adventures of Ulysses*, designed by Lamb as a companion to the *Adventures of Telemachus*. In 1810 began to appear Leigh Hunt's quarterly periodical, *The Reflector*, in which Lamb published much (including the essays on the tragedies of Shakespeare and on Hogarth) that subsequently appeared in the first collective edition of his *Works* (2 vols. 12mo.), which appeared in 1818. The establishment of the *London Magazine* in 1820 stimulated him to the production of a series of new essays which rose into instant popularity, and may be said to form the chief corner-stone in the small but classic temple of his fame. The first of these, as it fell out, was a description of the old South Sea House, with which Lamb happened to have associated the name of a "gay light-hearted foreigner" called Elia, who had frequented it in the days of his service there. The pseudonym adopted on this occasion was retained for the subsequent contributions which appeared collectively in a post 8vo. volume of *Essays* in 1823. After a brief career of five years the *London Magazine* came to an end; and about the same period Lamb's long connection with the India House terminated, a pension of about £450 having been assigned to him. The increased leisure, however, for which he had long sighed did not prove favorable to literary production, which henceforth was limited to a few trifling contributions to the *New Monthly* and other serials. The malady of his sister, which continued to increase with ever shortening intervals of relief, broke in painfully on his lettered ease and comfort; and it is unfortunately impossible to ignore the deteriorating effects of an over-free indulgence in the use of tobacco and alcohol on a temperament such as his. His removal on account of his sister to the quiet of the country, by tending to withdraw him from the stimulating society of the large circle of literary friends who had helped to make his Wednesday evening "at homes" so remarkable, doubtless also tended to intensify his listlessness and helplessness. One of the brightest elements in the closing years of his life was the friendship and companionship of Emma Isola, whom he and his sister had adopted, and whose marriage in 1833 to Mr. Moxon, though a source of unselfish joy to Lamb, left him more than ever alone. While living at Edmonton, he was overtaken by an attack of erysipelas brought on by an accidental fall as he was walking on the London road; after a few days' illness he painlessly passed away on December 27, 1834. The sudden death of one so widely known, admired, and beloved as Charles Lamb fell on the public, as well as on his own attached circle, with all the poignancy of a personal calamity and a private grief. His memory wanted no tribute that affection could bestow, and Wordsworth has commemorated in simple and solemn verse the genius, virtues, and fraternal devotion of his early friend.

In depth of thought and splendor of genius Charles Lamb was surpassed by not a few of his contemporaries, but as an essayist he is entitled to a place beside Montaigne, Sir Thomas Browne, Steele, and Addison. He unites many of the characteristics of each of these writers,—refined wit, exquisite humor, a genuine and cordial vein of pleasantry, and heart-touching pathos. His fancy as an essayist is distinguished by great delicacy and tenderness; and even his conceits are imbued with human feeling and passion. He had an extreme and almost exclusive partiality for our earlier prose writers, particularly for Fuller, Browne, and Burton, as well as for the dramatists of Shakespeare's time; and the care with which he studied them is apparent in all he ever wrote. It shines out conspicuously in his style, which has an antique air, and is redolent of the peculiarities of the 17th century. Its quaintness has subjected the author to the charge of affectation, but there is nothing really affected in his writings. His style is not so much an imitation as a reflection of the older writers; for in spirit he made himself their contemporary. A confirmed habit of studying them in preference to modern literature had made something of their style natural to him; and long experience had rendered it not only easy and familiar but habitual. It was not a masquerade dress he wore, but the costume which showed the man to most advantage. With thought and meaning, often profound, though clothed in simple language, every sentence of his essays is pregnant, and in this respect he bears a strong resemblance to the writers already named. If he had their manner, he possessed their spirit likewise. To some of his essays and specimens we are considerably indebted for the revival of the dramatic writers of the Shakespearean age; for he preceded Gifford and others in wiping the dust of ages from the works of these authors. In his brief comments on each specimen he displays exquisite powers of discrimination; his discernment of the true meaning of his author is almost infallible. As a poet Lamb is not entitled to so high a place as that which can be claimed for the essayist and critic. His dependence on Elizabethan models is here also manifest, but in such a way as to bring into all the greater prominence his native deficiency in "the accomplishment of verse." Yet it is impossible, once having read, ever to forget the tenderness and grace of such verses as those to Hester Savory and on "The Old Familiar Faces," or the quaint humor of "A Farewell to Tobacco." As a letter-writer also Lamb is entitled to rank very high.

The *Letters* of Charles Lamb, with a sketch of his life by one of his executors, Sir Thomas Noon Talfourd, appeared in 2 vols. in 1837, and *Final Memorials of Charles Lamb*, by the same hand, were published in 1848. Supplementary to these is the *Memoir* by another personal friend, B. W. Procter (Barry Cornwall), published in 1866. See also Fitzgerald's *Charles Lamb, his Friends, his Haunts, and his Books*, 1866; Cradock's *Charles Lamb*, 1867; and Carew Hazlitt's *Mary and Charles Lamb: Poems, Letters, and Remains*, 1874. There have been several complete editions of the *Works* of Lamb; of these the fullest as well as most recent is that of Fitzgerald (*Life, Letters, and Writings of Charles Lamb*, 6 vols., 1870–76).

LAMBALLE, MARIE THÉRÈSE LOUISE DE SAVOIE-CARIGNAN, PRINCESSE DE (1749–1792), daughter of Louis Victor of Carignan, was born at Turin, 8th September, 1749. In 1767 she was married to Sanislaus, prince of Lamballe, and son of the duke of Penthièvre. After his death in the following year an unsuccessful attempt was made to arrange a marriage between her and Louis XV. She then retired from the court; but, having accidentally made the acquaintance of Marie Antoinette, she was after the accession of Louis XVI. appointed by the queen superintendent of the royal household, and enjoyed her closest intimacy and friendship. In 1792 she shared for a week her imprisonment in the Temple, but on the 19th August she was transferred to La Force, and, having refused the oath against the monarchy, she was on September 3d delivered over to the fury of the populace, after which her head was placed on a pike and carried before the windows of the imprisoned queen.

See Lescure, *La Princesse de Lamballe*, 1869; and Fassy, *Louise de Savoie-Carignan, Princesse de Lamballe, et la Prison de La Force*, 1868.

LAMBERT, JOHANN HEINRICH (1728–1777), physicist and mathematician, was born at Mulhausen, Alsace, August 29, 1728. He was the son of a tailor; and the slight elementary instruction he obtained at the small free school of his native town was supplemented altogether by his own private reading. Having cultivated a good style of penmanship, he became bookkeeper at Montbéliard ironworks, and subsequently (1745) secretary to Professor Iselin, the editor of a newspaper at Basel, who three years later recommended him as private tutor to the family of President A. von Salis of Coire. Coming thus into virtual possession of a good library, Lambert had peculiar opportunities for improving himself in his literary and scientific studies. In 1759, after completing with his pupils a lengthened tour of two years' duration through Göttingen, Utrecht, Paris, Marseilles, and Turin, he resigned his tutorship and settled at Augsburg. Munich, Erlangen, Coire, and Leipsic became for brief successive intervals his home. Finally in 1764 he removed to Berlin, where he received many favors at the hand of Frederick, was elected a member of the Royal Academy of Sciences, and ultimately (1774) undertook the editing of the astronomical almanac. On September 25, 1777, he died of consumption, the natural result of a life spent in excessive application to all kinds of mental labor. Seventeen hours daily were devoted by him to reading and writing; and, as might have been expected in the case of one who wrote so much, many of his numerous publications are of little permanent interest. Not a few, however, are very valuable, and show him to have been a man of original and active mind with a singular facility in applying mathematics to practical questions.

Lambert's most important work, *Pyrometrie* (Berlin, 1779), is a systematic treatise on heat, containing the records and full discussion of many of his own experiments. Worthy of special notice also are *Photometria*, Augsburg, 1760; *Insigniores orbitæ Cometarum proprietates*, Augsburg, 1761; and *Beiträge zum Gebrauche der Mathematik und deren Anwendung*, 4 vols., Berlin, 1765–72.

The *Memoirs* of the Berlin Academy from 1761 to 1784 contain many of his papers, which treat of such subjects as resistance of fluids, magnetism, comets, probabilities, the problem of three bodies, meteorology, etc. In the *Acta Helvetica* (1752–60) and in the *Nova Acta Erudita* (1763–69) several of his contributions appear. In Bode's *Jahrbuch* (1776–80) he discusses nutation, aberration of light, Saturn's rings, and comets; in the *Nova Acta Helvetica* (1787) he has a long paper "Sur le Son des Corps Elastiques;" in Bernoulli and Hindenburg's *Magasin* (1787–88) he treats of the roots of equations and of parallel lines; and in Hindenburg's *Archives* (1798–99) he writes on optics and perspective. Many of these pieces were found among his effects after his death, and published posthumously. Recognized as among the first mathematicians of his day, he was also widely known for the universality and depth of his philological and philosophical knowledge. The most valuable of his logical and philosophical memoirs were published collectively in 2 vols., 1782. See Huber's *Lambert nach seinem Leben und Wirken.*

LAMBERT, JOHN (1619–1694), was born in 1619 at Calton Hall in the parish of Kirkby Malham, in the West Riding of Yorkshire. His family was of ancient lineage, and long settled in the county. He studied at the Inns of Court, but without making the law his profession. In 1640 he married Frances, daughter of Sir William Lister. He was present at the great meeting of the Yorkshire gentry on Heyworth Moor (3d June, 1642), and in September was appointed a captain of horse under Lieutenant-Colonel Fairfax. He did good service at the siege of Hull (11th October, 1642), at Bradford (5th March, 1644), and at the important engagement at Selby (10th April, 1644). At Marston Moor (2d July, 1644) he commanded part of Sir Thomas Fairfax's cavalry on the right wing. He was sent into York to arrange terms for the surrender of the city, which took place July 16, 1644. When the "New Model" army was formed in the beginning of 1645, Colonel Lambert was appointed commissary-general of the army in the north. He beat the royalists at Keighley and Ferrybridge, and took several strong places. He followed Fairfax's campaign in the west of England in 1646, and was a commissioner with Cromwell and others for the surrender of Oxford in the same year.

When the quarrel between the army and the parliament began, Lambert threw himself warmly into the army's cause. He is said by Clarendon to have assisted Ireton in drawing up the several addresses and remonstrances issued by the army, both men having some experience in the law, and being "of a subtle and working brain." In August, 1647, Lambert was sent as major-general by Fairfax to take charge of the forces in the northern counties. His wise and just managing of affairs in those parts is commended by Whitelocke. He displayed personal courage in suppressing a mutiny among his troops, kept strict discipline, and showed much diligence in hunting down the moss-troopers who infested the moorland country.

When the Scotch army under the marquis of Hamilton invaded England in the summer of 1648, Lambert was obliged to retreat till Cromwell came up from Wales, and joining him destroyed the Scotch army in three days' fighting from Preston to Warrington. Lambert pressed Hamilton with the cavalry, and took him prisoner at Uttoxeter, a few days after the battle. He then marched back into Scotland, where he was left in charge of the troops. In December, 1648, he sat down before Pontefract Castle, which held out till March, 1649. Lambert was thus absent from London at the time of the violence put upon the parliament by Colonel Pride, and the other measures which led to the king's death.

Cromwell, when appointed to the command of the war in Scotland (26th July, 1650), took Lambert with him as major-general. He was wounded at Musselburgh, but was with Cromwell at Dunbar on the 2d of September, when the soldiers begged that Lambert might lead them the next day, and Cromwell willingly gave his consent. He defeated the "Protesters" or "Western Whigs" at Hamilton, on the 1st of December, 1650. In the following July he was sent over into Fife to get a position in the rear and flank of the Scotch army near Falkirk, and force them to decisive action by cutting off their supplies from Perth. A battle fought at Inverkeithing, with heavy loss to the Scots, in which Lambert behaved with great gallantry, gave him the position he required, and he improved it by taking Inchgarvie and Burntisland. Charles now (as Lambert had foreseen) made for England. Lambert with the cavalry was ordered to harass his march down the western shires, while Cromwell followed through Yorkshire and the Midlands. In the action at Warrington Bridge Lambert again distinguished himself by his personal courage, and at Worcester also (3d September, 1651), where he commanded the forces on the eastern bank of the Severn, and had his horse shot under him. Parliament now conferred on him a grant of lands in Scotland worth £1000 per annum.

In November, 1651, he was made a commissioner to settle the affairs of Scotland, and on the death of Ireton he was appointed lord deputy of Ireland in February, 1652. He accepted the office with pleasure; but his magnificent preparations offended the Commons, who limited his office to the term of six months. Lambert thereupon resigned the deputyship without entering on its duties.

Notwithstanding this affront Lambert took part with Cromwell in the expulsion of the Rump (20th April, 1653) and its council of state. He was joined to the lord-general and two others as additional members of the little parliament of nominees, making up the number to one hundred and forty-four. He presented the act of resignation of that assembly, and was principally concerned in drawing up the address requesting Cromwell to assume the protectorate, and the Instrument of Government, which was the constitution of the Protectoral rule. At the installation of Cromwell he bore a prominent part. In the parliament of 1654, and again in 1656, Lambert (or Lord Lambert as he is now generally called) sat as member for the West Riding of Yorkshire. When the proposal to declare Oliver king was started in parliament (February, 1657) he at once declared strongly against it. A hundred officers headed by Fleetwood and Lambert waited on the Protector, and begged him to put a stop to the proceedings. Lambert was not convinced by Cromwell's arguments, and Cromwell and he henceforward never spoke to each other as friends. On his refusal to take the official oath of allegiance to the Protector, Cromwell deprived him of his commissions, giving him, however, a pension of £2000 a year. He retired to his house and garden at Wimbledon, and appeared no more in public during Oliver Cromwell's lifetime.

On the accession of Richard he seems to have expected the first place in the army, but was not unwilling to be second to Fleetwood. The Protector was between two parties—the court party, who wished to hold to the "Petition and Advice," and the army party or Wallingford House party, who, whilst supporting Richard as Protector, wished to put the control of the army into stronger hands. Richard saw that to deliver up the power of the sword was to abdicate, and refused to make Fleetwood general. Lambert was elected for Pontefract in Richard's parliament, and took part with the republican malcontents who soon combined with Wallingford House. Councils of officers were held, which Lambert, though holding no commission, was invited to attend. They determined to stand by the "good old cause" and to demand the dissolution of the parliament as being too full of monarchical and Presbyterian notions—in fact, to put the civil power aside and set up a military government in its stead. The Protector dissolved parliament (22d April, 1659). The officers, unable to rule without a parliament, restored the Rump as representing the Commonwealth (7th May, 1659). Richard's Protectorate had practically ended with his parliament, and he now laid down the show of royalty. Sir George Booth and Sir Thomas Middleton headed a royalist rising in Cheshire, which Lambert put down after a sharp encounter near Chester. He promoted a petition from his army that Fleetwood might be made lord-general and himself major-general. The republican party in the house took offence. The Commons (12th October, 1659) cashiered Lambert, Desborough, and other officers, and retained Fleetwood's commission as chief of a military council of seven, republicans of the old sort. Lenthall, the speaker, was to give his orders to the army. On the next day (13th October) Lambert caused the doors of the House to be shut and the members kept out. On the 26th a "committee of safety" was appointed, of which Lambert was a member. He was also appointed major-general of all the forces in England and Scotland, Fleetwood being general. Lambert was now sent with a large force to meet Monk, who was in command of the English forces in Scotland, and either negotiate with him or force him to terms. Monk, however, declared for the liberty and authority of parliament, and set his army in motion southward. The committee of safety was obeyed no more than the Rump had been. The soldiers themselves cried out for the restoration of parliament, and on the 26th of December the Rump was recalled to restore some appearance of lawful authority.

Meanwhile the bulk of Lambert's army was dissolved by the mere appearance of Lord Fairfax in arms on Marston Moor, and he was kept in suspense by Monk's deceits and delays, till his whole army fell from him, and he came back to town almost alone. Monk marched unopposed to London, and declared for a "free parliament." The "excluded" Presbyterian members were recalled. Lambert was sent to the Tower (3d March, 1660), from which he escaped a month later (9th April, 1660). He tried to rekindle the civil war in favor of the Commonwealth, but was speedily recaptured, and sent back to the Tower (24th April). On the Restoration he, along with Vane, was exempted from danger of life by an address of both Houses to the king. The next parliament (1662) brought a charge of high treason against them. Vane was beheaded, but Lambert was spared, and remained in custody in the island of Guernsey for the remainder of his life. He died at the age of seventy-five in 1694.

Lambert would have left a better name in history if he had been a Cavalier. His genial, ardent, and excitable nature, easily raised and easily depressed, was more akin to the royalist than the puritan spirit. Vain and sometimes overbearing, as well as ambitious, he believed that Cromwell could not stand without him, and, when Cromwell was dead, he imagined himself equal to succeed him, and thought the first place must be his by right. Yet his ambition was less selfish than that of Monk. Lambert is accused of no ill faith, no want of generosity, no cold and calculating policy. Lambert was not merely a soldier. He was an able writer and speaker, and an accomplished negotiator, and took pleasure in quiet and domestic pursuits. He learnt his love of gardening from Lord Fairfax, who was also his master in the art of war. He painted flowers, besides cultivating them, and incurred the blame of Mrs. Hutchinson by "dressing his flowers in his garden and working at the needle with his wife and his maids." He made no special profession of religion; but no imputation is cast upon his moral character by his detractors. It has been said that he became a Roman Catholic before his death. (F. W. C.*)

LAMBESE, or **Lambessa**, the ancient *Lambæsa* and the *Tazzut* or *Tezzulet* of the natives, is situated in the French province of Constantine in Algeria, about 6 miles east of Batna. The modern village is well known for its great convict establishment (founded about 1850); and the remains of the Roman town, and more especially of the Roman camp, in spite of the wanton vandalism to which they have been more than once subjected since their discovery, are among the most interesting in Northern Africa. The ruins of the town are situated on the lower terraces of the Jebel Aures, and consist of triumphal arches, temples, aqueducts, and an immense quantity of ordinary masonry evidently belonging to private houses. To the north and east lie extensive cemeteries with the stones still standing in their original alignments; to the west is a similar area, from which, however, the stones have been largely removed for building the modern village. Of the temples the most noteworthy are those to Æsculapius and Health (Salus), and to Isis and Serapis. About two-thirds of a mile from the town on the level ground of the plain of Batna stands the camp. It measures 1640 feet from north to south by 1476 feet from east to west, and in the middle rise the ruins of a prætorium. This noble building is 92 feet long by 66 feet broad and 49 feet high; its southern façade has a splendid peristyle half the height of the wall, consisting of a front row of massive Ionic columns and an engaged row of Corinthian pilasters. The ruins of both city and camp have yielded a rich harvest of inscriptions (Renier edited 1500, and there are 4185 in the *Corpus Inscr. Lat.*, vol. viii.); and, though a very large proportion are epitaphs of the barest kind, the more important pieces supply a fair outline of the history of the place.

Lambæsa was emphatically a military foundation. The camp of the third legion (Legio III. Augusta), to which it owes its origin, appears to have been established between 123 and 129 A.D., in the time of Hadrian, whose address to his soldiers was found inscribed on a pillar in a second camp to the west of the great camp still extant. By 166 mention is made of the decurions of a *vicus*, 10 curiæ of which are known by name; and the vicus became a municipium probably at the time when it was made the capital of the newly founded province of Numidia. The legion was removed by Gordianus, but restored by Valerianus and Gallienus; and its final departure did not take place till after 392. The town soon afterwards declined. It never became the seat of a bishop, and no Christian inscriptions have been found among the ruins.

See Bruce; Peyssonnel; L. Renier, *Inscriptions romaines de l'Algérie*, Paris, 1855; Gustav Wilmann, "Die Röm. Lagerstadt Afrikas," in *Commentationes phil. in honorem Th. Mommseni*, Berlin, 1877; Playfair, *Travels in the Footsteps of Bruce*, London, 1877. A ground plan of the ruins is given in *Mém. des Antiq. de France*, tom. xxi.

LAMBETH. See **London**.

LAMECH, לֶמֶךְ, is a name which appears in each of the antediluvian genealogies, Gen. iv. 16–24 and Gen. v. In the first he is a descendant of Cain, and through his three sons father of the several avocations of early civilization; in the latter he is father of Noah. In each case, though in different senses, he marks the close of the first epoch of the world's history. Since the publication of Buttmann's *Mythologus* it has come to be generally recognized that the two genealogies terminating in Lamech are divergent forms of a single list. The parallelism of the two is not confined to the identical names, Lamech and Enoch. Methuselah (Μαθουσαλα), not Methusael, is the true reading of the LXX. in Gen. iv. 18, and there are some textual grounds for thinking that in the same verse Mehujael has displaced an older reading Mahalaleel. Kainan again is closely akin to Cain, and there is also a less close resemblance between Jared and Irad, while Enos (Enosh) and Adam both mean *man*. Thus the two series beginning with Enosh and Adam and ending in Lamech do not vary more than is often the case with different recensions of ancient name lists. See especially Lagarde, *Orientalia*, ii. 33 *sq*. Again it has been pointed out, especially by Wellhausen, *Jahrb. f. D. Theol.*, 1876, p. 400 *sq.*, that Gen. iv. 16–24 is in its original conception quite distinct from the history of the curse of Cain (Gen. iv. 1–15), and offers the history of the beginnings of existing civilization (verse 20 *sq.*), not of a civilization extinguished by the flood; and the continuation of this narrative is plausibly sought in the history of the tower of Babel, according to which the human race entered Babylonia from the east (comp. iv. 16 with xi. 2), whereas the movements of the sons of Noah start from Ararat. On this view we are to suppose that the oldest literary source of the Hebrew history of the origins of our race ignored the flood, and traced the beginnings of city life to a land east of Eden (Nod), which has no place in later geography, and of which Cain was the first settler. Lamech is a descendant of Cain, under whose sons the different special avocations of a very primitive civilization differentiate themselves. The mass of the people are tent dwellers and shepherds, their "father" or the patron of their occupation being Jabal; but the arts are also developed in two branches, the "father" of minstrelsy being Jubal, while the art of metallurgy is traced back to Tubal Cain (LXX. simply θοβελ). The etymologies of the proper names throw little light on this interesting conception; that of Lamech is quite obscure,[1] and the names of the sons, if they are Semitic, may be all derived from the root יבל, expressing the notion of "offspring." It is indeed conceivable that some of the names are of non-Semitic origin; *tápûl* in Persian and Turkish means bronze, and the nation of Tubal was known to the Hebrews for bronze-work (Ezek. xxvii. 13), which would go well enough with the fact that Kayn in Arabic means a smith. But on the other hand the wives and daughters of Lamech, as well as the other two sons, have names that point naturally to Hebrew roots, so that it is very doubtful how far one is entitled to press these foreign analogies in explaining what is certainly one of the oldest Hebrew traditions.

What we read in Genesis of Lamech and his race seems to be a mere fragment of an older and more copious tradition. He has two wives—Adah (עָדָה, "ornament"?), a name which reappears in Gen. xxxvi., in the genealogy of the Edomites, and Zillah (צִלָּה, "shadow"). Ewald gives to these names a mythological color by making Adah mean "aurora" (Arabic *ghadât*) in contrast to Zillah, "shadow;" but in that case we should expect the LXX. to transcribe the word by Γαδα, not Αδα, as Irad is rendered Γαιδαδ. At the same time the unquestionable occurrence of names of gods in the Edomite genealogy where Adah recurs favors the view that something of the same sort may be found in Gen. iv. 16 *sq.* On the other hand it is certainly important that the sons of Lamech form two brotherhoods (verse 21) divided by their maternal descent. The fathers of pastoral life and minstrelsy stand apart from the father of metallurgy and his sister Naamah. Handicraft especially in metals is generally practised by foreigners among the Semitic nomads, so that Tubal Cain may very well represent another race, such as the non-Semitic people which introduced metallurgy in Chaldæa according to Assyriologists. The name Naamah ("gracious") is so plainly akin to the divine name Naaman (No'mân, Adonis) that we can scarcely refuse to compare what is said of her brother with the Phœnician legend in Philo Byblius (Euseb., *Pr. Ev.*, I. x. 9) of two brothers, inventors of iron and iron-working, of whom one named Chrysor was skilled in sayings, incantations, and divination, and was worshipped as a sort of Phœnician Hephæstus. The details of Phœnician legend, however, in this as in other cases, are widely divergent from the Bible story.

The savage "sword song" of Lamech is unique in the Bible, and breathes the true spirit of the desert:—

Adah and Zillah, hear my voice;
Ye wives of Lamech, give ear unto my speech.
I slay a man for a wound,
A young man for a stroke;
For Cain's vengeance is sevenfold,
But Lamech's seventyfold and seven.

In the other form of the genealogy the line of Lamech is dissociated from the guilty Cain and leads up to Noah. This form of the tradition is much more recent, belonging to the Levitical or priestly narrator. Its chief importance is that it shows how inseparably Lamech and his genealogy were connected with the ancestry of the Hebrew race.

LAMEGO, a town in the district of Vizeu, in the province of Beira, Portugal, is situated 6 miles south of the Douro, and about 50 miles east of Oporto. As the seat of a bishop, it contains a Gothic cathedral, a part of which is referred to the 14th century. One of the churches was formerly a Moorish mosque, and, though intrinsically commonplace, enjoyed for a long time an undeserved fame as the meeting-place of the cortes said to have been convened in 1143 or 1144 by Alphonso Henriquez, the first king of Portugal, to settle the royal succession and to determine the laws of the country. But within the last forty years it has been pretty clearly demonstrated that no such cortes ever met. To archæologists the ancient bath preserved at Lamego will afford more interest than the old Moorish castle, which crowns the hill on which the city stands. Numbers of swine are reared in the neighborhood, which furnish the well-known Lisbon hams. The old name of Lamego was Lama or Lamacœni. Under the Moors, who were driven out in 1038 by Ferdinand of Castile, it was a leading city. The population in 1878 was 8383.

LAMENNAIS, HUGUES FÉLICITÉ ROBERT DE (1782–1854), French theologian, philosopher, and political writer, was born at St. Malo in Brittany. His father, Pierre Louis Robert, merchant and shipowner, had been ennobled by Louis XVI. because of aid to royal naval armaments and for importing and selling corn at easy prices in a time of public distress. His property of La Mennais, with the feudal prefix De, gave him a new surname. His wife was as noted for her saintly temper as her humane husband for skepticism. The death of his mother and his father's bankruptcy deprived young Lamennais early of regular education. An eccentric uncle got charge of him, and for years the freedom of this uncle's library was all his training. His elder brother Jean, priest, educationist, and author, had taught him the elements of Latin, and by his own further efforts he comprehended Livy at ten. Well read in Rousseau at twelve, he criticised religion so adroitly with the parish priest that he could not be admitted to communion. In 1796 he sent a discourse combating modern philosophy to a provincial academy. He visited Paris with his father next year, where he wrote democratic letters to the newspapers. On his return he joined his brother for study at a house near Dinan called La Chenaie, built by their maternal grandfather. Greek, Latin, Hebrew, modern languages, the church fathers, the controversialists, and historians occupied him. Religious struggle, and an intense melancholy, aided it may be by the *malheureuse passion* which he is said to have suffered from, account for the fact that he was twenty-two before taking his first communion, though in direct preparation for the clerical life.

In 1808 his hand found its proper work. His *Reflections on the State of the Church during the 18th Century and on the Actual Situation*, published anonymously at Paris, was the first important theological stand made against the materialistic philosophy which had its apotheosis in imperialism. Napoleon's police seized the book as dangerously ideological, with its eager recommendation of religious revival and active clerical organization. It awoke the ultramontane spirit which has played so great a part since in the politics of churches and states. But Lamennais was not yet ready for the contest. Pious exaltation of spirit was his prevailing mood, as is shown by his translation next year of the *Spiritual Guide* of the ascetic Blosius. Indeed, to the end of his life there is recurrence to what may be called poetic religious feeling, one of his latest reliefs from the storms of political struggle being a translation of the Gospels. In 1811 he took the tonsure, but shortly after became teacher of mathematics in the seminary founded by his brother at St. Malo. Theological politics had large discussion after the concordat of 1802, by which the Gallican Church was re-established; and the brothers' joint work, *Tradition upon the Institution of Bishops*, which was published a few days after the restoration, condemns the Gallican principle which allowed bishops to be created irrespective of the pope's sanction.

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[1] The conjectures and supposed parallels offered by Ewald (*Geschichte*, i. 362, 391; *Jahrb.*, vi. 2) and Movers (i. 476 *sq.*) offer no safe basis for speculation. G. Smith (*Chaldæan Genesis*, ch. xvii.) proposes to identify the name with the Accadian Lumugu and Lamga, "moon."

The revival of the Bourbon monarchy drew Lamennais to Paris, and the Hundred Days sent him to exile. The abbé Caron gave him work in his school for French exiles in London; and he also became tutor at the house of Lady Jerningham, whose first impression of him as an imbecile changed into friendship. In 1815 he returned with the abbé to Paris, where his seeming fatuity cost him much misery as a seminarist of St. Sulpice; but with Caron's aid, whom he called his spiritual father, he took full sacerdotal ordination next year, though with reluctance, as a letter to his sister shows. He enjoyed much peace with his friend at the Maison des Feuillantes, and finished there the first volume of his great work, the *Essay on Indifference in the Matter of Religion*. Published in 1817, it affected Europe like a spell. Since Bossuet no clergyman wielded such power as he gained at a blow. He denounced toleration, and advocated a Catholic restoration to belief. The right of private judgment, introduced by Descartes and Leibnitz into philosophy and science, by Luther into religion, and by Rousseau and the Encyclopedists into politics and society, had, he contended, terminated in practical atheism and spiritual death. Ecclesiastical authority, founded on the absolute revelation delivered to the Jewish people, but supported by the universal tradition of all nations, he proclaimed to be the sole hope of regenerating the European communities. In 1824 the fourth volume completed the work, and the *Defence* of the same date indicates the violent opposition he met with, not only from his natural enemies, the lovers of personal freedom in thought, science, and politics, sacred or civil, but from the Gallican bishops and monarchists, because he argued that all authority rests in the Holy See, and from his ultramontane friends, because he dared to support the Christian revelation by an analysis of human, or, as they considered, profane tradition.

Meanwhile Lamennais had become journalist on the *Conservateur*, with Chateaubriand, De Bonald, and De Villèle for his fellows in essentially political work. When in 1820 De Villèle became the chief of the ultras, or friends of absolute monarchy, Lamennais, who was not the monarchist they thought him, left the *Conservateur* with other contributors, named "the incorruptibles," and in the *Drapeau Blanc* and in the *Mémorial Catholique* he opposed his previous comrade. His principles compelled him to draw a firm line as to the divine right of even legitimate kings, especially in connection with church supremacies. In 1823 he was before the tribunals for an article in the *Drapeau Blanc*. He went to Rome in 1824, and Pope Leo XII., his admirer, offered him the cardinal's hat, which he refused. On his return he published *Religion in its Relations to Civil and Political Order*, the first volume of which was a picture of the religious state of France, and the second an attack on the competence of the assembly of the clergy in 1682 to decree the liberties of the Gallican Church. The law accepting these liberties, Lamennais was summoned before the state courts, and with all France keenly interested was condemned to pay a fine. From this time he broke with the legitimists and the liberals, and Rome became to him the only seat of the social problem. His ideal was a pure theocracy.

But in the *Progress of the Revolution and War against the Church* the element of popular political liberty began to appear, modifying such infallibility of the head of the church as deposing of princes and dispensing with oaths of allegiance taken by their subjects implied. The revolution of 1830 increased his popular leanings, and in the journal *L'Avenir*, which he founded in September with the mottoes "God and Liberty," "The Pope and the People," theories strange to ultramontanism were broached. With Lacordaire, Montalembert, Gerbet, and other disciples, he demanded rights of local administration, enlarged suffrage, universal and equal freedom of conscience, of instruction, of meeting, and of the press. Methods of worship were to be criticised, improved, or abolished, and all in absolute submission to papal spiritual but not temporal authority. The Jesuits and the prelates grew alarmed, and "the modern Savonarola" was denounced to Gregory XVI. On their spiritual obedience the writers of *L'Avenir* were ordered to suspend the journal, which they did (1831), and Lamennais, Lacordaire, and Montalembert set out for Rome to get the papal pardon and blessing. They were not received, and "Catiline departed," to be overtaken by a bitter encyclical letter at Munich from the pope condemning the new doctrines. So interested was Gregory in the questions raised that under an assumed name he published a work of refutation. To his demand of submission Lamennais signed obedience, with a saving clause as to his country and humanity. The iron had entered his soul, and, deeply wounded, he retired to La Chenaie, the scene of his youthful inquiries and memories. His genius had turned the entire Christian church against him, and those whom he fought for so long, the ultramontanes, were the fiercest of all his opponents. The famous *Words of a Believer* appeared in 1834, and his final rupture with the church took place. "Small in size but immense in its perversity," was the pope's criticism in a new encyclical letter. A tractate of aphorisms, it has the vigor and sacred breathing of a Hebrew prophet.

Henceforth Lamennais is the apostle of the people alone. The *Affairs of Rome and the Ills of the Church and Society* came from old habit of religious discussions rather than from his real mind of 1837, or at most it was but a last word. *Modern Slavery*, *The Book of the People*, *Politics for the People*, two volumes of articles from the journal of the extreme democracy, *Le Monde*, are titles of works which show that he has arrived among the missionaries of liberty, equality, and fraternity, and he soon gets a share of their martyrdom. *The Country and the Government* caused him a year's imprisonment in Ste. Pélagie. He struggled through difficulties of lost friendships, limited means, and personal illnesses, faithful to the last to his hardly won dogma of the sovereignty of the people, and, to judge by his contribution to Louis Blanc's *Review of Political Progress*, was ready for something like communism. He was named president of the "Société de la Solidarité republicaine," which counted half a million adherents in fifteen days. The Revolution of 1848 had his sympathies, and he started *Le Peuple Constituant*, but was compelled to stop it on the 10th July, complaining that silence was for the poor; but again he was at the head of *La Révolution Democratique et Sociale*, which also succumbed. He managed his own publications; and pamphlets without number, and at intervals volumes of *Mélanges*, kept his influence fresh and his republican aims to the front as much as possible. In the constituent assembly he sat on the left till the *coup d'état* of Napoleon III. in 1851, put an end to all hopes of popular freedom. While deputy he drew up a constitution, but it was rejected as too radical. A translation of Dante chiefly occupied him till his death in the fourth year of the second empire. He refused to be reconciled to the church, and was buried at Père La Chaise without funeral rites, according to his own directions, mourned by a countless concourse of democratic and other admirers.

During the most difficult time of his republican period he had one resource by which to find solace for his intellect from the noise of daily politics. From 1841 to 1846, he was engaged on the work which will remain longest as evidence of his thinking power and of his clear, brilliant style, his *Sketch of a Philosophy*. Of the four volumes, the third, which is an exposition of art as development from the necessities and aspirations of the temple, stands pre-eminent. The rest of the work somewhat answers to the modest title of the book. Some papers which he wished to be published intact after his death were kept back by the religious seal of his brother and sister, but in 1855 and afterwards till 1859 six volumes appeared under the care of Émile Forgues. Blaize, the nephew of Lamennais, disputed various rights with Forgues, and in his biography of his uncle he questions facts in the account of the life prefixed by the editor to the *Posthumous Works*. But the whole matter is of private rather than public interest, affecting the position of Lamennais in little degree.

The complete works have been published twice at Paris, in 12 volumes, 1836–37, and in 11 volumes by Pagnerre, 1844 *sq.* Neither edition is anything like complete, but that of Pagnerre is the more so. Besides the biographical matter given by Forgues and Blaize as preface—the former to the *Posthumous Works*, the latter to the *Unedited Works*, Sainte-Beuve has Lamennais as one of his skilful *Portraits Contemporains*, Castille has him among the *Portraits politiques au dix-neuvième siècle*, and George Sand's thoughts of "the Breton" can be read in *French Authors at Home*. Robinet, Gerbet, and Regnault may be selected from many others who give personal details. Querard's *Les Supercheries Littéraires Devoilées*, article "La Mennais," will give ample introduction to all that is known of the author's works, and of the works connected with him. (T. SI.)

LAMENTATIONS, BOOK OF. The Old Testament book of Lamentations bears in Hebrew Bibles the superscription אֵיכָה, "Ah how!" the opening word of the first chapter, and also of chapters ii. and iv. The Talmud, however, and Jewish writers in general call it the book of קִינוֹת, "elegies" or "dirges,"[1] of which the Septuagint title θρῆνοι and the Latin *Lamentationes* or *Lamenta* are translations. The fuller title *Lamentationes Jeremiæ Prophetæ*, *Lamentations of Jeremiah*, expresses the ancient tradition as to the authorship of the book. It is found in the Syriac and in some MSS. of the LXX., *e. g.*, in ℵ but not in A and B; and the shorter anonymous form is undoubtedly older.

The dirges which make up the book are five in number, and the first four are alphabetical acrostics,—successive verses in chaps. i., ii., iv., or successive sets of three verses in the case of chap. iii., beginning with successive letters of the alphabet. The last chapter has twenty-two verses, like chaps. i., ii., and iv., but is not an acrostic.

It is noteworthy that in chaps. ii., iii., and iv. the letter *Pe* (פ) precedes *'Ayin* (ע), contrary to the ancient and established order common to the Hebrew alphabet with its Greek and Latin derivatives, in which O stands for ע. The sense shows that this irregularity is not due to a transposition of the original order of the verses, while the fact that the same transposition occurs three times makes it plain that the deviation from the common order is not due to want of skill to make the acrostic perfect, but rests on a variation in the order of the alphabet as used by the author. Thus it has not unnaturally been argued by Thenius that chap. i., which takes the alphabet in the common order, must have a different author from chaps. ii.–iv.; but it is quite as probable that in chap. i., as Ewald suggests in the 2d ed. of his *Dichter*, p. 326, v. 16 originally followed ver. 17, and was transposed to reduce the acrostic to the usual form. In the other chapters the sense forbade such transposition.

The subject of the five dirges is not the death of an individual; they refer to a national calamity—the widowhood of Jerusalem and the overthrow of the Judæan state by the Chaldeans. But the examples of Amos v. 1, 2, Jer. ix. 19 [18], Ezek. xix., show that they are not less properly called dirges on that account; the lamentations of Israel over the desolation of Zion, the agonies of the last desperate struggle and the extinction of national existence, appropriately took a form modelled on the death-wail sung by "cunning women" (Jerem. ix. 17) and poets "skilful of lamentation" (Amos v. 16) at the wake (אֵבֶל) of the illustrious dead. Among the Hebrews, as among other primitive peoples, this type of poetry was much cultivated, and reached great artistic perfection at an early date, as appears from David's elegy on Saul and Jonathan; and as it was practised by persons of special skill, whose services were engaged by the relatives of the dead, it naturally assumed a certain formal and even artificial character. This accounts for the use in our book of the elaborate acrostic form, which to our minds seems little suited for such composition. We are not to think of these dirges as an unstudied effusion of natural feeling, but as carefully elaborated poems in which every element of pity and terror which the subject supplied is brought forward with conscious art to stir the minds of the hearers. It is far from improbable that the Lamentations were originally composed, as Ewald suggests, for a solemn act of mourning in which the captive or fugitive Israelites united, and we know that they ultimately took their place in the ritual of the great day of mourning, the 9th of Ab, when the synagogue still celebrates the fall of the temple.[2] The fast or weeping of the fifth month (Ab) was already an old usage in the time of Zechariah (vii. 3), and it is quite possible that the ritual use of the book of Lamentations goes back to the early days of this ancient custom. Such considerations meet the difficulty which has sometimes been felt in supposing a single author to have written a whole series of elegies on the fall of Jerusalem. In a solemn and formal ceremony of mourning the repetition of the same theme in successive songs of lamentation is only natural. These observations do not of course prove the unity of the book, but they add force to the arguments for unity derived from the plan and language of the whole, and urged by critics, like Ewald and Nägelsbach, who are not influenced by the tradition which makes Jeremiah the author. The evidence for unity of authorship, it may be at once observed, applies most forcibly to the first four chapters, which are also connected by their acrostic form, and especially by the peculiarity in the order of the alphabet already alluded to as still found in chaps. ii., iii., and iv., and perhaps at one time found even in chap. i.

The first elegy commences with a picture of distress of Zion during and after the siege (i. 1–11), Jerusalem, or the people of Judah, being figured as a widowed and dishonored princess. Then in the latter half of the poem she herself takes up the lamentation, describes her grievous sorrow, confesses the righteousness of Jehovah's anger, and invokes retribution on her enemies. In the second chapter the desolation of the city and the horrors of the siege are again rehearsed and made more bitter by allusion to the joy of the enemies of Israel. The cause of the calamity is national sin, which false prophets failed to denounce while repentance was still possible, and now no hope remains save in tears and supplication to stir the compassion of Jehovah for the terrible fate of his people. The third elegy takes a personal turn, and describes the affliction of the individual Israelite or of the nation, under the type of a single individual, under the sense of Jehovah's just but terrible indignation. But even this affliction is a wholesome discipline. It draws the heart of the singer nearer to his God in penitent self-examination, sustained by trust in Jehovah's unfailing mercy, which shows itself in the continued preservation of His people through all their woes. From the lowest pit the voice of faith calls to the Redeemer, and hears a voice that says, "Fear not." Jehovah will yet plead the cause of His people, and so in the closing verses the accents of humble entreaty pass into a tone of confident appeal for just vengeance against the oppressor. In the fourth acrostic the bitter sorrow again bursts forth in a passionate wailing. The images of horror imprinted on the poet's soul during the last months of Jerusalem's death-struggle and in the flight that followed are painted with more ghastly detail than in the previous chapters, and the climax is reached when the singer describes the capture of the king, "the breath of our nostrils, the anointed of Jehovah, of whom, we said, 'Under his shadow we shall live among the nations.'" The cup of Israel's sorrow is filled up. The very completeness of the calamity is a proof that the iniquity of Zion has met with full recompense. The day of captivity is over, and the wrath of Jehovah is now ready to pass from His people to visit the sins of Edom, the most merciless of its foes.

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[1] This name, as will appear below, is perhaps as old as the book of Chronicles, and is the Hebrew title known to Jerome (*Prol. Gal*).

[2] See *Mas. Sôpherim*, chap. xviii., and the notes in Müller's edition, Leipsic, 1878.

Thus far there is both unity and progress in the thought. Behind the division into four acrostics lies a larger grouping in three sections, each of which begins with the elegiac איכה, followed by a representation in increasing detail of the great calamity, and passes on through the thought of Jehovah's righteousness to hope, which, as in Psalm cxxxvii., finds its characteristic culmination and point of rest in the assurance of righteous vengeance. The central section (chaps. ii. and iii.) is the most subdued in tone, and sounds the profoundest depths of religious feeling, while the opening section presents the theme in its broadest unity, under the form of personification, and is balanced in chap. iv. by the surging flood of an anguish which pours itself forth all the more unreservedly that it contains the seeds of hope.

The fifth chapter, which takes the form of a prayer, does not follow the scheme common to the three foregoing sections. The elegy proper must begin with the utterance of grief for its own sake. Here on the contrary the first words are a petition, and the picture of Israel's woes comes in to support the prayer. The point of rest too is changed, and the chapter closes under the sense of continued wrath. The centre of the singer's feeling no longer lies in the recollection of the last days of Jerusalem, but in the long continuance of a divine indignation which seems to lay a measureless interval between the present afflicted state of Israel and those happy days of old which are so fresh in the recollection of the poet in the first four chapters. The details too are drawn less from one crowning misfortune than from a continued state of bondage to the servants of the foreign tyrant (ver. 8), and a continued series of insults and miseries. And with this goes a change in the consciousness of sin: "Our fathers have sinned, and are not; and we have borne their iniquities" (ver. 7; compare Zech. i. 2-6, and similar complaints in very late psalms). These differences, combined with the absence of the acrostic form, suggest that the chapter may be a later addition. It may be noted also that in ver. 6 the community which joins in the prayer has humiliating relations to Assyria (Syria?) on the one hand and to Egypt on the other, which seems to imply that it dwells in Palestine,—a situation to which the complaint that strangers possess its land and houses, that the weak remnant of Israel is in constant danger from Bedouin incursions (ver. 9), and the picture of the foxes that walk among the ruins of Zion, may also point. Moreover, the fact that the book has five parts, like the Psalter and the Pentateuch, makes it very conceivable that it received its present form after the Pentateuch was complete, that is, after the time of Ezra. The linguistic arguments for the unity of the book (most fully stated by Nägelsbach, p. xvi.) seem to break down as regards chap. v.

According to a tradition which passed unquestioned among the Jews and Christians till recent times, the author of the whole book is the prophet Jeremiah. To estimate the value of this tradition, we must trace it back as far as possible. A note prefixed to the Septuagint translation says that, "after Israel was taken captive and Jerusalem laid waste, Jeremiah sat down and wept, and sang this elegy over Jerusalem." This note may very possibly have stood in the Hebrew copy of the translator, but it certainly cannot be regarded as part of the original text, and it does not bring the tradition within three hundred years of the age of Jeremiah. Another argument bearing on the authority of the tradition has regard to the original place of the book in the Old Testament canon. In Hebrew Bibles the Lamentations stand among the Hagiographa, forming one of the five Megilloth or small books written on separate rolls for liturgical use on separate occasions. In the common order of printed Hebrew Bibles the book stands third among the Megilloth, because in the order of the ecclesiastical year the solemnity of the 9th of Ab was the third annual occasion at which a Megillah was used (see CANTICLES, vol. v. p. 29). In the Septuagint and Syriac, on the other hand, the Lamentations are attached to the book of Jeremiah, Baruch intervening in the former version; and it has been often supposed that this was the older arrangement,—that is, that even in Hebrew copies the book originally formed an appendix to Jeremiah, and was afterwards separated for liturgical reasons. The argument for this view turns on the fact that side by side with the Talmudic enumeration of twenty-four Old Testament books, agreeably to the present Hebrew arrangement, there was another enumeration which gave twenty-two books, taking Ruth with Judges and Lamentations with Jeremiah (Jerome, *Prol. Gal.*). This seems to be the reckoning adopted by Josephus, but the evidence that it had an established place among the Jews of Palestine at or even after this time is scanty and precarious.[1] At any rate the artificial scheme which accommodates the number of sacred books to the number of the twenty-two Hebrew letters is one that can hardly be original. It first appears about the time of the labors of the rabbins in the last days of the Jewish state to give final form to the canon.

Here then there is nothing to carry us beyond the evidence of the Septuagint, and Nöldeke has pointed out that there is some reason to suspect that the Septuagint translation of Lamentations is not by the same hand with that of Jeremiah, which goes to prove that even in the Greek the two books (which are in fact separated by the Apocryphal Baruch) were not originally one. Certainly the book of Lamentations has not shared the very peculiar history of the text of Jeremiah, the Greek of the former agreeing with the Hebrew so closely as to make it probable that the text was early established by frequent liturgical use, while the prophecies underwent many variations in transmission. There is, however, one piece of evidence in the Hebrew canon itself which ancient writers accepted as connecting the name of Jeremiah with our book. In 2 Chron. xxxv. 25 we read that Jeremiah pronounced a dirge over Josiah, and that the death of Josiah was still referred to according to stated usage in the dirges used by singing men and women in the author's day, and collected in a volume of קינות—the ordinary Jewish name of our book. Josephus says that the dirge of Jeremiah on this occasion was extant in his days (*Ant.*, x. 5, 1), and no doubt means by this the canonical Lamentations. Jerome on Zech. xii. 11 understands the passage in Chronicles in the same sense; but modern writers have generally assumed that, as our book was certainly written after the fall of Jerusalem, the dirges alluded to in Chronicles must be a separate collection. This, however, is far from clear. The קינות of the Chronicler had, according to his statement, acquired a fixed and statutory place in Israel, and were connected with the name of a prophet. In other words, they were canonical as far as any book outside the Pentateuch could be so called at that age. Moreover, the allusion to the king, the anointed of Jehovah, in Lam. iv. 20, though it really applies to Zedekiah, speaks of him with a warm sympathy which later ages would not feel for any king later than Josiah. The Chronicler in particular recognizes only thoroughly good kings (of whom Josiah was the last), and kings altogether bad, for whom he had nothing but condemnation, and with whom he certainly could not imagine a prophet to sympathize.[2] It thus seems highly probable that in the time of the Chronicles, that is, about the close of the Persian period, the book of Lamentations had a recognized liturgical use in the hands of a guild of singers, and was already connected with the name of Jeremiah, though the passage in Chronicles does not make it apparent that the whole official collection of dirges was ascribed to him. But even this testimony is some two centuries and a half later than the events which the book of Lamentations bewails, and is connected with an undoubted error, though a natural one, as to the reference of the book. We cannot therefore feel sure that the tradition current in the guild of singers was authentic and continuous; the general subject of the Lamentations, and particularly the obvious applicability to the personal circumstances of Jeremiah of such passages as iii. 14, 55 (comp. Jer. xx. 7; xxxviii.), made it natural or even inevitable to think of him as author, if any attempt was made to connect the book, as the later Jews sought to connect all books, with some known name. Nor can we lay special weight on the acceptance of the tradition by an author who transfers post-exile Psalms to the Davidic age (1 Chron. xvi. 7 *sq.*).

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[1] The supposed testimony of Origen (Eus., *H. E.*, vi. 25) breaks down, for if it applied to the Hebrew Bible it would also prove, what we know to be false, that the epistle of Jeremiah stood in the Hebrew canon. Origen, Jerome, and other Christian writers were probably influenced by the statement of Josephus. The testimony of the book of Jubilees, as cited by Syncellus and Cedrenus, is very doubtful (Rönsch, *B. der Jub.*, p. 527 *sq.*)

[2] See Nöldeke, *A. Tliche Literatur*, p. 144.

When we proceed to test the internal probability of the tradition we find it to be surrounded by grave difficulties. The language, as Ewald observes, and Nägelsbach (p. xi. *sq.*) has shown with great completeness, is very remote from that of Jeremiah, and even if we separate out chap. v., in which the features already pointed out make it peculiarly difficult to think of him as author, the standpoint of the book corresponds very imperfectly with that of the prophet. Jeremiah, through all his life, was a man standing by himself, isolated from his people. At the taking of the city the Chaldæans themselves acknowledged this and treated him with favor. He was carried into Egypt against his will, still counselling patient submission to the foreign rule, and there he continued in opposition to the mass of the fugitives as decidedly as before. The Lamentations, on the contrary, show us a poet in sympathy with the old life of the nation, whose attitude to the temple services, and especially to the king, is far more popular than Jeremiah's. Nor could Jeremiah speak of the calamity as involving the cessation of revelation and the silence of prophecy (ii. 9); for the Divine word in his breast was as clear and strong after the catastrophe as before it. The judgment, terrible as it was, had far less painful significance to Jeremiah than to the nation at large (Jer. xxiv. 1 *sq.*, xlii. 9 *sq.*). To this it may be objected that in chap. iii., where the singer's complaint takes a more personal turn, Jeremiah himself is pictured in his isolation from Israel at large. A closer examination shows, however, that this interpretation turns on a single word in iii. 14. The addition of a final ם, not always written in old times, changes "all my people" into "all peoples," restores the harmony between iii. 14 and verses 61–63, and makes the singer of chap. iii., as the general argument of the chapter requires, a representative of Israel among the heathen, not an isolated figure among unsympathetic countrymen.

Thus viewed, the Lamentations are the earliest evidence of the great national repentance wrought by the fall of the Jewish state. We have here for the first time a genuine expression of popular feeling fully penetrated by those convictions of Israel's sin and Jehovah's righteousness which the people of Judah had long resisted, mocking and persecuting the divine messengers who had sought to force them on the conscience of their countrymen. This cry of deepest anguish from the depths of a nation's despair, chastened by a sense of sin, and rising at length into an attitude of sublime faith in the confident appeal to the righteousness and love of Jehovah, contains the germ of the new life of the Israel of the restoration, and may be taken as the starting-point of a fresh epoch in the Old Testament development. It is not probable that these new thoughts and new hopes found so clear and perfect literary expression in the very first days of the exile. Several passages, especially ii. 14 compared with Ezek. xiii. (שָׁוְא וְתָפֵל), appear to indicate acquaintance with the book of Ezekiel, which is, as Nägelsbach points out, another argument against authorship by Jeremiah, and combines with the expression in ii. 9 to point to the time when the study of the written word, so characteristic of the age of the exile, had begun to supply the lack of continuous oral revelation. It is hardly possible to give a more exact determination of the place and time of writing. Ewald argues for an origin among the fugitives in Egypt; but the passages to which he appeals (i. 3; iv. 18 *sq.*; v. 4 *sq.*) do not bear out this conclusion, and our scanty historical knowledge of the period points to the eastern captivity as the more probable seat of the spiritual movement to which the book belongs.

Literature.—The older literature is fully given by Nägelsbach, p. xvii. Among recent commentaries may be noticed those of Kalkar (in Latin), 1836; Ewald in his *Dichter*, vol. i. pt. ii. (2d ed., 1866); Thenius in *Kurzgef. Handb.*, 1855, who ascribes chaps. ii. and iv. to Jeremiah (comp. Budde in *Z. f. ATliche Wiss.*, 1882, p. 45); Vaihinger, 1857; Neumann, 1858; Engelhardt, 1867; Nägelsbach, 1868 (English translation, 1871); Keil, 1872 (English translation, 1874); Payne Smith in the *Speaker's Commentary*; and Reuss, *La Bible: Poésie Lyrique*, 1879. (W. R. S.)

LAMETTRIE, Julien Offray de (1709–1751), one of the creators of the French illumination, and the earliest exponent of that system of materialism which was afterwards elaborated by Holbach and Cabanis, was born at St. Malo on December 25, 1709. After for some years studying theology in the Jansenist schools with the intention of entering the church, he suddenly changed his career and threw himself with characteristic energy into the profession of medicine. In 1733 he went to Leyden to study under Boerhaave, then in the zenith of his fame, and in 1742 returned to Paris, where he obtained the appointment of surgeon to the guards. During an attack of fever he made some observations on himself with reference to the action of quickened circulation upon thought, which led him to the conclusion that psychical phenomena were to be accounted for as the effects of organic changes in the brain and nervous system. This conclusion he worked out in his earliest philosophical work, the *Histoire Naturelle de l'Âme*, which appeared about 1745. So great was the outcry caused by its publication that Lamettrie was forced to betake himself to Leyden, where he developed his doctrines still more boldly and completely, and with great originality in his books *Homme Machine* and *Homme Plante*, treatises based upon principles of the most consistently materialistic character. The ethics of these principles were worked out in subsequent volumes, *Discours sur le Bonheur*, *La Volupté*, and *L'Art de Jouir*, in which the end of life is found in the pleasures of the senses, and virtue is reduced to self-love. So strong was the feeling against Lamettrie that in 1748 he was compelled to quit Holland for Berlin, where Frederick the Great not only allowed him to practise as a physician, but appointed him court reader. He died in 1751, when his position as a philosopher was publicly recognized in an address written by the king himself, and read before the Berlin Academy. His collected *Œuvres Philosophiques* appeared after his death in several editions, published in London, Berlin, and Amsterdam respectively. The best account of his system is that given in A. Lange's *Geschichte des Materialismus*.

LAMIA was a female demon, whose name was used by Greek mothers to frighten their children; from the Greek she passed into Roman demonology. She was also known as a sort of fiend, the prototype of the modern vampire, who in the form of a beautiful woman enticed young men to her embraces, in order that she might feed on their life and heart's blood. In this form the tale has been used by Goethe as the subject of one of his most powerful poems, *Die Braut von Corinth.* The name Lamia is clearly the feminine form of Lamus, king of the Læstrygones (*q. v.*). Both are called in some forms of the legends children of Poseidon; and the analogy of other myths makes it probable that they are ultimately a pair of deities, male and female. At some early period, or in some districts, Lamus and Lamia were worshipped as gods; but the names did not attain general currency. Their worship disappeared, and they preserved an existence only in legend. They have gained a worse character than any other of the old divine forms which persist in Greek legend; but their history is remarkably like that of the malignant class of demons in Germanic and Celtic folklore. Both names occur in the geographical nomenclature of Greece and Asia Minor; and this makes it probable that the deities belong to that religion which spread from Asia Minor over Thrace into Greece.

LÄMMERGEYER (*i. e.*, Lamb Vulture), or Bearded Vulture, the *Falco barbatus* of Linnæus and the *Gypaetus barbatus* of modern ornithologists, one of the grandest birds of prey of the Palæarctic Region—inhabiting lofty mountain chains from Portugal to the borders of China, though within historic times, if not within living memory, it has been exterminated in several of its ancient haunts. Its northern range in Europe does not seem to have extended further than the southern frontier of Bavaria, or the neighborhood of Salzburg;[1] but in Asia it formerly reached a higher latitude, having been found even so lately as 1830 in Dauria (see BIRDS, vol. iii. p. 638, note 4), where according to Herr Radde (*Beitr. Kenntn. Russ Reichs*, xxiii. p. 467) it has now left but its name. It is not uncommon on many parts of the Himalayas, where it breeds, and on the mountains of Kumaon and the Punjab, and is the "Golden Eagle" of most Anglo-Indians. Returning westward, it is found also in Persia, Palestine, Crete, and Greece, the Italian Alps, Sicily, Sardinia, and Mauritania.

In some external characters the Lämmergeyer is obviously intermediate between the Families *Vulturidæ* and *Falconidæ*, and the opinion of systematists has from time to time varied as to its proper position; but as this ought to depend on the decision of anatomists, who have not yet delivered their verdict, it must be still left in doubt; and there would be little advantage in recounting how one author has referred it to the former group and another to the latter, since nobody seems to have applied the only sure test—that afforded by characters which are not superficial.[2] It will suffice to say that most writers have deemed its Vulturine affinity the strongest (relying apparently on the form of the beak, which can scarcely be said to be either Aquiline or Falconine), in spite of its well-feathered head and tarsi. The whole length of the bird is from 43 to 46 inches, of which, however, about 20 are due to the long cuneiform tail, while the pointed wings measure more than 30 inches from the carpal joint to the tip. The coloration of the plumage is very peculiar; the top of the head is white, bounded by black, which, beginning in stiff bristly feathers turned forwards over the base of the beak, proceeds on either side of the face in a well-defined band to the eye, where it bifurcates into two narrow stripes, of which the upper one passes above and beyond that feature till just in front of the scalp it suddenly turns upwards across the head and meets the corresponding stripe from the opposite side, inclosing the white forehead already mentioned, while the lower stripe extends beneath the eye about as far backwards and then suddenly stops. A tuft of black bristly feathers projects beardlike from the base of the mandible, and gives the bird one of its commonest epithets in many languages, as well as an appearance almost unique among the whole Class *Aves*. The rest of the head, the neck, throat, and lower parts generally are clothed with lanceolate feathers of a pale tawny color—sometimes so pale as to be nearly white beneath;[3] while the scapulars, back, and wing-coverts generally, are of a glossy grayish black, most of the feathers having a white shaft and a median tawny line. The quill-feathers, both of the wings and tail, are of a dark blackish-gray. The irides are of a light orange, and the sclerotic tunics,—equivalent to the "white of the eye" in most animals,—which in few birds are visible, are in this very conspicuous and of a deep crimson, giving it an air of great ferocity. In the young of the year the whole head, neck, and throat are clothed in dull black, and most of the feathers of the mantle and wing-coverts are broadly tipped and mesially streaked with tawny or lightish gray.

The Lämmergeyer breeds early in the year. The nest is of large size, built of sticks, lined with soft material, and placed on a ledge of rock—a spot being chosen, and often occupied for many years, which is nearly always difficult of access, and not unfrequently quite inaccessible, to man, from the precipitous or overhanging configuration of the cliffs. Here in the month of February a single egg is usually laid. This is more than 3 inches in length by nearly 2¼ in breadth, of a pale but lively brownish-orange. The young when in the nest are clad in down of a dirty white, varied with gray on the head and neck, and with ochraceous in the iliac region. How long the eggs take in hatching, or how long the young remain nestlings, seems to be unknown. Equally unknown is the length of time that elapses before the latter assume the adult plumage, but it is probable that this period must at least exceed a twelvemonth.

There is much discrepancy as to the ordinary food of the Lämmergeyer, some observers maintaining that it lives almost entirely on carrion, offal, and the most disgusting garbage; but there is no question of its frequently taking living prey, and it is reasonable to suppose that this bird, like so many others, is not everywhere uniform in its habits. Its very name shows it to be the reputed enemy of shepherds, and it is in some measure owing to their hostility that it has been exterminated in so many parts of its European range. The usual mode of proceeding is said to be by suddenly rushing at the animal, especially if it be young, when in a somewhat dangerous position, so startling it as to make it lose its foothold and fall down the precipice.[4] But the Lämmergeyer has also a great partiality for bones, which when small enough it swallows and slowly digests. When they are too large, it is said to soar with them to a great height and drop them on a rock or stone that they may be broken into pieces of convenient size. Hence its name Ossifrage,[5] by which the Hebrew *Peres* is rightly translated in the Authorized Version of the Bible (Lev. xi. 13; Deut. xiv. 12)—a word corrupted into OSPREY (*q.v.*), and applied to a bird which has no habit of the kind.

The Lämmergeyer of Northeastern and South Africa is deemed by systematists to be specifically distinct, and is known as *Gypaetus meridionalis* or *G. nudipes*. In habits it seems closely to resemble the northern bird, from which it differs in little more than wanting the black stripe below the eye and having the lower part of the tarsus bare of feathers. It is the "Golden Eagle" of Bruce's *Travels*, and has been beautifully figured by Mr. Wolf in Dr. Rüppell's *Syst. Uebers. der Vögel Nord-Ost-Afrika's* (Taf. 1). (A. N.)

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[1] Dr. Girtanner has a valuable paper on this bird in Switzerland (*Verhandl. St.-Gall. naturw. Gesellschaft*, 1869–70, pp. 147–244.)

[2] Professor Huxley's labors have unfortunately not been directed to this particular point, and therefore throw little or no light on it. He puts the *Vulturidæ* and *Falconidæ* together under the name of *Gypaetidæ*, very properly separating from them the American Vultures as *Cathartidæ*.

[3] Herr Meves (*Öfvers. Vet. Akad. Förhandlingar*, 1860, p. 487) asserts that in some cases, as proved by chemical tests, the red coloring is due to a superficial deposit of oxide of iron on the feathers, and that the coloring matter on the eggs (to be presently described) also arises from the same cause. This opinion has, however, been denied by several other naturalists, though none of them seem to have tried the experiment; while Mr. Hume who has (*Scrap Book*, p. 46), confirms Herr Meves's statement. In confinement, moreover, the bird has been observed always to lose or not to acquire its tawny tint.

[4] Stories are told of its attacking human beings under such circumstances, and the present writer is not disinclined to believe that some such stories may be true, though he is unable to refer to any that rest on testimony sufficient to dispel all doubt.

[5] Among other crimes attributed to the species is that, according to Pliny (*Hist. Nat.*, x. cap. 3), of having caused the death of the poet Æschylus, by dropping a tortoise on his bald head! In the Atlas range the food of this bird is said to consist chiefly of the *Testudo mauritanica*, which "it carries to some height in the air, and lets fall on a stone to break the shell" (*Ibis*, 1859, p. 177). It was the ἄρπη and φήνη of Greek classical writers.

LAMONT, Johann von (1805–1879), was born at Braemar, Aberdeenshire, on December 13, 1805. He was sent at the age of twelve to be educated at the Scottish monastery in Ratisbon, and apparently never afterwards returned to his native country,—so that he became to all intents and purposes a German. After passing through the gymnasium and lyceum, he devoted himself to theology; but his strong bent for scientific studies was recognized by the head of the monastery, P. Deasson, and on his recommendation he was admitted to the then new observatory of Bogenhausen (near Munich), where he worked under Soldener, latterly as his assistant. After the death of his chief in 1835 he was, on Schumacher's recommendation, (Steinheil, supported by Bessel, also competing for the office), appointed to succeed him as conservator of the observatory. In 1852 he became professor of astronomy at the university of Munich. He held both these posts till his death, which took place on the 6th of August, 1879. Though by no means a man of commanding genius, Lamont occupied a very important place among the scientific men of his day. As evidence of the universal respect in which he was held, it may be mentioned that he was a member of the Academies of Brussels, Upsala, and Prague, of the Royal Society of Edinburgh, of the Cambridge Philosophical Society, and of many other learned corporations. His work bore for the most part on astronomy and magnetism. Among his contributions to the former may be noted his great star catalogue, and his determination of the mass of Uranus from observations of its satellites (*Mem. Astron. Soc.*, 1838). His *Handbuch des Erdmagnetismus* (Berlin, 1849) is a standard work on the subject.

For fuller details concerning his published work the specialist may be referred to Poggendorff's *Biographisch-Literarisches Handwörterbuch*, or to the Royal Society's *Catalogue of Scientific Memoirs*.

LA MOTTE FOUQUÉ. See Fouqué.

LAMP. Technically a lamp is an apparatus in which to burn fluid combustible substances. Lamps are mostly intended for yielding light; but there are also special forms, the purpose of which is to afford highly concentrated heat in a convenient and portable form. The substances used in lamps for lighting are of two classes—(1) fixed oils, and (2) fluid hydrocarbons obtained from the distillation of bituminous shales, etc. (paraffin oil), petroleum, and essential oils. The latter class may be distinguished as mineral oils. Till very recently fixed oils were almost exclusively used for lamps; but since the introduction of the cheaper and more convenient mineral oils, in the second half of the 19th century, the use of fixed oils has steadily decreased in all parts of the world.

There is scarcely any fixed or fatty oil which has not been used, more or less, for burning. Many oils are so used in the districts which produce them, although they hardly enter into ordinary commerce under the name of burning oils. The so-called fish oils (sperm, whale, and seal) were in recent times principal burning oils, and to a limited extent are still so employed. Of the vegetable oils of commerce, colza oil is the most extensively used as an illuminant, and after it come other rape oils, poppy oil, the lower qualities of olive oil, sesamum or gingelly oil, candle-nut oil, and ground-nut oil, all of which, however, are local or restricted in consumption. The suitability of fixed oils for burning purposes depends on their purity or freedom from foreign matters, and on their limpidity, or, what is in effect the same thing, the temperature at which they solidify. Thus cocoa-nut fat is consumed in ordinary lamps in tropical regions, although in temperate latitudes it is a permanent solid. In the combustion of a fixed oil in lamps, the oil undergoes destructive distillation, and at the burning-point is resolved into a gaseous mixture. The comparative viscosity of all fixed oils renders it necessary to adopt some device supplementary to the capillary action of the wick for maintaining at the level of the burner a supply of oil sufficient to support uniform combustion. Again, the lubricant properties of fixed oils make it practicable to adopt various mechanical devices to regulate the supply of fuel to the burner, and otherwise control illumination.

The mineral oils, on the other hand, are, as sold, mixtures of various volatile hydrocarbons which give off inflammable vapors at comparatively low temperatures, and in consumption in lamps they come to the burning point in the condition of vapor. With highly volatile oils, and the use of imperfectly fitted lamps, though not with proper oil and fittings, there is some danger of explosion; there is also a risk that with imperfect combustion deleterious gases may be diffused through an apartment. Mineral oils possess such a high degree of limpidity that the suction of the wick alone is generally sufficient to bring the necessary supply of fuel to the burner.

The qualities of a lamp are judged of by the brilliance, steadiness, and uniformity of light it yields in proportion to the quantity of oil it consumes; by the convenient position of the light in relation to the equal illumination of the space it has to light; by the form, portability, and convenience of the lamp itself; and by the simplicity and economy of its construction, regard being had to efficiency. The chief points to consider in connection with the structure of lamps are (1) the means of supplying oil to the burner and of regulating that supply (2) the form and arrangement of the wick or medium over which the flame is supported, (3) the regulation and control of the currents of air in the lamp which support combustion, and (4) the position of the oil reservoir in relation to the dissemination of the light and the stability of the lamp itself.

The simple form which was used down to the end of the 18th century, and which as a "cruisie" continued in common use in Scotland till the middle of this century, illustrates the most elementary and most imperfect arrangement of a lamp. Here, as in the lamps of antiquity, the oil vessel lies immediately behind the burning point of the wick, with which the oil is about level when the reservoir is full. The wick is a round soft cord or fibrous mass. Such a lamp has no merit but simplicity. The light is thrown only forward and to the sides, the back being entirely in shadow. The wick, being a round solid mass, takes up oil equally at the centre and circumference; but to the outer edges of the flame only is there any access of air; consequently combustion in the centre is imperfect, resulting in a smoky unsteady flame, and a discharge into the atmosphere of the acrid products of destructive distillation. Further, as the level of the oil sinks in the reservoir, the wick has to feed the flame from a greater distance by mere capillary force, and the supply thus diminishing, the light decreases in proportion.

Since the time when inventors first began to better the primitive lamp, just one hundred years ago, the improvements in lamp construction have been enormous; the forms and modifications of invention bearing on lamps have been innumerable, and many excellent devices which did good service have been superseded by others simpler and more efficient. Notice can here be taken only of such inventions as developed new principles and features of originality.

The first improvement was in wicks and burners. In 1783 Leger of Paris devised a flat band or ribbon wick and burner, which produced a broad thin flame with no core, so that all parts of the oil supply were brought into intimate contact with the air, and perfect combustion and a steady flame were secured. The deficiencies of the flat wick flame were that the light was comparatively thin and impoverished, and that the parts of a room facing the thin ends of the flame were badly illuminated. To some extent these evils were overcome by the adoption of a curved form of burner, which in the end led up to the burner invented by Ami Argand, of Paris, and patented in England in 1784. In its simplest form the Argand burner consists of two concentric tubes or cylinders, between which the tubular wick is contained. The inner tube is open throughout, and to it a current of air passes from below, and, being carried upwards by the draught of the flame, atmospheric oxygen for combustion is supplied as well to the inner circumference as to the outer side of the flame, whence the name "double current burner" which it frequently receives. An adequate and controllable flow of air to the interior of the Argand burner having been secured, it remained to devise some means by which the current supplied to the outer circumference of the flame could be strengthened and regulated. This Argand secured by means of a chimney, which was made at first of sheet iron and suspended over the flame; but that device was quickly abandoned in favor of a glass chimney, which rested on a perforated gallery placed a little below the level of the burner. Subsequent experience suggested the formation of a shoulder or constriction on the chimney at a point a little above the level of the flame, whereby the air current is directed inward against the external surface of the flame, thus materially improving the combustion. Argand's original burner is the parent form of innumerable modifications all more or less complex in their adaptations.

A typical example of the burner and chimney is represented in fig. 1, in which the burner is composed of three tubes, *d*, *f*, *g*. The tube *g* is soldered to the bottom of the tube *d*, just above *o*, and the interval between the outer surface of the tube *g* and the inner surface of the tube *d* is an annular cylindrical cavity closed at bottom, containing the cylindrical cotton wick immersed in oil. The wick is fixed to the wick tube *ki*, which is capable of being moved spirally; within the annular cavity is also the tube *f*, which is capable of being moved round, and serves to elevate and depress the wick. P is a cup that screws on the bottom of the tube *d*, and serves to receive the superfluous oil that drops down from the wick along the inner surface of the tube *g*. The air enters through the holes *o*, *o*, and passes up through the tube *g* to maintain the combustion in the interior of the circular flame. The air which maintains the combustion on the exterior part of the wick enters through the holes *m*, with which *rn* is perforated. When the air in the chimney is rarefied by the heat of the flame, the surrounding heavier air, entering the lower part of the chimney, passes upward with a rapid current, to restore the equilibrium. RG is the cylindrical glass chimney with a shoulder or constriction at R, G. The oil flows from a side reservoir, and occupies the cavity between the tubes *g* and *d*. The part *ki* is a short tube, which receives the circular wick, and slides spirally on the tube *g*, by means of a pin working in the hollow spiral groove on the exterior surface of *g*. The wick-tube has also a catch, which works in a perpendicular slit in the tube *f*; and, by turning the tube *f*, the wick tube will be raised or lowered, for which purpose a ring, or gallery, *rn*, fits on the tube *d*, and receives the glass chimney RG; a wire S is attached to the tube *f*, and, bending over, descends along the outside of *d*. The part *rn*, that supports the glass chimney, is connected by four other wires with the ring *q*, which surrounds the tube *d*, and can be moved round. When *rn* is turned round, it carries with it the ring *q*, the wire S, and the tube *f*, and thereby produces elevation or depression of the wick.

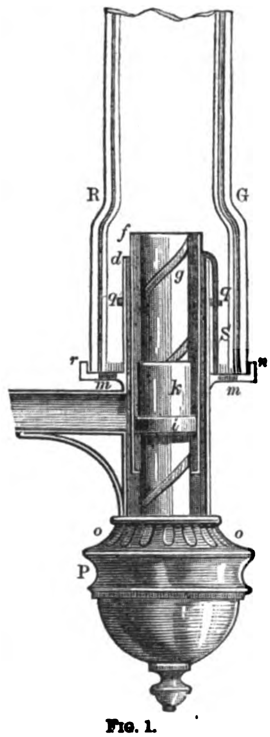

FIG. 1.

A device in the form of a small metallic disk or button, known as the Liverpool button, from having been first adopted in the so-called Liverpool lamp, effects for the current of air passing up the interior of the Argand burner the same object as the constriction of the chimney RG secures in the case of the external tube. The button fixed on the end of a wire is placed right above the burner tube *g*, and throws out equally all round against the flame the current of air which passes up through *g*. The result of these expedients, when properly applied, is the production of an exceedingly solid brilliant white light, absolutely smokeless, this showing that the combustion of the oil is perfectly accomplished.

The means by which a uniformly regulated supply of oil is brought to the burner varies of course with the position of the oil reservoir. In some lamps, not now in use, by ring-formed reservoirs and other expedients, the whole of the oil was kept as nearly as possible at the level of the burner. In what are termed fountain, reading, or study lamps, the principal reservoir is above the burner level, and various means are adopted for maintaining a supply from them at the level of the burner. But the most convenient position for the oil reservoir in lamps for general use is directly under the burner, and in this case the stand of the lamp itself is utilized as the oil vessel. In the case of fixed oils it is necessary with such lamps to introduce some appliance for forcing a supply of oil to the burner, and very many methods of effecting this have been devised, most of which were ultimately superseded by the moderator lamp. The Carcel or pump lamp, invented by Carcel in 1800, is still to some extent used in France. It consisted of a double piston or pump, forcing the oil through a tube to the burner, worked by ingenious clockwork arranged to go a certain number of hours.

An example of a form of reading lamp still in general use is seen in section in fig. 2. The lamp is mounted on a standard on which it can be raised or lowered at will, and fixed by a thumb screw. The oil reservoir is in two parts, the upper *ac* being an inverted flask which fits into *bb*, from which the burner is directly fed through the tube *d*; *h* is an overflow cup for any oil that escapes at the burner, and it is pierced with air-holes for admitting the current of air to the centre tube of the Argand burner. The lamp is filled with oil by withdrawing the flask *ac*, filling it, and inverting it into its place. The under reservoir *bb* fills from it to the burner level *ee*, on a line with the mouth of *ac*. So soon as that level falls below the mouth of *ac*, a bubble of air gets access to the upper reservoir, and oil again fills up *bb* to the level *ee*, and so on it goes as long as combustion continues and the supply of oil in *ac* endures. The principle is susceptible of numerous modifications.

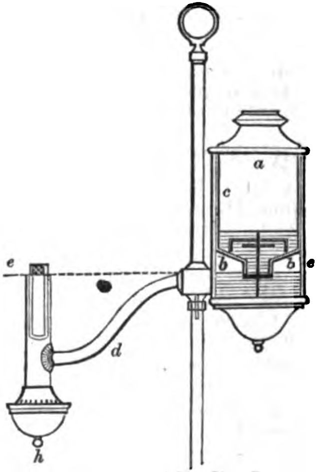

FIG. 2.—Section of Reading Lamp.

The Moderator lamp (fig. 3), invented by M. Franchot about 1836, from the simplicity and efficiency of its arrangements rapidly superseded almost all other forms of mechanical lamp. The two essential features of the moderator lamp are (1) the strong spiral spring which, acting on a piston within the cylindrical reservoir of the lamp, serves to propel the oil to the burner, and (2) the ascending tube C through which the oil passes upwards to the burner. The latter consist of two sections, the lower fixed to and passing through the piston A into the oil reservoir, and the upper attached to the burner. The lower or piston section moves within the upper, which forms a sheath inclosing nearly its whole length when the spring is fully wound up. Down the centre of the upper tube passes a wire, "the moderator," G, and it is by the wires that the supply of oil to the burner is regulated. The spring exerts its greatest force on the oil in the reservoir when it is fully wound up, and in proportion as it expands and descends its power decreases. But when the apparatus is wound up the wire passing down the upper tube extends throughout the whole length of the lower and narrow piston tube, obstructing to a certain extent the free flow of the oil. In proportion as the spring uncoils, the length of the wire within the lower tube is decreased; the upper flow of oil is facilitated in the same ratio as the force urging it upwards is weakened. In all mechanical lamps the flow is in excess of the consuming capacity of the burner, and in the moderator the surplus oil, flowing over the wick, falls back into the reservoir above the piston, whence along with new supply oil, it descends into the lower side by means of leather valves *a*, *a*. B represents the rack which, with the pinion D, winds up the spiral spring hard against E when the lamp is prepared for use. The moderator wire is seen separately in GG; and FGC illustrates the arrangement of the sheathing tubes, in the upper section of which the moderator is fixed.

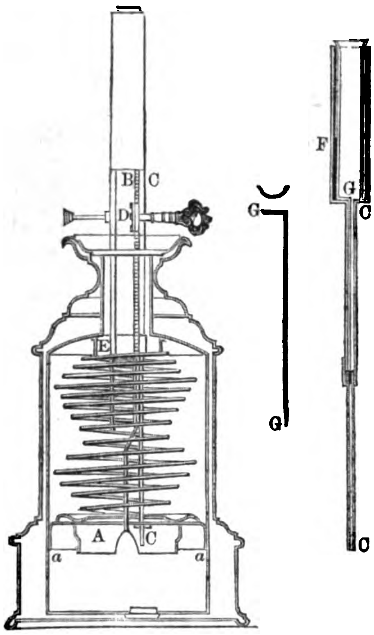

Fig. 3.—Section of Moderator Lamp.

Lamps for Mineral Oils. At an early period numerous attempts were made to utilize the highly inflammable volatile hydrocarbons and alcohols, which from their cheapness and abundance offered some hope of competing with the fixed oils then in universal use for illuminating purposes. These lamps had little success, and no small danger accompanied their limited use. The Vesta lamp of Young, introduced in 1834 for burning spirit of turpentine under the name of camphene, procured a smokeless flame by means of the Argand burner, constricted chimney, and Liverpool button, with the access of abundant air. It was not, however, till the introduction of paraffin oils and petroleum that mineral oil lamps became of great importance. Lamp makers had not to direct their attention to mechanical arrangements, for mineral oils rise abundantly by capillarity alone; the problem was to produce a sufficiently powerful current of air to insure complete and smokeless combustion of these richly carbonaceous compounds, and, in view of the highly volatile nature of the liquids dealt with, to prevent their exposure to the air, and more particularly to prevent the heating of the oil reservoir which would generate explosive mixtures, or vapors of dangerous tension.

Mineral oil lamps, like those for fixed oils, are constructed with both circular or tubular and flat-wick burners. In the case of the latter a cone or brass cap is placed over the burner, having a slit or opening a little longer and wider than the wick-holder itself. This cone serves to direct the whole current of air which enters below against the surface of the flame, and mingling with the vapor of the oil, produces perfect combustion, with a white flame which rises over the slit in the cone. The cool air current entering under the cone is also beneficially utilized in preventing the undue heating of the oil reservoir and the metallic wick-holder which passes down into it.

These flat wick lamps are simple in construction, cheap, and, so far as they go, economical light producers, but their flame is thin, and it is not practicable to compensate for the thinness by increased breadth of wick, because in such a case the edges of the light come so near the chimney that at these points the glass becomes rapidly heated, causing unequal expansion and destruction of the chimney. In 1865 Messrs. James & Joseph Hinks of Birmingham secured a patent for improvements in the burners of mineral oil lamps, "whereby two or more flat flames or one circular or nearly circular flame may be produced by the use of two or more single flat wicks." Under this patent was manufactured their well-known duplex lamp, which has gone far to supersede all other forms.

An improved form of their lamp is shown in fig. 4, in which a portion of the cone B is removed to show the two parallel flat wicks A, A, which have each a separate slit or opening in the cone. C is the coincident winder for raising or lowering the wicks in the tubes, by which the wicks can be moved separately or simultaneously as desired. D is a lever for raising the extinguishers E, whereby not only is the light instantly extinguished, but the wicks are also covered and protected from dirt, while all evaporation by the wick-holder is prevented. Messrs. Hinks & Son have further devised an automatic lighting attachment which obviates the necessity of raising the glass chimney for lighting the lamp.

Messrs. Hinks claimed in their 1865 patent the use of "two or more flat flames," and since that period numerous burners have been produced in foreign countries in which more than two flat wicks are used. The crown burner of Brünner in Vienna contains no less than six flat wicks. There are triplex burners, too, in which the wicks are arranged as a triangle; a most valuable lamp of this construction is the "Hesperus" of Messrs. Jones & Willis of Birmingham. Another form, the triplexicon, has three burners so closely placed together that the flames coalesce into a solid flame about half an inch in thickness. Further, there are star-shaped and cruciform burners, and others of little practical value.

The circular or tubular burners for mineral oils have been much simplified from the forms necessary in the case of colza, etc. A tubular wick is no longer required; a simple flat wick of a size that will allow its edges exactly to meet round the upper edge of the burner ring is used instead. In the form shown in fig. 5 the wick-holder and burner consists of a hollow truncated cone, with a vertical conical section removed from its side. The flat wick passes up through this cone, its edges meeting and forming in effect a circular wick at the top, while the central current of air gets ready access to the tube by the conical opening formed in its side, and the outer current passes up within the chimney walls as usual. This form also is easily susceptible of numerous modifications. (J. PA.)

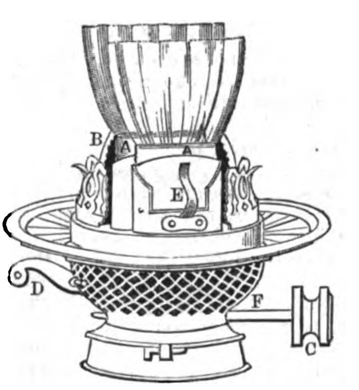

Fig. 4.—Duplex Burner.

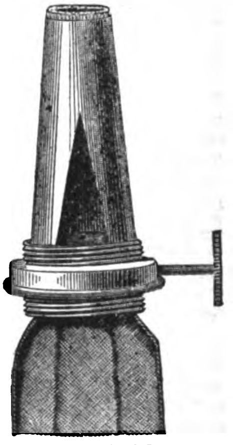
Fig. 5.—Conical Burner.

Ancient Lamps.—Though Athenæus states (xv. 700) that the lamp (λύχνος) was not an ancient invention in Greece, it had come into general use there for domestic purposes by the 4th century B. C., and no doubt had long before been employed for temples or other places where a permanent light was required in room of the torch of Homeric times. Herodotus (ii. 62) sees nothing strange in the "festival of lamps," Lychnokaie, which was held at Sais in Egypt, except in the vast number of them. Each was filled with oil so as to burn the whole night. Again he speaks of evening as the time of lamps (*περὶ λύχνων*, vii. 215). Still, the scarcity of lamps in a style anything like that of an early period, compared with the immense number of them from the late Greek and Roman age, seems to justify the remark of Athenæus. The commonest sort of domestic lamps were of terra-cotta and of the shape seen in figs. 6 and 7, with a spout or nozzle (*μυκτήρ*) in which the wick (*θρυαλλίς*) burned, a round hole on the top to pour in oil by, and a handle to carry the lamp with. A lamp with two or more spouts was *δίμυξος*, *τρίμυξος*, etc., but these terms would not apply strictly to the large class of lamps with numerous holes for wicks but without nozzles. Decoration was confined to the front of the handle, or more commonly to the circular space on the top of the lamp, and it consisted almost always of a design in relief, taken from mythology or legend, from objects of daily life or scenes such as displays of gladiators or chariot races, from animals and the chase. A lamp in the British Museum has a view of the interior of a Roman circus with spectators looking on at a chariot race. In other cases the lamp is made altogether of a fantastic shape, as in the form of an animal, a bull's head, or a human foot. Naturally color was excluded from the ornamentation except in the form of a red or black glaze, which would resist the heat. The typical form of hand lamp (figs. 6, 7) is a combination of the flatness necessary for carrying steady and remaining steady when set down, with the roundness evolved from the working in clay and characteristic of vessels in that material. In the bronze lamps this same type is retained, though the roundness was less in keeping with metal. Fanciful shapes are equally common in bronze. The standard form of handle consists of a ring for the fore finger and above it a kind of palmette for the thumb to press on to keep the lamp steady. Instead of the palmette is sometimes a crescent, no doubt in allusion to the moon. It would only be with bronze lamps that the cover protecting the flame from the wind could be used, as was the case out of doors in Athens. Such a lamp was in fact a lantern. Apparently it was to the lantern that the Greek word *lampas*, a torch, was first transferred, probably from a custom of having guards to protect the torches also. Afterwards it came to be employed for the lamp itself (*λύχνος*, *lucerna*). When Juvenal (*Sat.*, iii. 277) speaks of the *aenea lampas*, he may mean a torch with a bronze handle, but more probably either a lamp or a lantern. Lamps used for suspension were mostly of bronze, and in such cases the decoration was necessarily on the under part, so as to be seen from below. Of this the best example is the lamp at Cortona, found there in 1840 (engraved, *Monumenti d. Inst. Arch.*, iii. pls. 41, 42, and in Dennis, *Cities and Cemeteries of Etruria*, 2d ed., ii. p. 403). It is set round with sixteen nozzles ornamented alternately with a siren and a satyr playing on a double flute. Between each pair of nozzles is a head of a river god, and on the bottom of the lamp is a large mask of Medusa, surrounded by bands of animals. These designs are in relief, and the workmanship, which appears to belong to the beginning of the 5th century B. C., justifies the esteem in which Etruscan lamps were held in antiquity (Athenæus, xv. 700). Of a later but still excellent style is a bronze lamp in the British Museum found in the baths of Julian in Paris (figs. 8, 9, 10. The chain is attached by means of two dolphins very artistically combined. Under the nozzles are heads of Pan (fig. 8); and from the sides project the foreparts of lions (fig. 10). To what extent lamps may have been used in temples is unknown. Probably the Erechtheum on the acropolis of Athens was an exception in having a gold one kept burning day and night, just as this lamp itself must have been an exception in its artistic merits. It was the work of the sculptor Callimachus, and was made apparently for the newly rebuilt temple a little before 400 B. C. When once filled with oil and lit it burned continuously for a whole year. The wick was of a fine flax called Carpasian (now understood to have been a kind of cotton), which proved be the least combustible of all flax (Pausanias, i. 26, 7). Above the

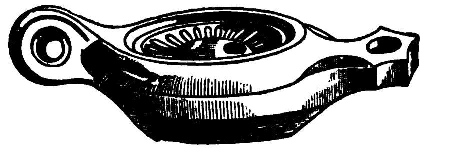
FIG. 6.

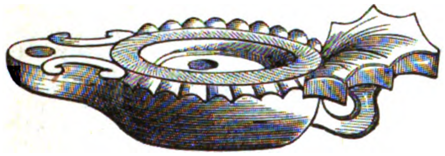
FIG. 7.

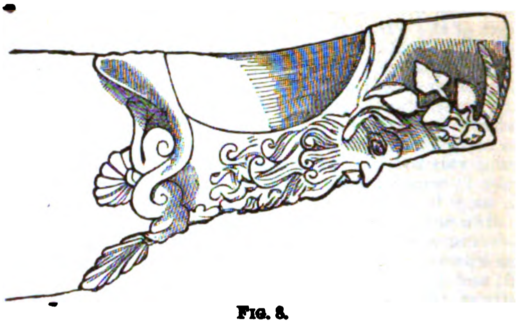
FIG. 8.

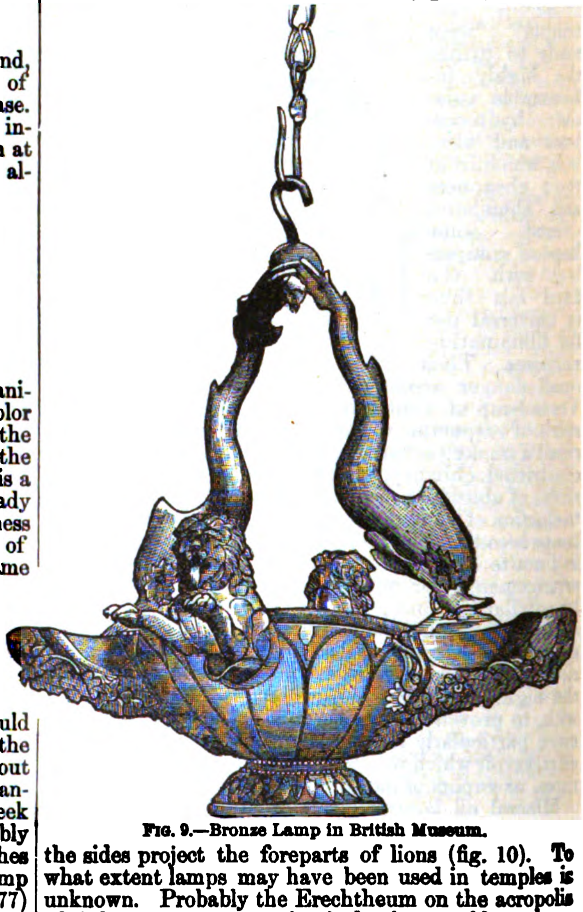
FIG. 9.—Bronze Lamp in British Museum.

lamp a palm tree of bronze rose to the roof for the purpose of carrying off the fumes. But how this was managed it is not easy to determine unless the palm be supposed to have been inverted and to have hung above the lamp spread out like a reflector, for which purpose the polished bronze would have served fairly well. The stem if left hollow would collect the fumes and carry them out through the roof. This lamp was refilled on exactly the same day each year, so that there seems to have been an idea of measuring time by it, such as may also have been the case in regards to the lamp stand (λύχνειον) capable of holding as many lamps as there were days of the year, which Dionysius the Sicilian tyrant placed in the Prytaneum of Tarentum. At Pharæ in Achaia there was in the market-place an oracular statue of Hermes with a marble altar before it to which bronze lamps were attached by means of lead. Whoever desired to consult the statue went there in the evening and first filled the lamps and lit them, placing also a bronze coin on the altar. A similar custom prevailed at the oracle of Apis in Egypt, Pausanias adds (vii. 22, 2). At Argos he speaks of a chasm into which it was a local custom continued to his time to let down burning lamps, with some reference to the goddess of the lower world, Persephone (ii. 22, 4). At Cnidus a large number of terra-cotta lamps were found crowded in one place a little distance below the surface, and it was conjectured that there must have been there some statue or altar at which it had been a custom to leave lamps burning at night (Newton, *Discoveries at Halicarnassus*, etc., ii. p. 394). These lamps are of terra-cotta, but with little ornamentation, and so like each other in workmanship that they must all have come from one pottery, and may have been all brought to the spot where they were found on one occasion, probably the funeral of a person with many friends, or the celebration of a festival in his honor, such as the *parentalia* among the Romans, to maintain which it was a common custom to bequeath property. For example, a marble slab in the British Museum has a Latin inscription describing the property which had been left to provide among other things that a lighted lamp with incense on it should be placed at the tomb of the deceased on the kalends, nones, and ides of each month (*Mus. Marbles*, v., pl. 8, fig. 2). For birthday presents terra-cotta lamps appear to have been frequently employed, the device generally being that of two figures of victory holding between them a disk inscribed with a good wish for the new year:—ANNV NOV FAVSTV FELIX. This is the inscription on a lamp in the British Museum, which, besides the victories, has among other symbols a disk with the head of Janus. As the torch gave way to the lamp in fact, so also it gave way in mythology. In the earlier myths, as in that of Demeter, it is a torch with which she goes forth to search for her daughter, but in the late myth of Cupid and Psyche it is an oil lamp which Psyche carries, and from which to her grief a drop of hot oil falls on Cupid and awakes him. Terra-cotta lamps have very frequently the name of the maker stamped on the foot. Clay moulds from which the lamps were made exist in considerable numbers. (A. S. M.)

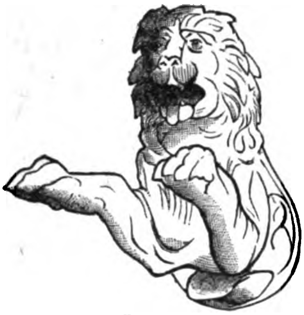

FIG. 10.

LAMP-BLACK is a deep black pigment consisting of carbon in a very fine state of division, obtained by the imperfect combustion of highly carbonaceous substances, which, producing a smoky flame, forms a deposit of soot or lamp-black. It is manufactured from scraps of resin and pitch refuse and inferior oils and fats, and other similar combustible bodies rich in carbon. For making lamp-black from resinous bodies a cylindrical stone chamber into which the flow of air can be easily regulated by openings at its lower part is used. Within the chamber is suspended a cone of sheet-iron fitting closely to the circumference of the chamber. The iron cone, which has an opening at the top, serves for a chimney, and can be raised or lowered in the chamber at will. The resinous material to be burned is placed in a cast-iron pot, and heated till it gives off vapors, when it is placed in the chamber and set on fire. The access of air is regulated to produce the maximum of smoke consistent with the maintenance of combustion. The abundant deposit of lamp-black on the walls of the chamber and cone is at the end of the operation collected by allowing the cone to sink, thus scraping the walls and carrying the whole deposit with it. Some manufacturers employ a series of small chambers communicating with each other, a stove tube leading into the first. These chambers have an opening below by which the deposit of lamp-black is removed, and in the last of the series the best quality is obtained. The finest lamp-black is procured by the combustion of oil in a special form of lamp, the deposit from this being finely divided and lustrous in hue. Lamp-black so collected contains traces of oil, which may be removed by heating to redness in a covered crucible. The oil present, however, is not detrimental to its employment for printing ink and as a pigment for oil painting, which are its principal uses. Further, lamp-black is largely used for "ebonizing" cabinet-work, and in the waxing and lacquering of leather. It is the principal constituent of China ink, and has numerous other applications.

LAMPEDUSA, a small island in the Mediterranean, about 90 miles east of Mahadia in Tunis, and 100 miles west of Malta, in 35° 28′ N. lat. and 12° 25′ E. long. Situated on the edge of the submarine platform which extends along the eastern coast of Tunis, it must be considered as attaching itself physically to the African continent, but politically it belongs to the kingdom of Italy, and forms part of the commune of Licata in Sicily. In its 19 miles of coast it presents a great number of bays, of which the largest serves as a harbor, and is capable of admitting vessels of from 300 to 400 tons burden. The highest point of the island is about 330 feet above the sea. There are no springs, and the water obtained from the artificial wells is usually brackish. The soil is mostly calcareous; beds of marl occur here and there on the surface. Vines, fig-trees, carob-trees, and sumach are successfully grown, and the wild olive flourishes luxuriantly. Firewood used to be obtained from the island for Malta. Rabbits swarm in all directions. The population in 1871 was 946.

Lampedusa is the Lopadussa of Strabo. In 1555 Andrew Doria anchored the vessels of Charles V. at Lampedusa, after an engagement with the Turks. Alphonso of Aragon made the island a fief of one of his courtiers, who sold it in 1677 to the prince Ferdinand Tommasi. But no permanent settlement seems to have been effected; the place, according to popular belief, was too terribly haunted by apparitions. Sir Kenelm Digby relates (1628) that his men told him "there dwelt no persons in Lampedusa, but there is a lamp perpetually burning. The Turks have great reverence to the place, and always leave oil or bread or something behind them through devotion, but they know not for whom, and it hath proved very fatal to carry away anything from thence as well to Christians as to Turks." Dumont, who personally visited the island, mentions a "little chapel dedicated to the Virgin, in which there is an altar with a turban laid upon it, which is usually called Mohammed's tomb," and adds the popular belief that any one attempting to carry off the gifts would be miraculously prevented escaping the island. The earl of Sandwich (1737) found Lampodusa with but a solitary inhabitant; and Captain Smyth states that about 1815 it was leased by an Englishman, Fernandez, who lived alone with his family. Ferdinand II. of Bourbon claimed it as Government property, and from 1843 attempts were made to establish a regular colony at the national expense. About £17,000 per annum was expended on the project, but the result was far from satisfactory. The population, introduced from Sicily, remained stationary during twenty years. Catherine II. at one time proposed to purchase Lampedusa for the purpose of making it a Russian naval station.

If it could be shown that Shakespeare derived the material of *The Tempest* from an Italian original, Lampedusa would have very strong claims to be considered the first prototype of the enchanted isle. It is the Lipadosa of *Orlando Furioso*, the scene of the shipwreck of Roger of Sicily and of his conversion by the hermit. A Sicilian legend which forms the subject of Wieland's poem *Klelia und Sinibald, oder die Bevölkerung von Lampedusa*, tells how two ladies of Palermo were cast ashore on the island, and found there two hermits who fell so deeply in love with them as to renounce their ascetic life. In Sicilian the "hermit of Lampedusa" corresponds to the English Vicar of Bray, lighting up the chapel near his cell with equal readiness for the Crescent or the Cross.

See Crusius, *Turco-Græcia*, Basel, 1584; Digby, *Journal of a Voyage into the Mediterranean*, Camden Society, 1868; Dumont, *Nouvelle Voyage au Levant*, The Hague, 1694, London, 1702; Captain Smyth, *Memoir Descriptive of the Resources of Sicily*, 1824; Joseph Hunter, *New Illustrations of Shakspeare*, vol. i., 1845.

LAMPREY, a fish belonging to the family *Petromyzontidæ* (from πέτρος and μύζω; literally, stone-suckers), which with the hag-fishes or *Myxinidæ* forms a distinct subclass of fishes, the *Cyclostomata*, distinguished by the low organization of their skeleton, which is cartilaginous, without vertebral segmentation, without ribs or real jaws, and without limbs. The lampreys are readily recognized by their long, eel-like, scaleless body, terminating anteriorly in the circular, suctorial mouth which is characteristic of the whole subclass. On each side, behind the head, there is a row of seven branchial openings, through which the water is conveyed to and from the gills. By means of their mouth they fasten themselves to stones, boats, etc., as well as to other fishes, their object being to obtain a resting place on the former, whilst they attach themselves to the latter for the purpose of deriving nourishment from them. The inner surface of their cup-shaped mouth is armed with pointed teeth, with which they perforate the integuments of the fish attacked, scraping off particles of the flesh and sucking the blood. Mackerel, cod, pollack, and flat-fishes are the kinds most frequently attacked by them in the sea; of river fish the migratory *Salmonidæ* and the shad are sometimes found with the marks of the teeth of the lamprey, or with the fish actually attached to them. About ten species are known from the coasts and rivers of the temperate regions of the northern and southern hemispheres. In Great Britain and Europe generally, three species occur, of which the two larger, if not all three, are met with also in North America, viz., the large spotted Sea-lamprey (*Petromyzon marinus*); the River-lamprey or Lampern (*P. fluviatilis*); and the Small Lampern or "Pride" or "Sand-Piper" (*P. branchialis*). The first two are migratory, entering rivers in the spring to spawn; of the river-lamprey, however, specimens are met with in fresh water all the year round. Lampreys, especially the sea-lamprey, are esteemed as food, and were formerly even more so than at present; but their flesh is not easy of digestion. Henry I. is said to have fallen a victim to this, his favorite dish. The species of greatest use is the river-lamprey, which as bait is preferred to all others in the cod and turbot fisheries of the North Sea. Yarrell states that formerly the Thames alone supplied from 1,000,000 to 1,200,000 lamperns annually, but their number has so much fallen off that, for instance, in 1876 only 40,000 were sold to the cod-fishers. That year, however, was an unusually bad year; the lamperns, from their scarcity, fetched £8 10s. a thousand, whilst in ordinary years £5 is considered a fair price. The season for catching lamperns closes in the Thames about the middle of March. The origin of the name lamprey is obscure; its Latinized form *Lampetra*, which occurs in all ichthyological works of the Middle Ages, was unknown in classical times; and its derivation from *lambere petras* is a specimen of etymologi ingenuity. The development of lampreys has receiv much attention on the part of naturalists, since Au Müller discovered that they undergo a metamorpho and that the minute worm-like lamperns previou known under the name of *Ammocœtes*, and abund in the sand and mud of many streams, were nothi but the undeveloped young of the river-lampreys a small lamperns. See ICHTHYOLOGY.

LAMPRIDIUS, ÆLIUS. See AUGUSTAN HISTO vol. iii. p. 65.

LAMPSACUS, an ancient Greek colony in My Asia Minor, known as Pityusa or Pityussa before colonization by Ionian Greeks from Phocæa and Mil tus, was situated on the Hellespont, opposite Callip lis in Thrace. It possessed a good harbor; and t neighborhood was famous for its wine, so that, havi fallen into the hands of the Persians during the Ioni revolt, it was assigned by their king to Themistoc to provide him with wine, as Percote did with me and Magnesia with bread. After the battle of Myc (479 B.C.), Lampsacus joined the Athenians, bu having revolted from them soon afterwards, had to reduced by force. In the Roman wars against An ochus of Syria, its inhabitants were received as alli of Rome. Lampsacus was the chief seat of the w ship of Priapus; and it is related that Alexander t Great was with difficulty restrained from destroyi the city on account of the immorality fostered by t obscene rites of that god. The modern Lamsaki probably not on the site of Lampsacus, but must near it.

LANARK, an inland county of Scotland, lies b tween 55° 15′ and 55° 57′ N. lat., and between 3° 20′ and 4° 23′ W. long., and is bounded N. by Dumbarton and Stirling, E. by Stirli Linlithgow, Midlothian, and Peebles, S. by Dumfri and W. by Ayr, Renfrew, and Dumbarton. Its gre est length northwest to southeast is over 50 miles, a its greatest breadth from east to west over 30 mil The total area comprises 568,868 acres, or 888 squ miles. Though only the twelfth as regards extent, stands far above all the other Scottish counties in po of population, having 904,405 inhabitants in 1881, only 18,909 less than the aggregate of the three cou ties that rank next to it.

Plate I

The greater part of the county to the east and sout included in what is known as the upper ward, consi of high moorlands frequently rising into lofty round hills, in many cases more than 2000 feet above se level, the highest summits being Coulter Fell (245 and Tinto (2350) in Carmichael parish, and Gre Louther (2403), Five Cairn Louther (2377), Quee berry Hill (2285), Sergeant Law (2257), and seve others in Crawford parish, which consists chiefly of cluster of mountains. The highest inhabited land Scotland is at Leadhills, a village in the southern e tremity of the county, which is about 1300 feet abo sea-level. The remainder of the county to the nort west of Tinto softens down to gentle undulations, nev rising to an elevation of more than 700 feet, and gra ually opening out into the fertile vale of Clyde.

The principal river is the Clyde, which is formed several streams rising among the mountains that sep rate Lanark from Peebles and Dumfries near to t sources of the Tweed and Annan, the chief of the streams being the Crook Burn, Powtrail Water, an Elvan Water. Running almost north, the river joined by the Glengonner Burn, the Duneaton Wate and other streams; after receiving the Medwyn ne Carstairs it flows southwest, and then, on being join by the Douglas Water, it turns abruptly to the north west—its general direction for the rest of its course. At Bonnington, the first of the famous falls of Clyde, the banks slope gently downwards, and are adorned with lofty trees and leafy shrubbery. The river widens as it reaches the fall, and its course remains uninterrupted until it suddenly descends a precipice 27 feet in

height in a broad and unbroken stream. From this point it rolls turbulently along between lofty and precipitous banks of sandstone rocks beautified with wood until it reaches the magnificent fall of Corra, where it rushes over a precipice 85 feet in height into the deep abyss of the linn. Through a deep ravine it reaches a small fall called Dundaff Linn and after passing a singular piece of rock called "Wallace's Chair," skirts New Lanark and the county town of Lanark. Shortly afterwards it receives the Mouse, which, dashing and foaming from the split rocks of Cartland Crags, adds to the volume of the stream and contributes at the precipice of Stonebyres to form the fourth fall of Clyde. Near the ruins of Craignethan Castle it receives the Nethan, and a little further on the Avon, and then sweeps through the richly wooded haughs of Hamilton past Bothwell to Glasgow, where it becomes navigable. The lochs are few and small, the principal being Bishop Loch between the parishes of Cadder and Old Monkland, Black Loch in New Monkland, and Johnston Loch in Cadder. The Hillend reservoir for supplying the Forth and Clyde and the Monkland Canals has an area of 307 acres. The Forth and Clyde Canal traverses the northwest corner of the county; the Monkland Canal connects Glasgow with the southern extremity of Old Monkland parish; and the Ardrossan Canal passes by Govan to Renfrew and Ayr.

Geology and Minerals.—Lanarkshire is nearly wholly occupied by the Carboniferous strata forming the coal-field of the Clyde basin. This is almost entirely confined to the county, but portions of it extend into Dumbartonshire, Renfrewshire, and Stirlingshire. The formation rests on traps and ashes associated with the Lower Calciferous Sandstones, which towards the east separate the coal-field from that of the Lothians, and in the west from that of Ayr. The middle portion of the formation, which contains the best coal-seams with blackband and other ironstones, is without limestone, and apparently of freshwater origin, although a bed of marine fossils has been detected in the series near Glasgow. Towards the border on all sides a lower marine series with encrinal and coralline limestones crops out. It also contains many valuable coal-seams and veins of ironstone, and, while affording a great variety of marine fossils, possesses a few interpolated beds of estuarine or freshwater origin. The line of junction between this lower series and the Old Red Sandstone occurs in the vicinity of the Falls of Clyde, Lanark, and Carstairs. Besides the older trap rocks, which bound the field to the east and west, others, probably of the same age as the Upper Carboniferous series, rise through and disturb the strata of the interior in many places; and numerous basaltic dykes, which, however, are generally unconnected with faults in the strata, extend through the area of the coal-field in an easterly direction. These, like the other erupted masses, usually alter the strata with which they come into contact, converting coal into coke and clay into jasper, and highly indurating the shales and sandstones. The isolated coal-field of Lesmahagow, about 7 miles square, is nearly surrounded by Old Red Sandstones, upon which also the coal rests.

The amount of coal available in the Lanark coal-field is estimated at 2,044,090,216 tons, slightly less than that in the Midlothian coal-field, and less than a fourth of that available in Scotland. The mines lie scattered over a considerable area, but the principal coal-fields are in the districts between Glasgow, Hamilton, and Airdrie. The coal-field is perhaps best developed in the neighborhood of Hamilton, the seam being rich and easily reached; and the famous Wishaw "ell coal" is there found in its best state. There is a valuable seam of gas coal at Lesmahagow; this is also frequently associated with blackband ironstone. The number of shafts or pits from which minerals were raised in 1880 was 452, and connected with these 25,882 persons were employed underground and 5355 on the surface. The gross amount of minerals raised was 11,071,054 tons, nearly one-half of the whole amount raised in Scotland. The total amount of coals raised was 10,026,999 tons, of ironstone 757,291, of fireclay 195,419, of oil shale 28,830, of limestone 59,419, of lead ore 1801, and of gannister 1295. The lead-mines are at Leadhills in the parish of Crawford. From the ore silver to the extent of 6 to 12 oz. to the ton is obtained. Copper-ore is found in the mines, and also antimony, but the quantity does not repay the coast of mining. The gold-mines are said to have been discovered in the reign of James IV., and it is stated that in 1542 as many as 300 persons were employed in connection with the industry, and that upwards of £100,000 sterling value was collected. The gold-field extends over an area of 25 miles by 12, but it is only in the neighborhood of the lead-mines that gold is found in considerable quantity. It does not, however, repay the labor of search and washing. Freestone and sandstone are abundant.

Agriculture.—The upper ward of Lanarkshire consists principally of moorland, even where the land is not too elevated to admit of successful tillage. The climate of this district is variable, and the rainfall considerable. Wheat is grown in the lower valleys, but the cereals best adapted for those portions of the district where grain is cultivated are oats and barley. In the higher grounds potatoes and Scotch kail are almost the only vegetables grown. Some portions of this district, on the borders of the Clyde, are, however, very fruitful. The feeding of cattle and dairy and sheep farming are largely followed. Generally twenty-five to thirty cows are kept, but on some farms most attention is directed to the rearing of cattle or sheep. Several large sheep farms are occasionally held by one tenant. In the middle ward the land is generally strong clay, with the exception of the alluvial deposits on the banks of the Clyde. A large portion of it is occupied by peat, and the presence of coal-pits has in many instances deteriorated the soil. In this district oats and barley are the principal crop. The banks of the Clyde have been occupied with orchards since the days of the Venerable Bede. Apples, pears, and plums are largely grown, but of late years more attention has been paid to gooseberries, currants, and strawberries. The district of the lower ward is much exposed to westerly breezes, but though humid is warm, severe frosts being seldom of long duration. It is very highly cultivated, its proximity to Glasgow having greatly stimulated improvements.

The following table gives a classification of holdings in 1875 and 1880:—

Years.	50 Acres and under.		From 50 to 100 Acres.		From 100 to 300 Acres.		From 300 to 500 Acres.		From 500 to 1000 Acres.		Above 1000 Acres.		Total.	
	No.	Acres.	No.	Acres.	No.	Acres.	No.	Acres.	No.	Acres.	No.	Acres.	No.	Acres.
1875	1,463	22,624	713	54,245	854	134,006	64	23,825	12	8,340	1	1,532	3,107	244,572
1880	1,406	23,351	684	52,384	830	132,262	76	28,783	13	8,987	1	1,374	3,010	247,141

The largest farms are in the upper ward, where they generally vary from 100 to 500 acres, although the largest number are between 100 and 200 acres.

According to the agricultural returns for 1881 the total area under crops was 247,777 acres, a percentage of 43.5, the percentage in 1870 being 41.8. The area under corn crops was 50,975 acres; under green crops, 19,578; rotation grasses, 63,361; permanent pasture, 113,407. The area under woods was 18,780 acres; orchards, 531; market gardens, 310; and nursery grounds, 39. Of corn more than four-fifths of the area was under oats, which in 1881 occupied 44,982 acres, while only 3790 were under wheat, 1408 beans, and 682 barley. Potatoes were grown on 9427 acres, turnips and swedes on 8552, and vetches on 1321.

The total number of horses in 1881 was 7755, of which 5611 are stated to be used solely for purposes of agriculture, and 2144 to be unbroken horses and mares kept for breeding purposes. The celebrated Clydesdale draught horses are supposed to have been bred from Flanders horses, imported in the 17th century by one of the dukes of Hamilton. The number of cows in 1881 was 33,730, of other cattle two years of age and above 10,989, and under two years of age 19,557. The average number of cattle to every 100 acres under cultivation was 25.9, the average for Scotland being 23. The cows are principally the Ayrshire breed, but there is also a cross between the Ayrshire and the improved Lanark. The best cheese is made in the Carnwath and Lesmahagow districts. Sheep in 1881 numbered 208,632, an average of 84.2 to every 100 acres under cultivation, the average for Scotland being 141.3. Pigs, which are largely kept by the coal-miners, numbered 5796.

According to the owners and heritages return, 1872–73, the land was divided among 9717 proprietors, and amounted to 553,097 acres, with a gross annual value, including minerals, of £1,736,268. Of the owners 7927, or 81 per cent., possessed less than 1 acre, and the average value per acre was £3 2s. 9d. There were seven proprietors who owned upwards of 10,000 acres, viz., the countess of Home, 61,943 acres; the duke of Hamilton, 45,731 acres; Sir Simon Macdonald Lockhart, 31,556; Sir Thomas E. Colebrooke, 29,604; the earl of Hopetoun, 19,180; Sir Windham Anstruther, 13,624; and A. D. R. W. Baillie Cochrane (now Lord Lamington), 10,833. The duke of Buccleuch possessed 9091 acres, and Colonel Buchanan 8549.

Manufactures.—In 1879 there were 314 iron-works, 5149 puddling furnaces, and 846 rolling mills. These are chiefly situated in the neighborhood of Airdrie, Coatbridge, Wishaw, Lesmahagow, and Glasgow. The principal other manufactures—cotton, flax, and silk—are connected chiefly with GLASGOW, to which article the reader is also referred for details regarding shipping and ship-building.

Railways.—Both the North British and the Caledonian systems have numerous lines and branches, both for general traffic and for minerals, supplying the county generally with ample railway communication.

Population.—Owing to the rapid development of the manufacturing and mining industries of the county, and especially to the fact that a great portion of Glasgow is included within its limits, the increase of the population since the beginning of the century has been very great. From 147,692 in 1801 it had increased in 1831 to 316,819, in 1851 to 530,169, in 1871 to 765,339, and in 1881 to 904,405, of whom 449,192 were males and 455,213 females. The county includes the greater part of the parliamentary burgh of Glasgow (population in 1881, 487,948), and the parliamentary burghs of Airdrie (13,363), Hamilton (13,997), Lanark (4908), and Rutherglen (11,265). Glasgow, Lanark, and Rutherglen are also royal burghs, and in addition to Airdrie and Hamilton the police burghs are Biggar (1556) in the upper ward; Wishaw (13,112) and Motherwell (12,911) in the middle ward; and Govan (49,448), Hillhead (6683), Maryhill (12,916), Partick (27,396), and Govanhill (9634) in the lower ward immediately adjoining Glasgow. The other towns are Baillieston, Bellshill, part of Busby, Calderbank, Cambuslang, Carluke, Coatbridge (population 18,425), Holytown, Larkhall, Lesmahagow, Newmains, Shettleston, Stonehouse, Strathaven, and Whifflet. There are also over seventy villages, the majority numbering over 500 inhabitants, and very many over 1000.

Administration.—The county comprises forty-nine parishes and two parts of parishes. For purposes of county taxation it is divided into an upper, a middle, and a lower ward, and the middle ward has also been lately divided into two districts for police purposes. The county is represented in parliament by two members, one for the northern division and one for the southern division.[1] The city of Glasgow returns three members, while Lanark, Hamilton, and Airdrie are included in the Falkirk district of burghs, and Rutherglen in the Kilmarnock district. A sheriff ordinary court is held at Glasgow, and sheriff courts are held at Lanark, Airdrie, and Hamilton.

History and Antiquities.—Lanarkshire at an early period was inhabited by a Celtic tribe, the *Damnii*, whose territory was divided by the Roman wall of Antonine between the Forth and Clyde, but none of whom were ever fully subdued by the Romans. Traces of these early inhabitants are still to be seen in remains of fortifications, mounds, and circles; and numerous stone axes, bronze celts, hand-mills, and urns belonging to the same period have also been dug up. Two Roman roads entered the county from Dumfriesshire, and after their junction near Crawford proceeded by Biggar, Carstairs, and Carluke, being joined at several points by others. Along the route of the roads there are many traces of camps and fortifications, and coins and other relics are frequently found. After the departure of the Romans a district of country which included Lanarkshire was united into the kingdom of Strathclyde, which in the 7th century was subdued by the Saxons of Northumberland, large numbers, however, of the Celtic population migrating to Wales. Formerly Lanarkshire included a portion of Renfrew, but this was disjoined in the time of Robert III. Lanark at the same time was divided into two wards, the over and the nether, with Lanark and Rutherglen as the chief towns in each ward. The division into three wards—upper, middle, and lower—took place in the last century. Among the more important events of later history connected with the county are the battles of Drumclog in the parish of Avondale, 1st June, 1679, in which the Covenanters defeated Graham of Claverhouse, and of Bothwell Bridge at Bothwell, near Hamilton, on the 22d June, of the same year, in which the Covenanters were defeated by the duke of Monmouth with great slaughter. The principal buildings of interest besides those noticed in the separate articles on particular towns, are the ruins of Blantyre Priory, the remains of the ancient Douglas Castle, Craignethan Castle (the Tullietudlem of Sir Walter Scott, where Mary Queen of Scots found refuge after her escape from Lochleven), and Bothwell Castle. See Irving's *History of the Upper Ward of Lanarkshire*, 3 vols., 1864.

LANARK, a royal and parliamentary burgh, the chief town of the above county, is situated on a slight eminence near the Clyde, 32 miles southwest of Edinburgh, and 25 southeast of Glasgow. It consists principally of one main street, which is spacious and well paved. The industries are hand-loom weaving and nail making. In the neighborhood there are extensive oil-works. The county buildings, in the Grecian style, were erected in 1836, and the assembly-rooms, erected in 1827, occupy the site of an old Franciscan monastery. The population of the town in 1871 was 5099, and in 1881 it was 4908.

A parliament was held by Kenneth III. at Lanark in 978, and occasionally it was the residence of the Scottish kings. Its charter is said to have been bestowed by Alexander I. It was more than once the scene of the exploits of William Wallace. New Lanark, a manufacturing village situated on the Clyde about a mile distant, is famous from its connection with the communistic projects of Robert Owen.

LANCASHIRE, or COUNTY OF LANCASTER, a maritime county in the northwest of England, lies between 54° 40′ and 55° 33′ N. lat., and between 3° 15′ and 1° 58′ W. long. A detached portion in the north, known as Furness, is situated between Cumberland and Westmoreland. The remainder of the county, separated from Furness by Morecambe Bay, is bounded N. by Westmoreland, E. by Yorkshire, S. by Cheshire, and W. by the Irish Sea, which forms also the southern boundary of Furness. The outline of the county is irregular. Its greatest length is 76 miles; south of the Ribble the average breadth is about 40 miles, while to the north it is only about 10 miles. The total area is 1,207,926 acres, or 1887 square miles. With the exception of a narrow tract of country along the south coast, the Furness division consists of hilly moorlands, a continuation of the Cumberland mountains, intersected by deep valleys. The highest summits of this region are Coniston Old Man (2633 feet) and Seathwaite Fells (2537 feet). A similar elevated district, forming part of a mountainous chain stretching from the Scottish border, runs along the whole eastern boundary of the main portion of the county, and to the south of the Ribble occupies more th n half the area,

Plate IV.

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[1] The Parishes comprised in North Lanarkshire are the following:—*Lower Ward:* Barony, Cadder, Carmunnock, Cathcart (part), city parish of Glasgow, Govan (part), and Rutherglen; *Middle Ward:* Avondale, Blantyre, Bothwell, Cambuslang, Dalziel, East Kilbride, Glassford, Hamilton, New Monkland, and Old Monkland. The following parishes constitute South Lanarkshire:—*Middle Ward:* Cambusnethan, Dalserf, Shotts, and Stonehouse; *Upper Ward:* Biggar, Carluke, Carmichael, Carnwath, Carstairs, Covington and Thankerton, Crawford, Crawfordjohn, Culter (part), Dolphinton, Douglas, Dunsyre, Lanark, Lesmahagow, Liberton, Moffat (part), Pettinain, Symington, Walston, Wandell and Lamington, and Wiston and Roberton.

stretching west nearly to Liverpool. The moorlands in the southern districts are covered chiefly with heather. Towards the north the scenery is frequently picturesque and beautiful, the green rounded elevated ridges being separated by pleasant cultivated valleys variegated by woods and watered by rivers. None of the summits of the range within the boundaries of Lancashire attain an elevation of 2000 feet, the highest being Blackstone Edge (1323 feet), Pendle Hill (1831 feet), and Boalsworth Hill (1700 feet).

Along the sea-coast from the Mersey to Lancaster there is a continuous plain occupied at one time by peat mosses, many of which have, however, been reclaimed. The largest is Chat Moss between Liverpool and Manchester. In some instances these mosses have exhibited the phenomenon of a moving bog. A large district in the north belonging to the duchy of Lancaster was at one time occupied by forests, but these have wholly disappeared. The coast is very irregular in outline, the principal inlets being the estuaries of the Mersey and Ribble, Lancaster Bay, and Morecambe Bay. To the south of Furness, between Morecambe Bay and the estuary of the Duddon, there is a small group of islands, the largest of which is Walney, 9 miles long, and with a breadth varying from a quarter to three-quarters of a mile. The principal river is the Mersey, which divides the county from Cheshire, and flowing by Stockport and Warrington opens into a fine estuary before reaching the sea at Liverpool. It drains an area of 580 square miles, and receives on its north bank the Irwell and the Sankey. For large vessels it is navigable to Warrington, and for smaller vessels to Stockport, the Irwell being navigable to Manchester. The Ribble, which rises in the mountains of the West Riding, forms for a few miles the boundary between Lancashire and Yorkshire, and then flows southwest to Preston, receiving the Hodder from the north and the Calder and Darwen from the south. The Wyre enters Morecambe Bay at Fleetwood. The Lune rises in Westmoreland, and falls into the sea at Lancaster Bay. The Winster separating Lancashire and Westmoreland, the Leven from Lake Windermere, the Crake from Lake Coniston, all flow south into Morecambe Bay; and the Duddon forming the boundary of the county with Westmoreland enters the Irish Channel. Windermere, the largest and most beautiful of English lakes, is partly included in the county. Some miles to the west and parallel with Windermere is Coniston Lake, 5½ miles long and 2 miles broad; and between the two larger lakes is Esthwaite Water, 12 miles in length by half a mile in breadth.

About the middle of last century the Sankey Canal, 10 miles long, the first in Britain, was constructed to bring coals from St. Helens to Liverpool. Shortly afterwards the duke of Bridgewater projected the great canal, completed in 1761, from Manchester across the Irwell to Worsley. The Leeds and Liverpool Canal, begun in 1770, connects Liverpool and other important towns with Leeds by a circuitous route of 130 miles. The other principal canals are the Rochdale Canal, the Manchester Canal, between Manchester and Huddersfield, the Lancaster Canal, and the Ulverstone Canal.

Geology and Minerals.—The greater part of Furness is occupied by slaty Silurian rocks belonging to the mountain formations of Cumberland and Westmoreland. This is mingled occasionally with Carboniferous Limestone, and in the lower region along the coast there is an Old Red Sandstone district and also a very rich deposit of iron ore. To the north of the Lune the country is occupied with Carboniferous Limestone. Near the sea are some low Old Red Sandstone cliffs, and the formation is also seen on the borders of Westmoreland, near Kirkby Lonsdale. South of the Lune the greater part of the higher ground is formed of Millstone Grit. Along the valley of the Mersey there is an extensive bed of New Red Sandstone, containing rocksalt, and the same formation occurs along the western boundaries of the county, but it is covered for the most part by the glacial drift deposits, which occupy nearly all the low ground, and in some cases fill up the valleys between the mountains. The coal-field of Lancashire occupies an irregular area of 217 square miles lying between the Ribble and the Mersey, its length being about 30 miles and its average breadth about 7 miles. The field extends into Cheshire and North Wales, and is separated from the Yorkshire field by the Millstone Grit which crops out beneath the Coal-measures. To the south of the Lune, near Ingleton, there is also a small coal-field which extends into Yorkshire. The upper Coal-measures consist chiefly of shales, sandstones, and limestones, with a bed of blackband ironstone. The middle measures contain a considerable variety of workable seams, the lowest being very valuable, and there is an important mine of cannel coal. The lower measure consists of flags, shales, and thin seams of coal, with gannister floors and roofs of slate. This coal is extensively mined in the mountain districts to the northeast of the bed. The coal district is traversed by immense dislocations which divide the field into several belts. Nearly all the marine fossils obtained are molluscs allied to *Anthracosia*, with the exception of a remarkable series obtained on the banks of the Tame near Ashton-under-Lyne.

The available coal supply of Lancashire is estimated at 5,165,000,000 tons. The amount raised in 1852 was 8,225,000 tons; in 1871 it was 13,851,000 tons, but for several years it has exceeded 18,000,000 tons, and in 1880 reached 19,120,294 tons. The amount of coal carried from Lancashire is about 11,000,000 tons, of which about 7,000,000 tons are shipped. The produce of the West Lancashire coalfield in 1880 was—coal 9,600,436 tons, fireclay 18,960 tons, and iron 1540 tons, the latter being obtained from the rubbish sent out of the pits. The coal is produced in the neighborhood of Wigan, St. Helens, and Prescot, and the fireclay in the St. Helens district. In the North and East Lancashire district 9,519,858 tons of coal were raised, 110,379 tons of fireclay, 4830 of alum shale, and 579 of copperas lumps. Through the kindness of Mr. Joseph Dickinson, inspector of mines for this district, we are enabled to give the produce of the field in seven principal divisions, viz.:—(1) the small detached field of Lunedale (lower series of measures), coal 410 tons; (2) the Burnley coal-field (lower and middle series), coal 1,036,015, fireclay 15,279; (3) an adjoining field lying southeast of a line drawn from Chorley to Blackburn (lower series), coal 388,274, fireclay 45,749; (4) a group lying further southeast and extending to Bacup, Rochdale, and Littleborough (lower series), coal 309,388, fireclay 13,298; (5) the part west of Chorley and southwards adjoining the Wigan coal-field (lower series), coal 2,030,027, copperas lumps 579; (6) the part east of the former division (middle and upper series), coal 4,789,495, fireclay 19,217; (7) the extreme southeast part, south of Rochdale, and east of the city of Manchester (lower and middle series), coal,966,249, fireclay 16,836, alum shale 4830. Rich red hæmatitic iron is obtained in great abundance in the district of Furness, the quantity raised in 1871 being 931,048 tons, and in 1880 it was 1,188,543 tons. Only a small quantity of sulphur-ore is raised, 2000 tons in 1879, valued at £900. Some copper is obtained in the Furness district, but the total quantity of ore raised in 1880 was only 442 tons. There are in various districts of the county large quarries for freestone and flagstone, the quantity raised in 1880 being 2404 tons. A fine blue slate is obtained in Furness. As much as 2973 tons of hydraulic limestone was in 1880 dug out of the Ardwick mine near Manchester. There is a mine of native oxide of iron at Warton, near Carnforth, from which in 1880 189 tons were obtained. Lead-ore and zinc-ore are being explored between Clitheroe and Chatburn, and rocksalt at Preesal near Fleetwood.

Climate and Agriculture.—The climate in the hilly districts is frequently cold, but in the more sheltered parts lying to the south and west it is mild and genial. From its westerly situation and the attraction of the mountains there is a very high rainfall, an average of nearly 50 inches annually being reached in the mountainous districts, while the average for the other districts is about 35. The soil after reclamation and drainage is fertile; but, as it is for the most part a strong clayey loam, it requires a large amount of labor. In some districts it is more of a peaty nature, and in the Old Red Sandstone districts of the Mersey there is a tract of light sandy loam, which is easily worked, and well adapted for wheat and potatoes. A considerable portion of country is still under peat, but the reclamations within late years have been very large, and at the same time great advances have been made in the methods of culture. In some districts the ground has been rendered unfit for agricultural operations by the rubbish from coal pits. A very large area is in pasturage, and dairy farming, owing to the populous character of the district, is very common.

The following table gives a classification of holdings according to size in 1875 and 1880:—

	50 Acres and under.		50 to 100 Acres.		100 to 300 Acres.		300 to 500 Acres.		500 to 1000 Acres.		Above 1000 Acres.		Total.	
	No.	Area.	No.	Area.	No.	Area.	No.	Area.	No.	Area.	No.	Area.	No.	Area.
1875	18,210	299,109	2,878	202,619	1,468	225,184	74	26,828	12	8,070	1	2,195	22,638	764,005
1880	17,428	286,009	3,077	219,412	1,552	235,174	104	31,555	13	3,582	1	2,726	22,170	783,408

Nearly all the yearly tenants are subject to two years' notice to quit. Great freedom is allowed in regard to rotation and to sale of produce, and it is a frequent custom to sell hay and straw, and to purchase artificial manure for the meadow lands to about one-third of the value sold. According to the agricultural returns for 1881 the total cultivated area was 787,732 acres, a percentage of 65.2 instead of 60 in 1870. The area under corn crops was 101,651 acres; under green crops, 59,971; rotation grasses, 63,387; and permanent pasture, 560,143, more than two-thirds of the whole under cultivation. Only 2573 acres were fallow. Of the area under corn crops 59,373 acres, or considerably more than the half, were occupied with oats, wheat coming next with 26,492 acres, while barley occupied 11,559. The large area of 42,809 acres was under potatoes, turnips and swedes occupying only 10,867 acres.

The total number of horses in 1881 was 38,484, of which 24,567 were used solely for agricultural purposes. Cattle numbered 222,968 (122,683 being cows), an average of 18.5 to every 100 acres under cultivation. They are mostly polled Suffolks, red Yorkshires, and Leicesters. Sheep numbered 284,317, an average of 23.6 to every 100 acres under cultivation, the average for England being 62.4. Cheviots are kept on the higher grounds, on the low grounds Southdowns and Leicesters. Pigs in 1881 numbered 37,700.

The county in 1872–73 was divided among 88,735 proprietors, possessing 1,011,769 acres, with an annual valuation of £13,878,277. Of the owners 76,177, or 87 per cent., possessed less than 1 acre, and the average value, including minerals, was £13 14s. 4d. per acre. Nineteen proprietors owned upwards of 5000 acres, the largest proprietor being the earl of Derby, who possessed 47,269 acres, with a rental of £156,735. Among other large proprietors are the duke of Bridgewater's trustees, the duke of Devonshire, the Marquis de Casteja, the earl of Stamford and Warrington, the earl of Wilton, the earl of Sefton, Lord Lilford, and Lord Skelmersdale.

Manufactures.—Lancashire is the principal seat of the cotton manufacture, not only in England, but in the world. The history of the industry in the county, and statistical details regarding it, will be found in the article COTTON, vol. vi. 434 *sq.* In 1879 the total number of factories was close on 2000, and the number of persons employed in these was nearly 370,000. The centre of the industry is Manchester and the neighboring towns, especially Oldham. Previous to the American war it employed nearly 100,000 more persons than at present. The woollen, silk, and linen manufactures employed in 1879 about 50,000 persons. There are a great variety of industries dependent on these staple manufactures, such as bobbin making, the preparation of dyes, calico printing, and the manufacture of machinery and of steam engines. Barrow-in-Furness is noted for the manufacture of iron and steel. Warrington has a large trade in sole leather. St. Helens is celebrated for its crown, sheet, and plate glass, and Prescot for its watches. Chemicals are largely manufactured in several towns. The principal seaports are Liverpool, Barrow, Ulverstone, Lancaster, Fleetwood, and Preston, to the separate articles on which the reader is referred for particulars regarding shipping, trade, and shipbuilding. The principal watering-places are Blackpool, Lytham, Morecambe, and Southport.

Railways.—The London and Northwestern, Midland, and Lancaster and Yorkshire Railways pass through the county, and it is intersected in all directions by a network of branch lines.

Population and Administration.—The population in 1881 was more than five times as great as in 1801. In that year it was 673,486, or only a little more than the population of Liverpool at the present time. In 1861 it amounted to 2,429,440, in 1871 to 2,819,495, and in 1881 to 3,454,225, of whom 1,667,979 were males and 1,786,246 females. The population of the northern parliamentary division was 273,417, of the northeastern division 238,544, of the southeastern 534,963, and of the southwestern division 482,148, —the population outside the limits of parliamentary boroughs being thus 1,529,072, and that of the parliamentary boroughs 1,925,153. Liverpool (552,425) is represented by three members, Manchester (population of municipal borough 341,508, of parliamentary 393,676) by three members, Salford (176,233) by two, Oldham (mun. 111,343, parl. 152,511) by two, Bolton (mun. 105,422, parl. 105,973) by two, Preston (mun. 96,532, parl. 93,707) by two, Blackburn (mun. 104,012, parl. 100,618) by two, Wigan (48,196) by two, Burnley (mun. 58,882, parl. 63,502) by one, Rochdale (68,865) by one, Bury (mun. 51,582, parl. 49,746) by one, Ashton-under-Lyne (mun. 37,027, parl. 43,389) by one, Warrington (mun. 41,456, parl. 45,257) by one, and Clitheroe (mun. 10,177, parl. 14,463) by one. As each division of the county has also two members, the total representation for the county is thirty-two members. The parliamentary boroughs of Staleybridge and Stockport are chiefly in Cheshire. The other principal municipal boroughs are Accrington (31,435), Barrow-in-Furness (47,111), Blackpool (14,448), Bootle-cum-Linacre (27,112), Heywood (23,050), Lancaster (20,724), Over Darwen (29,747), St. Helens (57,234), Southport (32,191), Swinton and Pendlebury (18,108), and Todmorden, chiefly in Yorkshire (23,861). There are besides a large number of other towns of over 10,000 inhabitants. The county palatine comprises six hundreds. It is attached to the duchy of Lancaster and so to the crown. It is in the northern circuit, and assizes are held for North Lancashire at Lancaster, and for South Lancashire at Liverpool and Manchester. The county has one court of quarter sessions, and is divided into twenty sessional divisions. The city of Manchester and the boroughs of Bolton, Liverpool, and Wigan have commissions of the peace and separate courts of quarter sessions; and the boroughs of Ashton-under-Lyne, Blackburn, Bromley, Lancaster, Oldham, Preston, Rochdale, Salford, and Warrington have commissions of the peace. There are ten police divisions. Most of the municipal boroughs have their own police. The county is chiefly in the diocese of Manchester, formed in 1847; but the northern portion of Furness is in Carlisle; a portion formerly in Chester is now part of the newly formed diocese of Liverpool, and a small portion adjoining Yorkshire is in Ripon. The chancery of the duchy of Lancaster, still a crown office, was at one time a court of appeal for the chancery of the county palatine, but now even its jurisdiction in regard to the estates of the duchy is merely nominal. The chancery of the county palatine has concurrent jurisdiction with the High Court of Chancery in all matters of equity within the county palatine, and independent jurisdiction in regard to a variety of other matters.

History and Antiquities.—Before the Roman invasion Lancashire formed part of the extensive northern province of the Brigantes, of whose occupation a few names and earthworks are the chief remains. The Romans held the district for three centuries and a half, and erected various camps or stations at Manchester, Ribchester, Lancaster, Colne, etc. They also constructed various roads, one entering the county at Warrington, and passing almost north to Carlisle. Manchester appears to have been the chief centre of this district, as the roads branched out thence in every direction,—into Cheshire by Stockport, by Stretford, and by Warrington, to Yorkshire by Littleborough or by Overborough near Colne, by Ribchester to Lancaster, by Kirkham to the Wyre, and by Westhaughton and Blackrod to

Preston. The Roman remains found within the county are thus summarized by Mr. W. T. Watkin in the *Transactions of the Historic Society of Lancashire and Cheshire* for 1880, p. 89:—

> "Excluding perhaps Northumberland, I doubt whether any English county has produced so many elaborate articles in the precious metals and in bronze of the Roman period. The silver arm from Littleborough, the gold *bullæ* from Manchester and Overborough, the gold rings from Standish, the silver cup from Emmott, the rich 'find' of silver articles from Walmersley, the bronze shield *umbo* from Kirkham, and the beautiful helmet from Ribchester, with the gold cup from the same place, form an almost unequalled collection of Britanno-Roman works of art."

After the departure of the Romans Lancashire was included in the kingdom of Strathclyde, which for some time retained its independence; but, although King Arthur, according to some authorities, fought several battles against them on the banks of the Douglas at Wigan, the Saxons gradually occupied the whole county, and during the Heptarchy it formed part of the kingdom of Northumbria. How extensive was their occupation may be judged of from the Saxon names of towns and villages remaining to the present day. Towards the end of the 9th century, however, the Danes invaded and permanently settled in the Furness district, and also in the southwest coast of the county, and in the opposite peninsula of Wirral in Cheshire, in all which places many Danish names of villages are still found.

In Domesday the portion of Lancashire between the Ribble and the Mersey was included in Cheshire and the remainder in Yorkshire. A great part of the land between the Ribble and the Mersey was granted by the Conqueror to Roger de Poictou of the family of Montgomery. It was then conferred by Henry I. on Stephen de Blois, afterwards king, on the decease of whose brother William it reverted to the crown, and was granted to one of the earls of Chester. That line becoming extinct in 1232, it passed to William de Ferrers, and after the second revolt of Robert de Ferrers, King Henry III. granted it to his younger son Edmund Crouchback, and with it the earldom of the county. (See LANCASTER, HOUSE OF.) In 1351 the county became a palatinate, and again, after sixteen years abeyance, in 1377. Henry IV., soon after ascending the throne, passed an Act declaring that the inheritance and titles of the duchy of Lancaster should remain to him and his heirs for ever a distinct and separate inheritance from the lands and possessions of the crown; and from the reign of Henry V. the sovereigns of England have held the duchy, as well out of as within the county palatine. At the Reformation most of the leading families of the county adhered to the Catholic faith, and a few, as the Blundels of Little Crosby and the Harringtons of Huyton, never left it. During the civil wars they were ardent supporters of the royalist cause, especially the Derby family, and the county was frequently the scene of sieges, as at Manchester, Liverpool, Warrington, Lathom House, etc., and of battles, as at Atherton Moor, Wigan, Preston, and Winwick.

The Cistercian abbey of Furness is perhaps one of the finest and most extensive ecclesiastical ruins in England. Whalley abbey, first founded at Stanlawe in Cheshire in 1178, and removed in 1296, belonged to the same order. There was a priory of Black Canons at Burscough, founded in the time of Richard I., one at Conishead dating from Henry II.'s reign, and one at Lancaster. A convent of Augustinian friars was founded at Cartmel in 1188, and one at Warrington about 1280. There are some remains of the Benedictine priory of Upholland, changed from a college of secular priests in 1318; and the same order had a priory at Lancaster founded in 1094, a cell at Lytham, of the reign of Richard I., and a priory at Penwortham, founded shortly after the time of the Conqueror. The Premonstratensians had Cockersand abbey, changed in 1190 from a hospital founded in the reign of Henry II., of which the chapter-house remains. At Kersal, near Manchester, there was a cell of Cluniac monks founded in the reign of John, while at Lancaster there were convents of Dominicans and Franciscans, and at Preston a priory of Grey Friars built by Edmund, earl of Lancaster, son of Henry III.

Besides the churches mentioned under the several towns, the more interesting are those of Aldingham, Norman doorway; Aughton; Cartmel priory church, with choir and transepts of the Transition between Norman and Early English, south chapel Decorated, and nave and windows Perpendicular; Hawkshead; Heysham, Norman with traces of Saxon; Hoole; Huyton; Kirkby, rebuilt with very ancient font; Kirkby Ireleth, late Perpendicular, with Norman doorway; Leyland; Melling (in Lonsdale), Perpendicular, with stained glass windows; Middleton, rebuilt in 1524, but containing part of the old Norman church and several monuments; Ormskirk, Perpendicular with traces of Norman, having two towers, one of which is detached and surmounted by a spire; Overton, with Norman doorway; Radcliffe, Norman; Sefton, Perpendicular, with fine brass and recumbent figures of the Molyneux family, also a screen exquisitely carved; Stidd, near Ribchester, Norman arch and old monuments; Tunstall, late Perpendicular; Upholland priory church, Early English, with low massy tower; Urswick, Norman, with embattled tower and several old monuments; Walton, anciently the parish church of Liverpool; Walton-le-Dale; Warton, with old font; Whalley abbey church, Decorated and Perpendicular, with Runic stone monuments.

The principal old castles are those of Lancaster, noticed below; Dalton, a small rude tower occupying the site of an older building; two towers of Gleaston Castle, built by the lords of Aldingham in the 14th century; the ruins of Greenhalgh Castle, built by the first earl of Derby, and demolished after a siege by order of parliament in 1649; the ruins of Fouldrey in Peel Island, near the entrance to Barrow, erected in the reign of Edward III., now a most dilapidated ruin, but "massive, great, and impressively solemn." There are many old timber houses and mansions of special interest, as well as numerous modern seats.

The principal histories of Lancashire are those by Edward Baines (1824, 2d ed. 1836, edited by Harland, 1868–70), and by Thomas Baines (1868–69). Many interesting papers on special subjects will be found in the 110 volumes issued by the Chetham Society, instituted at Manchester in 1843, and in the 32 volumes of *Transactions of the Lancashire and Cheshire Historic Society*; also in the *Palatine Note Book for* 1881. For a fuller list of the bibliography of the county and its several towns see Fishwick, *Lancashire Library*, 1877; Sutton, *Lancashire Authors*, 1876; and Anderson, *Topography of the United Kingdom*, 1881.

LANCASTER, a municipal borough and seaport town, the capital of Lancashire, England, is situated on the left bank of the river Lune, about 7 miles from its mouth, and on the London and Northwestern Railway, 52 miles northwest of Manchester. It is built on the slope of an eminence crowned by the old castle and church, and commanding fine views of the river and surrounding country. The older portion of the town is irregularly built, but of late years it has been much improved by the formation of new streets; and the sanitary and other arrangements are complete and satisfactory. The Lune is crossed by a bridge of five arches erected in 1788, and to the north of the town the Lancaster Canal is conveyed over the river by a handsome aqueduct. The ancient castle occupies the site of a Roman *castrum*. The Saxon foundations of a yet older structure still remain, and the tower at the southwest corner is supposed to have been erected during the reign of the emperor Hadrian. The Dungeon Tower, also supposed to be of Roman origin, was taken down in 1818. The greater part of the old portion of the present structure was built by Roger de Poictou, who, however, utilized some of the old Roman towers and the old walls in its erection. In 1322 much damage was done to the castle by Robert Bruce, whose attack it successfully resisted, but it was restored and strengthened by John of Gaunt, who added the greater part of the Gateway Tower as well as turrets to the Lungess Tower, which on that account has been named "John o'Gaunt's Chair." During the wars of the Commonwealth the castle was captured by Cromwell. Shortly afterwards it was converted into the county jail, and the building now includes the governor's house and the crown and nisi prius courts. To the northeast of the castle is the church of St. Mary, in the Early English style, originally erected by Roger de Poictou, but partly rebuilt in 1759, when the present lofty tower was added. The church contains several old monuments and brasses. A large Gothic Roman Catholic church, with a convent and schools adjoining, was erected in 1859, and there are also several other churches and chapels of some architectural pretensions. There is a grammar school, completed in 1853. Among the charitable institutions are the county lunatic asylum, the Ripley orphan hospital, opened in 1664, erected and endowed at a cost of £100,000, the dispensary and infirmary instituted in 1781, and the Royal Albert asylum for idiots and imbeciles. The town possesses a large market and a handsome town-hall. The principal industries of the town are cotton and silk spinning, cabinetmaking, and the manufacture of oil-cloth table-covers; and there are also iron-foundries, marble-polishing works, and a manufactory for railway carriages and wagons. The bulk of the shipping is engaged in the coasting trade, and large vessels require to unload at Glasson, 5 miles down the river, the cargoes being carried up to the town by lighters. The population of the municipal borough in 1871 was 17,245, and in 1881 it was 20,724.

From discoveries of celts, flint arrow-heads, and other similar remains, it is probable that Lancaster was an old British town. Its Roman name is unknown, but inscribed Roman altars, tombstones, Samian ware, and other pottery, and the remains of the old fortress preceding the castle, and of other buildings, leave no doubt that it was a Roman station of great importance. It was constituted a borough in the fourth year of Richard I., and it first returned members to parliament in the twenty-third year of Edward I. The privilege was withdrawn for some years before 1547, but from that time was enjoyed without interruption until 1867, when it was disfranchised for corrupt practices. The town was plundered and burned by the Scots in 1329 and 1389, was nearly depopulated during the Wars of the Roses, was captured by the Parliamentary forces in 1643, and retaken by the Royalists under the earl of Derby in the same year, was held by the Parliamentary troops in 1648, and was partly destroyed by fire in 1698. It was entered by the rebels in 1715, and again by a large force of them in 1745.

See Clarke, *Lancaster*, 1807, 2d. ed. 1811; *Lancaster Records*, 1869; Hall, *Lancaster Castle*, 1848; Simpson, *History and Antiquities of Lancaster*, 1852; and a paper on "Roman Lancaster," by W. Thompson Watkin, in *Transactions of the Historic Society of Lancashire and Cheshire*, 1876.

LANCASTER, the shire city of Lancaster county, Pennsylvania, U. S., is situated on the Conestoga river, 68 miles west of Philadelphia by rail. It was founded in 1730 and incorporated as a borough in 1742, was the State capital from 1799 to 1812, and in 1812 became a city. It is laid out on the rectangular plan, and is unusually well built. The city is the seat of numerous charitable and educational institutions. Among the latter is Franklin and Marshall College, the chief educational establishment of the Reformed Church, which also maintains a theological seminary in connection with it. The court-house is an imposing edifice, erected in 1853 at a cost of $166,000. The county jail is a massive sandstone structure, with a tower 110 feet high, built at a cost of $110,000 in 1851. Lancaster is the centre of one of the wealthiest agricultural regions in the United States. Its cotton, iron, and other mills are numerous and large, and it contains one of the most extensive watch factories in the country. Its tobacco trade requires nearly 100 large warehouses for its accommodation. A valuable trade in coal, lumber, leather, and grain is also carried on. James Buchanan, the fifteenth president of the United States, lived in Lancaster, and is buried there. The population in 1880 numbered 25,769.

LANCASTER, the chief city in Fairfield county, Ohio, United States, is situated on the Hocking river, about 30 miles southeast of Columbus. It is a well-built little manufacturing town, busy with foundries, flouring-mills, and various manufactures, such as agricultural implements and machinery. The court-house cost $150,000; and the city hall and public schools are also fine buildings. The neighboring country is fertile, being especially noted for its grain, live stock, and vineyards. The population in 1880 was 6803.

LANCASTER, House of. The name House of Lancaster is commonly used to designate the line of kings immediately descended from John of Gaunt, fourth son of Edward III. But the history of the family and of the title goes back a whole century further to the reign of Henry III., who created his second son, Edmund, earl of Lancaster in 1267. This Edmund received in his own day the surname of Crouchback, not, as was afterwards supposed, from a personal deformity, but from having worn a cross upon his back in token of a crusading vow. He is not a person of much importance in history except in relation to a strange theory raised in a later age about his birth, which we shall notice presently. His son Thomas, who inherited the title, took the lead among the nobles of Edward II.'s time in opposition to Piers Gaveston and the Spensers, and was beheaded for treason at Pontefract. At the commencement of the following reign his attainder was reversed and his brother Henry restored to the earldom, who, being appointed guardian to the young king Edward III., assisted him to throw off the yoke of Mortimer. On this Henry's death in 1345 he was succeeded by a son of the same name, sometimes known as Henry Tort-Col or Wryneck, a very valiant commander in the French wars, whom the king, for his greater honor, advanced to the dignity of a duke. The title was new in those days, for only one duke had ever been created in England before, and that was fourteen years previously, when the king's son Edward, so well known in history as the Black Prince, was made duke of Cornwall. This Henry Wryneck died in 1361 without heir male. Of his two daughters, Maud, the elder, was twice married, but died childless little more than a year after her father. The second, Blanche, became the wife of John of Gaunt, who thus succeeded to the duke's inheritance in her right; and on the 13th November, 1362, when King Edward attained the age of fifty, he was created duke of Lancaster, his elder brother, Lionel, being at the same time created duke of Clarence. It was from these two dukes that the rival houses of Lancaster and York derived their respective claims to the crown. As Clarence was King Edward's third son, while John of Gaunt was only his fourth, it ought to have followed in ordinary course that on the failure of the elder line the issue of Clarence should have taken precedence of that of Lancaster in the succession. But the rights of Clarence were conveyed in the first instance to an only daughter, and the ambition and policy of the house of Lancaster, profiting by advantageous circumstances, enabled them not only to gain possession of the throne, but to maintain themselves in it for three generations before they were dispossessed by the representatives of the elder brother.

As for John of Gaunt himself, it can hardly be said that this sort of politic wisdom is very conspicuous in him. His ambition was generally more manifest than his discretion; but fortune favored his ambition, even as to himself somewhat beyond expectation, and still more in his posterity. Before the death of his father he had become the greatest subject in England, his three elder brothers having all died before him. He had even added to his other dignities the title of king of Castile, having married, after his first wife's death, the daughter of Peter the Cruel. The title, however, was an empty one, the throne of Castile being actually in the possession of Henry of Trastamara, whom the English had vainly endeavored to set aside. His military and naval enterprises were for the most part disastrous failures, and in England he was exceedingly unpopular. Nevertheless during the later years of his father's reign the weakness of the king and the declining health of the Black Prince naturally threw the government very much into his hands. He even aimed, or was suspected of aiming, at the succession to the crown; but in this hope he was disappointed by the action of the Good Parliament a year before Edward's death, in which it was settled that Richard the son of the Black Prince should be king after his grandfather. Nevertheless the suspicion with which he was regarded was not altogether quieted when Richard came to the throne, a boy in the eleventh year of his age. The duke himself complained in parliament of the way he was spoken of out of doors, and at the outbreak of Wat Tyler's insurrection the peasants stopped pilgrims on the road to Canterbury and made them swear never to accept a king of the name of John. On gaining possession of London they gave still more emphatic proof of their dislike to him by burning his magnificent palace of the Savoy. The young king himself shared the general feeling, and after a few years John of Gaunt ceased for a time to have much influence. Richard found a convenient way to get rid of him by sending him to Castile to make good his barren title, and on this expedition he was away three years. He succeeded, however, so far as to make a treaty with his rival, King John, son of Henry of Trastamara, for the succession, by virtue of which his daughter Catherine became queen of Castile some years later. After his return the king seems to have regarded him with greater favor, created him duke of Aquitaine, and employed him in repeated embassies to France, which at length resulted in a treaty of peace, and Richard's marriage to the French king's daughter.

Another marked incident of his public life was the support which he gave on one occasion to the Reformer Wycliffe. How far this was due to religious and how far to mere political considerations may be a question; but it is certain that, in one way or another, not only John of Gaunt but his immediate descendants, the three kings of the house of Lancaster, all took deep interest in the religious movements of the times. A reaction against Lollardy, however, had already begun in the days of Henry IV., and both he and his son were obliged to discountenance opinions which were believed to be politically and theologically dangerous.

Accusations had been made against John of Gaunt more than once during the earlier part of Richard II.'s reign of entertaining designs to supplant his nephew on the throne. But these Richard never seems to have wholly credited, and during his three years' absence his younger brother, Thomas of Woodstock, duke of Gloucester, showed himself a far more dangerous intriguer. Five confederate lords, with Gloucester at their head, took up arms against the king's favorite ministers, and the Wonderful Parliament put to death without remorse almost every agent of his former administration that had not fled the country. Gloucester even contemplated the dethronement of the king, but found that in this matter he could not rely on the support of his associates, one of whom was Henry, earl of Derby, the duke of Lancaster's son. Richard soon afterwards, by declaring himself of age, shook off his uncle's control, and within ten years the acts of the Wonderful Parliament were reversed by a parliament no less arbitrary. Gloucester and his allies were then brought to severe account; but the earl of Derby and Thomas Mowbray, earl of Nottingham, were taken into favor as having opposed the more violent proceedings of their associates. As if to show his entire confidence in both these noblemen, the king created the former duke of Hereford and the latter duke of Norfolk. But within three months after the one duke accused the other of treason, and the truth of the charge, after much consideration, was referred to trial by battle according to the laws of chivalry. But when the combat was about to commence it was interrupted by the king, who, to preserve the peace of the kingdom, decreed by his own mere authority that the duke of Hereford should be banished for ten years—a term which was immediately after reduced to five—and the duke of Norfolk for life.

This arbitrary sentence was obeyed in the first instance by both parties, and Norfolk never returned. But Henry, duke of Hereford, whose milder sentence was doubtless owing to the fact that he was the popular favorite, came back within a year, having been furnished with a very fair pretext for doing so by a new act of injustice on the part of Richard. His father, John of Gaunt, had died in the interval, and the king, troubled with a rebellion in Ireland, and sorely in want of money, had seized the duchy of Lancaster as forfeited property. Henry at once sailed for England, and landing in Yorkshire while King Richard was in Ireland, gave out that he came only to recover his inheritance. He at once received the support of the northern lords, and as he marched southwards his followers became more numerous at every turn. The whole kingdom was soon practically at his command, and Richard, by the time he had recrossed the channel to Wales, discovered that his cause was altogether lost. He was conveyed from Chester to London, and forced to execute a deed by which he resigned his crown. This was recited in parliament, and he was formally deposed. The duke of Lancaster then stepped forward and claimed the kingdom as due to himself by virtue of his descent from Henry III.

The claim which he put forward involved, to all appearance, a strange falsification of history, for it seemed to rest upon the supposition that Edmund of Lancaster, and not Edward I., was the eldest son of Henry III. A story had gone about, even in the days of John of Gaunt, who, if we may trust the rhymer Hardyng (*Chronicle*, pp. 290, 291), had artfully got it inserted in chronicles deposited in various monasteries that this Edmund, surnamed Crouchback, was really humpbacked, and that he was set aside in favor of his younger brother Edward on account of his deformity. No chronicle, however, is known to exist which actually states that Edmund Crouchback was thus set aside; and in point of fact he had no deformity at all, while Edward was six years his senior. Hardyng's testimony is, moreover, suspicious as reflecting the prejudices of the Percys after they had turned against Henry IV., for Hardyng himself expressly says that the earl of Northumberland was the source of his information (see note, p. 353 of his *Chronicle*). But a statement in the continuation of the *Chronicle* called the *Eulogium* (vol. iii. pp. 369, 370) corroborates Hardyng to some extent; for we are told that John of Gaunt had once desired in parliament that his son should be recognized on this flimsy plea as heir to the crown; and, when the earl of March denied the story and insisted on his own claim as descended from Lionel, duke of Clarence, Richard put an end to the discussion and imposed silence on both parties. However this may be, it is certain that this story, though not directly asserted to be true, was indirectly pointed at by Henry when he put forward his claim, and no one was then bold enough to challenge it.

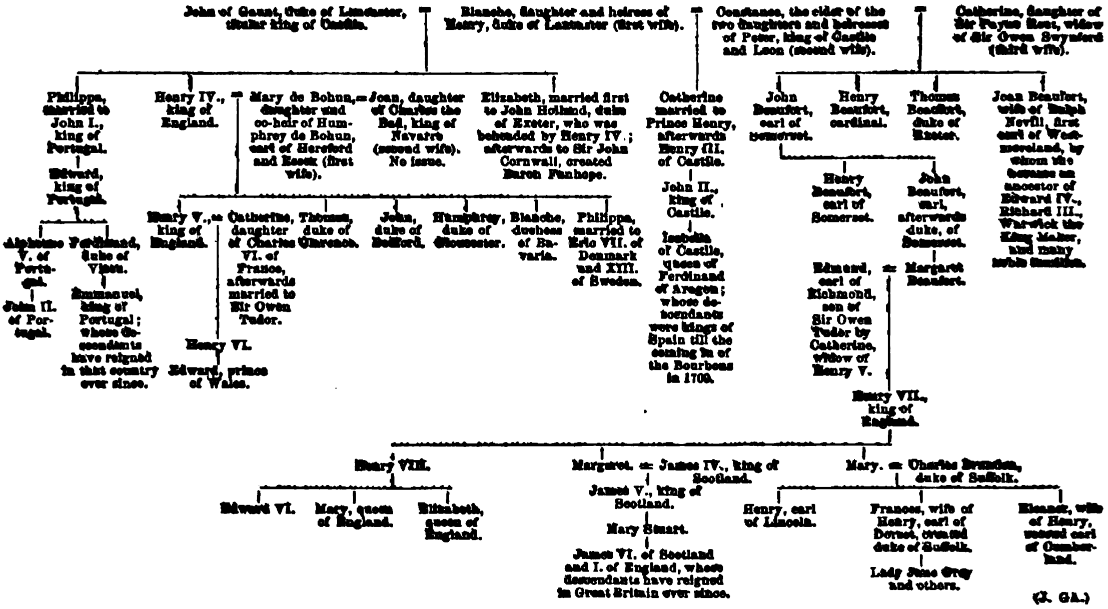
This was partly due, no doubt, to the fact that the true lineal heir after Richard was then a child, who had just succeeded his father as earl of March. Another circumstance was unfavorable to the house of Mortimer—that it derived its title through a woman. No case precisely similar had as yet arisen, and, notwithstanding the precedent of Henry II., it might be doubted whether succession through a female was favored by the constitution. If not, Henry could say with truth that he was the direct heir of his grandfather, Edward III. If, on the other hand, succession through females was valid, he could trace his descent through his mother from Henry III. by a very illustrious line of ancestors. And, in the words by which he formally made his claim, he ventured to say no more than that he was descended from the king just mentioned "by right line of the blood." In what particular way that "right line" was to be traced he did not venture to indicate.

It is unnecessary in this article to relate the history of the three successive kings belonging to the house of Lancaster (Henry IV., V., and VI.), as a brief epitome of their reigns will be found elsewhere (see vol. xi. pp. 588–590). With the death of the last-named sovereign the direct male line of John of Gaunt became extinct. But by his daughters he became the ancestor of more than one line of foreign kings, while his descendants by his third wife, Catherine Swynford, conveyed the crown of England to the house of Tudor. It is true that his children by this lady were born before he married her; but they were made legitimate by act of parliament, and, though Henry IV., in confirming the privilege thus granted to them, endeavored to debar them from the succession to the crown, it is now ascertained that there was no such reservation in the original

Act, and the title claimed by Henry VII. was probably better than he himself supposed.

We subjoin a pedigree of the royal and illustrious houses that traced their descent from John of Gaunt:—

TABLE OF THE PRINCIPAL DESCENDANTS OF JOHN OF GAUNT.


John of Gaunt, duke of Lancaster, titular king of Castile.
Blanche, daughter and heiress of Henry, duke of Lancaster (first wife).
Constance, the elder of the two daughters and heiresses of Peter, king of Castile and Leon (second wife).
Catherine, daughter of Sir Payne Roet, widow of Sir Owen Swynford (third wife).
Philippa, married to John I., king of Portugal.
Henry IV., king of England.
Mary de Bohun, daughter and co-heir of Humphrey de Bohun, earl of Hereford and Essex (first wife).
Joan, daughter of Charles the Bad, king of Navarre (second wife). No issue.
Elizabeth, married first to John Holland, duke of Exeter, who was beheaded by Henry IV.; afterwards to Sir John Cornwall, created Baron Fanhope.
Catherine married to Prince Henry, afterwards Henry III. of Castile.
John Beaufort, earl of Somerset.
Henry Beaufort, cardinal.
Thomas Beaufort, duke of Exeter.
Joan Beaufort, wife of Ralph Nevill, first earl of Westmoreland, by whom she became an ancestor of Edward IV., Richard III., Warwick the King Maker, and many noble families.
Edward, king of Portugal.
Alphonso V. of Portugal.
Ferdinand, duke of Viseu.
John II. of Portugal.
Emmanuel, king of Portugal; whose descendants have reigned in that country ever since.
Henry V., king of England.
Catherine, daughter of Charles VI. of France, afterwards married to Sir Owen Tudor.
Thomas, duke of Clarence.
John, duke of Bedford.
Humphrey, duke of Gloucester.
Blanche, duchess of Bavaria.
Philippa, married to Eric VII. of Denmark and XIII. of Sweden.
Henry VI.
Edward, prince of Wales.
John II., king of Castile.
Isabella of Castile, queen of Ferdinand of Aragon; whose descendants were kings of Spain till the coming in of the Bourbons in 1700.
Henry Beaufort, earl of Somerset.
John Beaufort, earl, afterwards duke, of Somerset.
Edmund, earl of Richmond, son of Sir Owen Tudor by Catherine, widow of Henry V.
Margaret Beaufort.
Henry VII., king of England.
Henry VIII.
Margaret.
James IV., king of Scotland.
Mary.
Charles Brandon, duke of Suffolk.
Edward VI.
Mary, queen of England.
Elizabeth, queen of England.
James V., king of Scotland.
Mary Stuart.
James VI. of Scotland and I. of England, whose descendants have reigned in Great Britain ever since.
Henry, earl of Lincoln.
Frances, wife of Henry, earl of Dorset, created duke of Suffolk.
Lady Jane Grey and others.
Eleanor, wife of Henry, second earl of Cumberland.

(J. GA.)

LANCASTER, SIR JAMES, an eminent English seaman of the Elizabethan period. In his early years he was in Portugal as soldier and merchant; in 1591 he made a voyage on his own account to the East Indies; in 1594–95 he had command of an expedition which made an attack on Pernambuco; and in 1600 he was placed at the head of the first fleet sent out by the newly-founded East India Company. During his later years he acted as one of the directors of the company. He died in 1620.

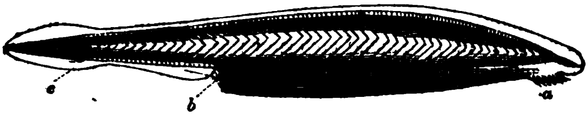
The original journals of Lancaster's principal voyage, during which he visited Java and Sumatra, have unfortunately been lost; and we only possess the narrative drawn up from them with questionable perspicacity by Purchas. The various portions of Hakluyt and Purchas relating to Lancaster have been edited for the Hakluyt Society by C. R. Markham (1879). The name of Lancaster Sound was bestowed by Baffin in honor of Sir James on the strait trending westward from Baffin's Bay.

LANCASTER, JOSEPH (1778–1838), was born in Southwark in 1778, and was the son of a Chelsea pensioner. He had few opportunities of regular instruction, but he very early showed unusual seriousness and desire for learning. At sixteen he looked forward to the dissenting ministry; but soon after his religious views altered, and he attached himself to the Society of Friends, with which he remained associated for many years, until long afterwards he was disowned by that body. At the age of twenty he began to gather a few poor children under his father's roof and to give them the rudiments of instruction, without a fee, except in cases in which the parent was willing to pay a trifle. Soon a thousand children were assembled in the Borough Road; and the attention of the duke of Bedford, Mr. Whitbread, and others having been directed to his efforts, he was provided with means for building a schoolroom, and supplying needful materials. The main features of his plan were the employment of older scholars as monitors, and an elaborate system of mechanical drill, by means of which these young teachers were made to impart the rudiments of reading, writing, and arithmetic to large numbers at the same time. The material appliances for teaching were very scanty—a few leaves torn out of spelling-books and pasted on boards, some slates, and a desk spread with sand, on which the children wrote with their fingers. The order and cheerfulness of the school and the military precision of the children's movements were very striking, and began to attract much public observation at a time when the education of the poor was almost entirely neglected. Lancaster had the skill which gains the loyalty of subordinates, and he succeeded in inspiring his young monitors with fondness for their work and with pride in the institution of which they formed a part. As these youths became more trustworthy, he found himself at leisure to accept some of the numerous invitations which crowded upon him, and to expound what he called "his system" by lectures in various towns. In this way many new schools were established, and placed under the care of young men whom he had trained. In a memorable interview with George III., Lancaster was encouraged by the expression of the king's wish that every poor child in his dominions should be taught to read the Bible. Royal patronage brought in its train resources, fame, and public responsibility, which proved to be beyond Lancaster's own powers to sustain or control. He was vain, reckless, and improvident. In 1808 a few noblemen and gentlemen came to his rescue, paid his debts, became his trustees, and founded the society which was at first called the Royal Lancasterian Institution but was afterwards more widely known as the British and Foreign School Society. With the strongest wish to retain his services and to treat him with liberality, they soon found that he was impatient of control, and that his wild impulses and heedless extravagance made it impossible to work with him. He quarrelled with the trustees, set up a private school at Tooting, became bankrupt, and in 1818 emigrated to America. There he met at first with a warm reception, gave several courses of lectures which were well attended, and wrote to friends at home letters full of enthusiasm and of high hopes for further usefulness, not unmingled with bitter denunciations of what he called the ingratitude and treachery of those who had been associated with him in England. But his fame was short-lived. The miseries of debt and disappointment were aggravated by sickness, and he settled for a time in the warmer climate of Caracas. He afterwards visited St. Thomas and Santa Cruz, and at length returned to New York, the corporation of which city made him a public grant of 500 dollars in pity for the misfortunes which had by this time reduced him to lamentable poverty. He afterwards visited Canada, where for a time his prospects brightened. He gave lectures at Montreal, and was encouraged to open a school which enjoyed an ephemeral success, but was soon abandoned. A small annuity provided by his friends in England was his only means of support. He formed a plan, however, for returning home and giving a new impetus to his "system," by which he declared it would be possible "to teach ten thousand children in different schools, not knowing the letters, all to read fluently in three weeks to three months." But these visions were never realized. He was run over by a carriage in the streets of New York in October, 1838, and was so much injured that he died in a few hours.

As one of the two rival inventors of what was called the "monitorial" or "mutual" method of instruction, his name was prominent for many years in educational controversy. Dr. Andrew Bell (q. v.) had in 1797 published an account of his experiments in teaching; and Lancaster in his first pamphlet, published in 1803, frankly acknowledges his debt to Bell for some useful hints. The two worked independently, but Lancaster was the first to apply the system of monitorial teaching on a large scale. As an economical experiment his school at the Borough Road was a signal success. He had one thousand scholars under discipline, and taught them to read, write, and work simple sums at a yearly cost of less than 5s. a head. His tract *Improvements in Education* described the gradation of ranks, the system of signals and orders, the functions of the monitors, the method of counting and of spelling, and the curious devices he adopted for punishing offenders. Bell's educational aims were humbler, as he feared to "elevate above their station those who were doomed to the drudgery of daily labor," and therefore did not desire to teach even writing and ciphering to the lower classes. The main difference between them was that the system of the one was adopted by ecclesiastics and Conservatives,—the "National Society for the Education of the Poor in the principles of the Established Church" having been founded in 1811 for its propagation; while Lancaster's method was patronized by the *Edinburgh Review*, by Whig statesmen, by a few liberal Churchmen, and by Nonconformists generally. It was the design of Lancaster and his friends to make national education Christian, but not sectarian,—to cause the Scriptures to be read, explained, and reverenced in the schools, without seeking by catechisms or otherwise to attract the children to any particular church or sect. This principle, since almost universally adopted by the school boards of England, was at first vehemently denounced as deistic and mischievous, and as especially hostile to the Established Church. To do them justice, it must be owned that the rival claims and merits of Bell and Lancaster were urged with more passion and unfairness by their friends than by themselves. Yet neither is entitled to hold a very high place among the world's teachers. Bell was cold, shrewd, and self-seeking. Lancaster had more enthusiasm, a genuine and abounding love for children, and some ingenuity in devising plans both for teaching and governing. But he was shiftless, wayward, and unmethodical, and incapable of sustained and high-principled personal effort. His writings were not numerous. They consist mainly of short pamphlets descriptive of the successes he attained at the Borough Road. His last publication, *An Epitome of the Chief Events and Transactions of his Own Life*, appeared in America in 1833, and is characterized, even more strongly than his former writings, by looseness and incoherency of style, by egotism, and by a curious incapacity for judging fairly the motives either of his friends or his foes.

Subsequent experience has not justified the sanguine estimate of the Edinburgh Reviewer, who so early as 1810 described Lancaster's method as "a beautiful and inestimable discovery, a plan now brought very near to perfection, by which education could be placed within the reach of all classes." We have since come to believe that intelligent teaching requires skill and previous training, and that even the humblest rudiments are not to be well taught by those who have only just acquired them for themselves, or to be attained by mere mechanical drill. But in the early stages of national education the monitorial method served a valuable purpose. It brought large numbers of hitherto neglected children under discipline, and gave them elementary instruction at a very cheap rate. Moreover, the educational results attained were in no sense contemptible. The little monitors were often found to make up in brightness, tractability, and energy for their lack of experience, and to teach the arts of reading, writing, and computing with surprising success. And one cardinal principle of Bell and Lancaster is of prime importance. They regarded a school not merely as a place to which individual pupils should come for guidance from teachers, but as an organized community whose members have much to learn from each other. They sought to place their scholars from the first in helpful mutual relations, and to make them feel the need of common efforts towards the attainment of common ends. (J. G. F.)

LANCELET (*Branchiostoma* [or *Amphioxus*] *lanceolatum*). This creature, the lowest in the scale of fishes, with which class it is generally associated, lacks so many characteristics of vertebrates generally that some naturalists regard it as the type of a separate division. It is of small size (about 3 inches long), compressed, semi-transparent, pointed at both ends, without limbs, but with a low fold of the skin, representing the median fin of fishes. The mouth, surrounded by tentacles, is situated below the anterior end of the body, the vent at a short distance from the opposite end. The water which has been received through the mouth for the respiratory function, as well as the spawn, are expelled by another opening in front of the vent (*porus abdominalis*). The skeleton is extremely rudimentary, and consists almost wholly of a simple notochord; neither skull nor ribs or limbs are developed. The lancelet possesses no brain or organ of hearing, and no kidneys. The heart retains the embryonic condition of vertebrates, is tubular and without chambers; the blood is colorless. Thus the lancelet shows unmistakable analogies to invertebrates, among which, indeed, it was placed by its first describer, Pallas; and as, besides, the earliest stages of its development are almost identical with those of invertebrate animals, it may well be regarded as a form intermediate between the two great divisions of the animal kingdom, viz., the vertebrates and invertebrates.



Lancelet (*Branchiostoma lanceolatum*). *a*, mouth; *b*, abdominal porus; *c*, vent.

The lancelet has been found in numerous localities of the temperate and tropical zones, sometimes in deep water, but more frequently in shallow sandy places of the coast; probably it is much more common than is generally supposed, but easily escapes observation on account of the transparency of its body, and the rapidity with which it buries itself in the sand. It is noteworthy that the first two specimens from which the species became known, although discovered at an interval of more than fifty years, were found on the Cornish coast. The first fell into the hands of the Russian naturalist Pallas, who took it to be a slug, and described it in 1774 under the name of *Limax lanceolatus*. The second was found by Couch in 1831, who recognized it as a fish and sent it to Yarrell. Since then it has been met with on other parts of the British coast, in North America, the West Indies, Brazil, Peru, Tasmania, Australia, and Borneo. For further details of its organization we refer to the article ICHTHYOLOGY.

LANCEWOOD is a straight-grained, tough, light, elastic wood obtained from the West Indies and Guiana. It is brought into commerce in the form of taper poles of about 20 feet in length and from 6 to 8 inches in diameter at the thickest end. Lancewood is principally used by carriage-builders for shafts; but since the practice of employing curved shafts has come largely into use it is not in so great a demand as formerly. The smaller wood is used for whip handles, for the tops of fishing rods, and for various minor purposes where even-grained elastic wood is a desideratum. The wood is obtained from two species of *Guatteria*, a genus belonging to the natural order *Anonaceæ*. The black lancewood or carisiri of Guiana (*Guatteria vir* *gata*) is a tree which grows to the height of 50 feet, of remarkably slender form, and seldom yields wood of more than 8 inches diameter. The yellow lancewood tree (yari-yari of Guiana) is of similar dimensions, found in tolerable abundance throughout Guiana, and used by the Indians for arrow-points, as well as for spars, beams, etc.

LAN-CHOW-FOO, the chief town of the Chinese province of Kan-suh, and one of the most important cities of the interior part of the empire, stands on the right bank of the Yellow River. The population is estimated by Gustav Kreitner (Bela Szechenyi expedition) at half a million in 1878. The houses, with very few exceptions, are built of wood, but the streets are paved with blocks of granite and marble. Silks, wood carvings, silver and jade ornaments, tin and copper wares, fruits, and tobacco are the chief articles of the local trade. Tobacco is very extensively cultivated in the vicinity. Since the occupation of Kashgar by the Chinese, the provincial governor resides three years at Su-chow and three years at Lan-chow-foo.

LANCIANO, the chief town of a circle in the province of Chieti, Italy, is situated on three hills, about 5 miles from the Adriatic coast. It is one of the most beautiful cities in the Abruzzi Citeriore, and has broad regular streets, and several fine buildings. The cathedral, an imposing structure with a fine clock-tower, is built upon bridges that span the gorge of the Feltrino, and is dedicated to our Lady of the Bridge. The churches of Santa Lucia and Santa Maria Maggiore, built on the sites of heathen temples, and the theatre, also deserve notice. Although the industry and trade of the town have declined, a considerable miscellany of manufactures is still carried on. The textile industry, dealing with flax, hemp, silk, wool, and cotton, is the leading one; iron-working, rope-making, and the manufacture of wax, soap, cream of tartar, etc., follow. There are four yearly fairs. In 1872 the population was 8758; including the suburbs it was 15,342, or, embracing the commune, 17,340.

Lanciano claims a respectable antiquity, for, although Pliny's Anxia or Anxa Frentanorum is to be placed about a mile from the present town, there is no doubt that under the early empire the present site was occupied by a town, as the oldest of the bridges on which the cathedral stands was erected by the senate and people of Anxanum, under Diocletian. During the Middle Ages Lanciano was of considerable importance, and enjoyed various privileges, chiefly of a commercial nature.

LANCRET, Nicolas (1660–1743), was born in Paris on 22d January, 1660, and became a brilliant painter of light comedy, but of light comedy which reflected the tastes and manners of French society under the regent Orleans. His first master was Pierre d'Ulin, but his acquaintance with and admiration for Watteau induced him to leave D'Ulin for Gillot, whose pupil Watteau had been. Two pictures painted by Lancret and exhibited on the Place Dauphine had a great success, which laid the foundation of his fortune, and, it is said, estranged Watteau, who had been complimented as their author. Lancret's work cannot now, however, be taken for that of Watteau, for both in drawing and painting his touch, although intelligent, is dry, hard, and wanting in that quality which distinguished his great model; these characteristics are due possibly in part to the fact that he had been for some time in training under an engraver. In 1719 he was received as Academician, and became councillor in 1735; in 1741 he married a grandchild of Boursault, author of *Æsop at Court*, but he survived his marriage only two years, dying, in his eighty-fourth year, on 14th September, 1743.

The number of his paintings (of which over eighty have been engraved) is immense; he executed a few portraits and attempted historical composition, but his favorite subjects were balls, fairs, village weddings, etc. The British Museum possesses an admirable series of studies by Lancret in red chalk, and the London National Gallery shows four paintings—the Four Ages of Man (engraved by Desplaces and L'Armessin), which have been cited by D'Argenville amongst the principal works of Lancret. See D'Argenville, *Vies des Peintres;* and Ballot, *Éloge de M. Lancret*.

LAND, in the sense in which it will be used in this article, which treats especially of its possession and tenure, includes that portion of the earth of which industry has rendered either the surface or the mineral riches underneath available for human requirements. It forms thus the storehouse from which nearly all human wealth is drawn, since it nourishes the animals and plants which supply mankind with food and clothing, and yields the stone, the coal, and the metals which make existence possible and progressive. The history of its use is therefore a main element in the history of our race, and the manner of its tenure and employment lies at the root of political and economic science. In the present article it is proposed to sketch in outline the historical development of the ideas relating to land, and briefly to point out the leading principles which influence its tenure and beneficial employment under the present circumstances.

Development of land tenure.

Tribal occupation.

The history of land commences with the division of men into tribes, for the division of tribes involves distinction of territory. The earliest age, when men lived solely on wild fruits or on the produce of the chase, may still be pictured to us in the habits of the North American Indians, while the second or pastoral stage is represented in modern times by the life of the Tartars of the Asian steppes. In both these conditions an immense tract of country is absorbed in the support of a small population, but the hardships of existence, aided sometimes by organized systems of child-murder, serve to keep the inhabitants within the limits of subsistence. Under such circumstances each tribe jealously guards its own territory from intrusion by others, but within its range all members of the community have equal and unrestricted rights of use. Among civilized nations the principle still survives. Each modern nation claims a special ownership in the fisheries within a certain distance of its coasts; but among the inhabitants of these coasts there is a common right to fish in the waters thus reserved. So also each modern state recognizes the shores as far as high-water mark, and the estuaries with their harvests of wild fowl, as the common property of its subjects. Even inland game is still not individual property, and in countries where legal rights are so ancient or so modern as in the Channel Islands and the United States of America, the local law is alike liberal in allowing to every one the right of sporting over his neighbor's ground, except in so far as modified by express and recent legislation.

Village tenure.

But the higher races very early discovered an ampler means of industrial existence than the natural produce of the earth affords. At what period in human history the artificial cultivation of plants was discovered it is impossible to say. We know that it was posterior to the division of the Aryan currents that flowed towards Hindustan and towards Europe, but before the subdivision of the latter; for the words denoting a field, a plough, and some species of grain have a common root in the Greek, the Latin, and the Germanic dialects, but not in the Sanskrit. But so soon as agriculture began it involved of necessity an approach to more settled habits. This change in the manner of life would combine with the fuller and more regular supply of food to promote a rapid increase of population. So long, however, as this did not exceed the resources of the territory belonging to the tribe, it would not of itself involve any change in the idea that its use was common to all. A certain portion of ground would be devoted to tillage, a certain number of the tribe would be appointed to perform the acts of cultivation, and the produce would be stored in the general barn. We have at the present day examples of such a system in some of the allmends of the Swiss canton of Valais, where a portion of the lands of the village is cultivated by joint labor, and the produce devoted to joint feasting. But it appears that in general this stage rapidly progressed to one of apportionment of the land in separate and smaller districts. The tribe, augmenting in numbers and perhaps in extent of territory, subdivided itself into villages, and each village exercised a tolerably independent rule over its own district. Within this range it still maintained a community of the forest and pasture, but the special skill and toil demanded by husbandry in most cases soon led to the appropriation to each family of a portion of the arable land in exclusive property. Still, however, the principle of common right prevailed so far that the village rulers changed every year the lots assigned for culture, so that one year of crop, followed by a relapse into natural growth for a succession of years, was the normal rotation. It is one which modern science cannot condemn, for where space is ample and the use of manure is unknown, there is no sounder method of cultivation. It is still, according to M. Laveleye, exemplified in the Ardennes region of Belgium.

Private property in land.

It is at this stage that contemporary observers first describe the tenure of land in ancient times, and illustrations of its survival in modern periods grow abundant. These will be hereafter pointed out. But except in special circumstances it is obvious that progress could not stop here. As population increased in each district, the available hunting grounds would diminish, and at the same time the necessity of more extensive and more frequent cultivation of crops would increase. By this process, in the absence of manure, the land would inevitably become less productive. But just as it demanded more labor it would become more definitely appropriated to a single family, for those who labored most would not willingly give place to those who had been less active. A stage would then be reached in which community of possession would be limited to the pasture lands of the village, and the arable lands would be possessed in permanence by each family. There generally was, indeed, while the territory still sufficed, a recognition of the right of each individual to an allotment from the common land. But at last the period would come in which this could be no longer afforded, and when either the tribe must migrate in a body, or cast off a swarm to seek its fortunes elsewhere, or leave a certain number of its members without the privilege of landed possession, to obtain subsistence in services to the rest, or in trades. When the two former alternatives become impracticable, the third is the inevitable course. Private property in land becomes then established, and we have thenceforward a new system, involving consequences for good and evil which legislation seeks to regulate.

Historical sketch.

With this general notion of the course of development it will now be convenient to trace, in some instances which have most affected the world's progress, the history and the results of the use and appropriation of land.

Primitive Rome.

In primitive Rome each household formed an absolute despotism, of which the father was the despot; households were united into gentes by derivation from a common ancestor, and the state consisted in a combination of gentes. To each household there was originally assigned a small portion (2 jugera, 1¼ acres) of land to be held in perpetuity as private property (*heredium*), and it may be assumed that on the death of a paterfamilias each son would be entitled to a like amount from the common lands of the gens. These common lands formed the main possession of the gentes, and it appears that they were to some degree cultivated in common, as well as used for pasturage. The state, however, also held common lands, partly original, partly derived from cession by each conquered neighbor, and these were let for rent (*vectigal*) in so far as not partitioned out. Cicero (*De Rep.*, ii, 9, 14) says that Numa was the first who divided the conquered lands into private shares, but it is certain that the example was only partially followed. But by the time of Servius Tullius the original private portion of many households must have been greatly but unequally enlarged, for his new military organization was based on the obligation of service imposed on the freeholders (*assidui*) as distinguished from the mere laborers and breeders of children (*proletarii*). The "classes" of the assidui were five, those who possessed 20 jugera (12½ acres), and who were specially denominated classici, and those who possessed respectively 15, 10, 5, and 2½ jugera. The first class, or classici, were about the half of the whole number of assidui, the second, third, and fourth classes comprised each about one-eighth of the entire number, and the fifth class was slightly more numerous. The equites formed a separate order, based on the possession of a still larger extent of land. At the same time a register of land was established, in which each owner was required to enter his property, and which was revised every four years, and sales were directed to be made before two witnesses. These arrangements show that even at this epoch the system of separate private property was in full operation, and that the difference of wealth which it engenders had already reached an advanced stage.

The progress of conquest, which at once enlarged the territory, brought in tribute, and furnished slaves, rapidly increased such inequalities. Trade, which followed conquest, and in which capitalists made large fortunes, tended in the same direction. Very early in Roman legal history we come upon tenancy-at-will, under the name of *precarium*, which of itself showed that there must have been large estates capable of subdivision. But besides tenants, each extensive landowner had a household of retainers, clients, freedmen, and latterly slaves, who tilled his ground for his personal profit. Thus there would be little demand for free labor, and the petty husbandman, whose small inheritance was inadequate for a growing family, fell necessarily into debt. His land would then be seized under the strict Roman law of bankruptcy, and he himself would sink into slavery, or at best into the already overcrowded class of laborers for insufficient hire. At the same time the conquered lands, which by theory were the property of the state, and to which every citizen had an equal right, were largely portioned out to the existing landowners, who held the chief posts and influence in the government. The revenues drawn from tribute were also farmed out to capitalists, and the taxes on the public were augmented in consequence of the permitted frauds of the collectors. At last came the crisis. The army, no longer representing the wealth of the state, but rather the proletariat, mutinied, and from the Mons Sacer menaced the city. It was the commencement of the long struggle of which the successive AGRARIAN LAWS (*q. v.*) were the land mark and remedies.

The object of these laws was well illustrated by the Licinian proposal (387 A.U.C.), nearly one hundred years after the first outbreak of discontent. It enacted that no citizen should hold more than 500 jugera of the public lands, that no one should graze more than one hundred oxen and five hundred sheep on the common lands, and that every landowner should be obliged to employ a number of free laborers proportioned to that of his slaves. But this, as all other laws proposed on behalf of the people, was coupled with political changes of which the main object was to open up new fields of ambition to those of the plebeians who were already opulent. When that object was attained, the agrarian remedies were suffered to fall into desuetude. The successful wars waged in the 6th and 7th centuries A.U.C. gave a temporary outlet to labor in the formation of agricultural colonies. But it at the same time immensely increased the number of slaves, who were treated as mere beasts of toil, to be worked out or sold off when no longer profitable. The free population, on the testimony of Cato and Polybius, diminished;

the slave population increased, and became in many districts an organized danger to public safety. A century later the Gracchi again endeavored to restore health to the body politic by a distribution of the state lands among the proletariat. The attempt was stifled in blood, but the necessity of the measure was proved by the fact that a full generation later Caius Julius Cæsar carried out the same reform.

The time for remedy was, however, past. The great estates (*latifundia*) had already been created; they were respected by the reformers, alike popular and imperial; and their inevitable growth swallowed up the small farms of new creation, and ultimately destroyed Rome. For its manhood was gone; the wealth of millionaires could not purchase back honesty or courage; and the defence of mercenaries failed to form any barrier against the wars of hardy northern invaders. Pliny's words "latifundia perdidere Italiam" embrace the truth, yet more fully made clear in many a generation after he wrote.

Ancient Germany. We shall now examine the systems prevalent in the nations by which the Roman empire was overthrown. Two great Roman writers, Cæsar and Tacitus, have given us a vivid picture of the German customs showing us the tenure of land in its earliest forms. Cæsar (*De Bell. Gall.*, vi.) says of the Germans of his time:

> "They are not much given to agriculture, but live chiefly on milk, cheese, and flesh. No one has a fixed quantity of land or boundaries of his property, but the magistrates and chiefs every year assign to the communities and families who live together as much land and in such spots as they think suitable, and require them in the following year to remove to another allotment. Many reasons for this custom are suggested: one is that they should not be led by permanence of residence to renounce the pursuits of war for agriculture, another that the desire of extensive possession should not induce the more powerful to seize the land of the weaker, another that they should not construct their houses with greater care to keep out heat and cold, another that the love of money should not create parties and disputes, and lastly that the mass of the people might remain contented with the justice of an arrangement under which every one saw his position as comfortable as that of the most powerful. As to the tribes themselves, their chief glory is to have their territory surrounded with as wide a belt as possible of desolated waste. They deem it not only a special mark of valor that every neighboring tribe should be driven to a distance, and no stranger should dare to reside in their vicinity, but at the same time they view it as a measure of precaution against the risk of sudden attacks."

A hundred years later the description of Tacitus shows that a certain modification of habit had been induced. Bringing together the leading particulars, we find he speaks of Germany as "covered with woods and morasses, the land fairly fertile but unsuited for fruit trees, well adapted for pasture, and carrying numerous herds of small sized polled cattle, in which the chief wealth of the natives consisted." But they seem no longer to have changed their actual dwellings every year, but to have

> "Built them with a certain rough solidity, and in villages, though the houses were not contiguous, but each was surrounded by a space of its own. The right of succession by children was recognized, and in default of children brothers and uncles took, but there was no right of making a will. They preferred to acquire property by war rather than by industry. Interest on loans was unknown. The land was apportioned (to villages apparently) according to the number of cultivators, and divided among them according to their rank, there being ample room for all. Every year they changed the arable land, which formed only a portion of the whole, not attempting to make labor vie with the natural fertility and abundance of the soil by planting orchards or setting out gardens and fields, but content with a single crop. Their food consisted chiefly of wild fruits, freshly killed game, and curds; their drink was a liquor prepared from barley or wheat, fermented like wine. Their slaves were not kept in the house, but each had a separate dwelling and an allowance of food, and they were treated with humanity, as servants or tenants."

These institutions were then obviously based on the existence of an ample supply of uninclosed and common land. But the natural increase of population, combined with the pressure put on the Germanic tribes from the east by the Slavs, made their territories too small for their ambition, if not for their maintenance, and five or six succeeding centuries were marked in the history of Europe chiefly by successive Germanic conquest and occupation of western and southern territory. The enormous increase of power and possession made it impossible for the original tribal government to survive; the great generals developed into kings and emperors, and their lieutenants, more or less independent according to individual capacity and distance from the capital, became dukes and counts. Gradually military authority, embracing the old idea of the land being the property of the state, evolved the new notion of feudalism. The sovereign represented the state; to him in that capacity land conquered from the enemy, or fortified by unsuccessful rebellion, became subject; and he granted it to his followers on condition of faithful service in war. They promised to be "his men," and from their own tenants they exacted in turn the like promise on the like conditions. The general insecurity made even free owners willing to buy the support of the sovereign on similar terms. Thus by degrees, less by derivation from the ideas of Roman law, to which it is sometimes attributed, than by the mere necessity of the times, and as a consequence of the incessant state of warfare in which mankind existed, there came to be established the feudal doctrine that all land was held of the sovereign on condition of suit and service, and that each immediate tenant of the sovereign was entitled to subinfeudate his possession on the same principles. Gradually the further attributes of property were added; service in war was commuted into rent, and the peaceful service of tilling the lord's reserved domain. The right of hereditary succession became grafted on the personal grant; the power of sale and devise followed. Local usages still had influence, but it may be said broadly that from about the 10th century private property, subject to feudal conditions, became the principle of the tenure of land in Europe.

There are, however, some nations in which feudalism has struck no root, or at least has not succeeded in seriously modifying the original type of common possession. It will be best to advert to some of them before proceeding further with the history of feudalism in its modern development.

India. The Indian branch of the Aryan stock has preserved with great fidelity the original notion of the possession of land. The village, consisting of detached houses and surrounded with the district belonging to it, forms still a self-regulating community. It is a legal person, to which the state looks for its rights, but which when performing them is free from internal state interference. It holds the forest and pasture ground in common property, allowing their use to each person entitled to the village rights. To each family is further apportioned a measure of arable land, but the stage is in general passed at which this portion is changed in successive years, and it is therefore the hereditary property of the family. But it is not in strictness subject either to will, to mortgage, or to sale. It is divisible on the death of the head of the family among his children, any of whom may transfer their shares to another member of the village, but not, except with its leave, to a stranger. These ancient customs have to some extent been modified by the introduction of English law, which, among other things, has subjected the villagers to the grinding exactions of the money-lenders, by giving creditors the security of an English mortgage. It cannot but be regretted that the desire to act justly which has led to the change should have been misled by the idea that whatever institution exists in England is necessarily and everywhere else equally equitable and necessary.

Slavonic peoples.

In Europe the Slav peoples, the latest arrival of Aryan stock in Europe, have preserved best the ancient characteristics of land tenure. Checked in their advance to the southeast, they have formed a narrow borderland in Bulgaria, Servia, Croatia, and Dalmatia, between the Germans on the one side and the Turks on the other. Here, therefore, we have the case of a population growing within a restricted area, under circumstances which prevented the development of extensive military sway, and its consequent feudalism. Accordingly we find prevailing a system midway between the ancient communism of the Germanic tribes and the institution of private property. The tribes have become broken up into families. Common lands, except where there is mountain or forest, have been partitioned into the separate ownership of families. But within the families there is still a strong sentiment of community. In the Servian and Bulgarian villages each family household consists of probably several generations, all housed under the same roof or within the same curtilage. The head of the family is judge rather than master; any member of the family may depart, but in so doing he abandons his claim to the family property, a claim, however, which in some cases may revive should he return to the paternal home. All who remain work in common at their appointed duties, and share in common the produce. The family possessions are inalienable; the share of each member is untransferable.

Russia.

To the north and east the faculty of unlimited emigration to the unoccupied lands of the steppes permitted or enforced the preservation of a still earlier type of common property. When the Russian village found its lands inadequate to its growing population, it threw off a swarm. The emigrants travelled in a compact body till they passed beyond the limits of present cultivation, and then took up their position on such lands as pleased them. For their protection against the aboriginal hunters who still roamed over the plains they built their houses on the uniform plan of an inclosed village, and the same reason concurred with native habit to induce them to maintain the system of common pasturage, and of united cultivation of the land apportioned to cropping. When the central government became strong enough to assert its sway over the scattered settlements, it levied its tax on the *mir*, or village community, and the community apportioned the amount per capita among its members. But, as land was ample in extent for all, it gave to each male, from the moment even of birth, a right to a share. When the shares became inadequate a fresh migration took place.

Serfdom took its rise in the prohibition of these migrations. Forbidden to depart to new lands, the peasants were compelled to submit to the demands for their labor either of the Government, where it held estates in the neighborhood of a village, or of nobles to whom grants of land had been made by the czar. Generally they were thus forced to give half their time to labor for their master. But they still continued possessors of their share in the village lands, and entitled to apply the other half of their time to its cultivation.

When emancipation came, their rights were regulated on the same basis. The village was maintained as an industrial and fiscal organization. But each peasant was declared to be entitled to a certain fixed minimum of land for his own property, varying according to the district, but on an average about 12 acres. For this, in so far as being in excess of the village lands it had to be made up from the land of adjoining owners, he is required to pay either services, to the extent of forty days in the year, or rent, at an average rate of about 2s. 4d. per acre. Such provisions can only be temporary. They resemble much those which prevailed in Germany prior to the modern reforms in tenure. They subject the peasant, untaught and unaccustomed to habits of individual energy, to a tax which he is not able to meet, and the suffering and complaints which are the consequence are at present general throughout Russia.

Switzerland.

In Switzerland also there has survived a system only slightly altered from that of the original communities. For here also conquest with its attendant feudalism was stayed, and freemen and free institutions survived the wreck which war made throughout Western Europe. In the forest cantons especially there still exists an essential community of land right. The inhabitants possess separately and by ordinary rules of inheritance certain portions of land. But in several cantons the bulk of the land, both arable, forest, and pastoral, forms the allmend of the state, or of the commune,—the common property, to which every descendant of the original inhabitants has a right. This common land is either partitioned out by lot to each person entitled, or is let for a rent, which is applied to the common benefit, or is made the subject of common labor, and the produce of bread and wine is devoted to common merry-makings. When the arable land is divided among cultivators, the period allowed before repartition is from five to nine years, and it is stated that so strong is the feeling of common interest that the shortness of the time does not interfere with the highest cultivation by each successive occupant. In some districts it furnishes farms of 20 acres to each family, in others it only suffices for allotments of a few perches.

France.

In France the custom of village proprietary survived in many districts down to the middle of the 17th century. But previous to the middle of the 18th century nearly the whole of the soil had passed into the hands of great landowners. The tenants and peasants were ground down with heavy exactions, not only in the form of rent, but of state taxation, and in services, or *corvées*, to be rendered to the lord or to the state. The artificial life of the nobles at court destroyed all sympathy between them and the cultivators, and brought them to look on their dependants as little more than beasts of burden, valuable only for the profit that might be made of them. The feeling engendered on the other side broke out in the Revolution. The country estates, from which the *emigrés* had fled, were sold in portions, and in many cases bought in fee simple for a trifle by the former tenants of the farms. The law of equal division among children continued the process of subdivision. It proceeds in an augmenting ratio, and though a few large properties still subsist, the bulk of the land in France is now held in small properties. It is not, however, universally cultivated by the owner. There is a large proportion of tenants, holding generally under leases not exceeding nine years; and there is no doubt that the shortness of the term impairs production. Another evil is the *morcellement* caused by the law of compulsory division on inheritance, but this must not be understood as objected to chiefly on the ground of the small extent of ground held by each proprietor. The real disadvantage complained of by French writers on agriculture is that through successive family divisions each man's total property consists of a number of small plots scattered up and down; and the remedy desired is not an interference with the present law of succession, but only an enactment to facilitate exchange and consolidation of plots, so as to give each cultivator his whole property within one boundary.

In France there are now about 2,000,000 properties under 12 acres, and 1,000,000 between 12 and 25 acres, while there are only 150,000 above 100 acres. Of the whole population there are 1,750,000 who cultivate their own land with their own hands, and who are not tenants, 850,000 who cultivate as tenants, and only 57,000 who cultivate by aid of a foreman or steward. Of farm laborers there are only 870,000. Belgium, Switzerland, Denmark, Norway, Sweden, and great portions of Italy are similarly divided into small holdings cultivated in general by the owner and his family.

Modern Germany.

In Germany, although feudalism was fully developed as a legal system and as the foundation of the aristocracy, it did not succeed in extirpating entirely the ancient rights of the people. A large portion of the land was held always as peasant properties, entirely free from any dues of service. Among these, in certain districts, there survived an organization essentially identical with that described by Tacitus. The village had its domain or mark, subdivided into the arable, the pasture, and the forest. In some cases the first of these was partitioned into individual and permanent properties, but in all the pasture and forest remained the joint property of the village. Instances, however, were not wanting even in our own days where the arable portion was subject to annual or less frequent repartition, and to apportionment by lot to each cultivator for the time which custom ordained. But even where this usage did not prevail, it was incumbent on all the villagers (as in Russia) to cultivate their several portions of the arable mark with the same crops and at the same seasons, for as soon as the crops were removed the whole community enjoyed a right of pasturage on the stubble. The rotation was, therefore, of the simplest, consisting in general of a triennial succession of wheat or rye, as winter-sown grain, followed by oats and barley as spring-sown crop, and then fallow. It differed for the worse from that of the ancient Germans in that the circumscribed limits of each village domain made it now impossible to allow to the whole arable mark a period of rest under pasturage.

But intermixed everywhere with the relics of the free village, institutions of the tree of feudalism struck its roots, and carried with it a species of serfage. None who were not noble could as a rule purchase land. On the lands of the nobles the tenants were bound to give to their lord a portion of their time in gratuitous labor. They held, however, their farms under condition of permanency, subject to this tax of labor, and to a variety of small and irregular exactions of the nature of rent. On this state of things in Prussia the Stein and Hardenberg reforms took effect. They gave to every peasant the same power as the noble enjoyed to become a landowner. Between the nobles and their tenants they partitioned the land in absolute property, the landlord retaining one-third, the tenant receiving two-thirds. Common rights and rents were made purchasable by the owner of the soil at twenty years' purchase of their estimated value. And laws of 1821 and 1850 sanctioned the division of common lands among all who previously had an interest in them. To aid the peasantry in purchasing up the dues still payable to their former landlords, land credit banks were introduced in 1850. These institutions advanced to the peasant owner the sum necessary for the purchase of the old rights over his property, commuted as they had already been to a definite sum. The advance thus made constituted a first charge on the land, and was represented by debenture bonds for small amounts. The owner might pay to their credit, at whatever time and in whatever sums he was able, instalments towards their redemption, but he was bound to redeem them fully within fifty years.

These reforms have converted large parts of Germany into the property of small owners residing on and tilling their own land, free from obligation to any other person. There do not seem to be data for judging of the economic result, because statistics do not distinguish between the produce of small properties and that of the large properties intermixed with them. But the most careful observers agree that the social results are similar in Germany to what they are elsewhere. The peasants, attached to their holdings, form the most stable element in the commonwealth. Their love of the land shows itself in the high prices given for it, and, as we shall see elsewhere, in the tendency to borrow in order to purchase more. It can at least be said that, whatever be the hardships of their lot, they would not exchange it for any other.

Great Britain.

The tenure of land in Great Britain may be traced with sufficient accuracy from the character of the elements of which the nation is composed. Under the Celtic tribes there can be no doubt that the ideas which we know prevailed among the ancient Irish and among the Scottish clans down to modern times formed the universal rule. The land was the possession of the clan; the chief was the leader but not the owner. The temporary and partial occupation by the Romans may have introduced the notion of absolute private property, and we may assume that it was at least asserted by such of the conquerors as cared to cultivate estates taken from the barbarians. But the withdrawal of the Romans, followed by the Saxon invasion, must have re-established the principle of common village ownership which formed the basis of both Celtic and German tenure. In the later Saxon period, however, there is no doubt that private ownership became gradually more extended. Then the feudal idea began to make progress in England, as it did at the same period on the Continent. It received an immense impulse from the Norman Conquest. William may not have claimed the whole land of England as his own, but the vast tracts which fell into his hands through confiscation of rights of so-called rebels were granted by him in the character of lord to such of the Saxons as he could trust, and to those of his own followers whom he desired to reward. When law began to form a system, the early Norman lawyers took this principle as the basis of their system. Thenceforth it became the undisputed maxim of English law, as well as of Scottish (with the exception of some isolated remains of "udal" rights in Orkney), that the sovereign was supreme lord of all the land, and that every one held under him as tenant in England, vassal in Scotland, names which have survived in legal theory and language down to the present day. They expressed then as now the unquestionable legal rule that there is no such thing in our system as an absolute private right of property in land, but that the state alone is vested with that right and concedes to the individual possessor only a strictly defined subordinate right, subject to conditions from time to time enacted by the community.

Within Scotland the feudal system has been preserved in remarkable purity. The majority of the larger estates, as well as many small ones, are still nominally held of the crown, and pay an annual rent, or "feu-duty," along with certain fines on succession or alienation, nor is the title of any heir or vendee complete till he has received the written acknowledgment of the sovereign. But each owner who holds of the sovereign may grant a subordinate estate to be held of himself as "superior" or lord, on such terms as he thinks fit, and the "vassal" thus constituted must in future obtain recognition of his title from his immediate superior, just as if he held directly of the crown. It is only within the last few years that the subordinate vassals thus holding have been allowed the means of commuting the services they had bound themselves to pay to the "subject superior," and of converting themselves into direct vassals of the crown, which forms the nearest approach to private property permitted by the law of Scotland.

In England feudal forms became partially obliterated at an earlier period. In 18 Edward I. parliament had put an end to subinfeudation. The services due by the crown's tenants were by a statute of Charles II. reduced to a form which left them merely nominal. But at a very remote period there had sprung up a tenure which in many respects was equivalent to feudal tenure. The serfs who cultivated the lord's lands, although at first subject to his absolute pleasure, yet, being left undisturbed for a considerable series of years, fell under the doctrine of English jurisprudence which recognizes custom as having the force of law. They gained thus a right of occupation in permanence, paying only such rents or services as were entered in the copy of the rolls of the manorial court, from which their tenure came to be designated copyholds. By degrees they obtained manumission from servitude, and with it the right of alienating or bequeathing the land they thus held. There were therefore two principal classes of property in England, freeholds, holding in general directly of the crown, and copyholds, holding of a lord of the manor, but both with indefeasible title subject to trifling services ascertained by custom or by statute. It would seem that in these two forms a very large number of those whom we now should call yeomen or peasant proprietors were established throughout the country. But in addition to these there were on the large estates a great number of those whom we should now properly call tenants-at-will, renting lands of the lord, and not established for a sufficient length of time to have acquired the status of copyholders.

About the middle of the 14th century English wool was found to be peculiarly well adapted to the use of the weavers of the Low Countries, and brought a high price. This led the owners of the large estates to substitute pasturage for tillage, and by consequence many of the cultivating tenants-at-will were evicted. Hence arose complaints precisely similar in motive and language to those which in our own times have been excited by the clearings in Ireland and the Highlands for the purpose of substituting sheep farming in place of husbandry by cottars and crofters. During the 15th century, probably for the same reason, the extensive wastes which covered a large part of England began to be inclosed, to the consequent disturbance of a number of squatters (called at the time "champions," from *champs*) who had settled on them, and derived not a very sufficient subsistence from feeding a few animals on the commons. It is noticeable that both Fitzherbert and Tusser, the earliest English agricultural writers, and the latter himself one of the people, commend the inclosures, on the ground that the land so reduced to separate ownership produced much more than it had done as commons. But these causes, combining with the breaking up of the monasteries, and the absorption of church lands into the estates of the adjoining landowners, gave rise to much disorder and misery. Parliament attempted to deal with the causes and effects by enactments directed by turns against the high rate of wages, against the destruction of farm houses and cottages, and against the idle or unemployed tramps who roamed over the country. It was a period of dislocation of social relations, of which we are not now in a position to judge accurately. But undoubtedly the ultimate result was a considerable increase in the magnitude of the larger estates and farms, gained by a proportionate decrease in the number of both of smaller size. It is from this period that we must date the diminution of the class of yeomen which has been the theme of lamentation with economists and historians down to our own times.

Contemporaneously with these changes the law was receiving those adjustments which tended to preserve the large estates undiminished in the possession of their hereditary owners. Entails were sanctioned by statute (De donis, 13 Edw. I.), but broken down some two centuries later by the ingenious judicial devices of fines and recoveries. Trusts were invented by the churchmen, but attacked by parliament, only to be re-established under the technical name of trusts upon uses. Lastly, estates for life were invented; and, being skilfully combined with so much of the principle of entails as the courts had sanctioned, they have formed the still existing method by which family estates are preserved from dispersion. The rule of law is that all persons living at the date of a settlement may be restricted to mere estates for their own lives, instead of taking the fee simple with full right of alienation. In this way each son when he succeeds finds himself merely a tenant for life, and as such possessed of no power to prevent his own son from becoming owner in fee simple when he in turn shall succeed. But a father so situated is little inclined to leave to his son powers of which he himself is deprived, while his son is generally willing to barter his future liberty for a present liberal allowance. Thus father and son strike a bargain; the father buys the son's surrender of his future right, and the son, for a price, agrees to submit himself to the restraints of being merely tenant for life when his father shall die. The process repeated from generation to generation has re-established in practice the system of entails which the courts had abrogated as contrary to public policy, and which every writer from Bacon downwards has denounced as hurtful to the nation.

Similar rules prevailed in Scotland. But, as entails were there of later introduction, so they were much more strict, and from 1680 to 1848 land might be settled in an endless succession of inconvertible life estates. In the latter year an Act was passed which, with a good deal of complication, substantially limits the right of creating life estates to one generation as in England. In 1875 another Act introduced the useful principle that the owner of a life estate might in certain circumstances buy up and extinguish some of the contingent interests in succession to his own at their present value, ascertained by computation based on the expectation of life.

The system of entails, or of creation of estates for life only, which has thus prevailed for several centuries in the United Kingdom, is sufficient to account for the fact that the large estates have continually augmented, in size and number, by the corresponding absorption of the small properties of yeomen. These small properties are seldom subjected to strict settlement. The owners occasionally fall into difficulties, and then their land is sold to pay their debts. They are frequently moved by natural affection either to divide their estates among children, or to subject them to charges for children other than the heir, and this also tends to bring them into the market for sale. But the large adjoining properties, the owners of which have been induced by family pride to limit their right to mere life interests, are not liable to be sold for debt. The immediate possessor may be crippled during his life, but his heir will succeed to the estate free from incumbrance by any prior possessor. In the same way the powers of each successive owner to charge the estate for younger children, and the liability to sale for payment of such charges, is restricted within narrow limits. These properties therefore continue undiminished; and when a small adjoining freehold comes into the market, it is seldom that the owner of the larger estate cannot find the money to effect its purchase. Once obtained, it is included in the next settlement of the larger estate, and thus permanently withdrawn from the operation of natural processes of disintegration. On the whole, it follows that large estates tend to grow, and in precisely the same proportion small ones tend to disappear.

It may be further observed that this tendency is materially aided by an absurdly bad and expensive conveyancing system, and by the law of mortgage. The costs of transfer of land are so enormous in England that they form a very large percentage on the price of small properties, and preclude any one from purchasing them with the motive of making a living upon them. So also the insecurity of title, which is greatest on the smaller properties, because they have been dealt with less carefully, compels any owner who needs an advance to pay usurious interest, by which his ruin is speedily effected, and the property brought to sale. On the other hand a large property changes hands at less comparative expense, and the necessity of a sale to meet temporary difficulties is at less cost obviated by mortgage, which permits the owner to hold on till some windfall of legacy or marriage once more reinstates him in easy circumstances, and enables him to take advantage of his poorer neighbor's necessities.

This does not mean that he cheats the small proprietor in the bargain. On the contrary, the desire of the rich to augment their estates induces them to give more than the real worth for the smaller properties. But this concurrence of circumstances tends steadily in the direction of increasing large estates and diminishing from age to age those that are small. The practical result is easily shown by a few figures. The cultivated land of the United Kingdom (including parks and permanent pastures, but not mountain or waste) amounted in 1880 to 47,515,747 acres. The total acreage is 77,635,301 acres. By the Domesday Book of 1875 it appeared that one-fourth of the total acreage (excluding plots under 1 acre) is held by 1200 owners, at an average for each of 16,200 acres; another fourth by 6200 persons, at an average of 3150 acres; another fourth is held by 50,770 persons, averaging 380 acres each; and the remaining fourth by 261,830 persons, averaging 70 acres each (Caird). Peers, in number about six hundred, hold rather more than one-fifth of all the land in the kingdom. Thus one-half of the whole territory is in the hands of only 7400 individuals; the other half is divided among 312,500 individuals. The total population of the United Kingdom (not including Channel Islands and Isle of Man) in 1881 was 35,100,000, so that barely one in a hundred owns more than an acre of soil.

Of tenant farmers there are in Great Britain 561,000, in Ireland 600,000. About 400,000 of those in Great Britain, but above 500,000 of those in Ireland, occupy less than 15 acres of cultivated soil, the average size of the remaining holdings being in Great Britain about 160 acres, in Ireland 75 acres.

British colonies.

In the countries which have been colonized from England the system of small properties rather than large has been generally adopted. The first settlers in New England carried with them the idea of the village community. They decreed that grants of land should be made to each householder to the extent of 20 acres, but the rest of the land apportioned to each villager was to be held in common. This system has been now expanded into the homestead law (see HOMESTEAD), prevailing over the whole United States, in virtue of which a citizen of the States is entitled to a free grant of 160 acres (¼ square mile) on condition of bringing it into cultivation within five years. The influence of slavery in the Southern States tended, as in Rome, to create large estates, but its abolition has arrested this course. On the whole, with the exception of a very few gigantic farms in the extreme west, it may be said that both the United States and Canada are countries of small farms, seldom exceeding 150 to 300 acres, and almost universally cultivated by the owner. The pastoral lands of Australia and New Zealand are still held in "runs" of immense extent, but whenever cultivation makes way there is a growing movement in the direction of opening them up to purchase in small farms.

United States.

Leading principles affecting land tenure.

The above sketch, imperfect as the limits of space have compelled it to be, of the history of land tenure throughout the world shows that it has pursued one unvarying course. Commencing in community of tribal possession, land has everywhere by degrees been appropriated to the villagers, to the family, and at last to the individual. But in every stage the conditions of its enjoyment and use have been absolutely regulated by the community in reference to the general welfare. A history so uniform would seem to rest on principles of human nature, and to be incapable of reversal. Nevertheless, in the present age two opposite parties have impugned its lessons. The one would revert to the almost prehistoric times when community of property, of labor, and of wealth formed the rule of existence. The other speaks of individual property, especially in land, as a sacred and indefeasible principle, and denounces every restraint or modification introduced by the state as spoliation. Between these extremes an infinite variety of ideas for more or less making land or its produce public property, or more or less restricting the right of the personal owner, have been put forward, and are, with some confusion, strenuously advocated. A brief attempt will now be made to discriminate between what in these ideas is sound and what is impracticable.

Communistic principle.

The principles of communism have unquestionably struck deep root in the minds of large classes of the public, chiefly in Germany, but to no inconsiderable extent in other countries and even in England. Nor can they be dismissed as merely criminal and worthy of no answer but repression. The answer must rather be that they are based on hopes and beliefs in the capability of human nature for self-sacrifice, which we have no warrant in yet accepting as our practical guide. A golden age may yet return, in which all shall be for the country and no one for himself, and we may even imagine that each successive age shows its nearer approach. But at least it has as yet not come. In every community there are found a large number of individuals who would not work honestly except under the compulsion of self-interest or of close superintendence. No socialistic scheme has yet been devised which copes with this tendency. In all of them a vast hierarchy of official inspectorship would be demanded, which, even if adequate, would eat up the profits. In all of them red-tapeism of regulation would forbid the progress derived from freedom to experiment. For the case of the culture of land, an art involving such variety of method applied to such variety of circumstances, it seems, as yet, impossible to conceive arrangements by which joint possession could result in beneficial production. We know it even among families to be at present a hindrance and source of loss. Nor has any definite scheme been yet proposed by socialists to show how it could be worked by the state. Till its advocates at least do this, and permit us to judge as men of business of the practical effect of their system in a given area and with given machinery, it were waste of time to discuss their aspirations and their imaginary results.

Doctrine of supremacy of private rights.

Those who, at the opposite pole, refuse to admit the right of the state to impose such conditions on private property as it deems for the general benefit may be dismissed even more briefly. Not only do they show entire ignorance of the history of land tenure at all times, but they belie the daily action of British legislation. Parliament seldom lets a session pass without making laws which assert the right of the state to take possession of property for public or private benefit, to tax it, and to restrain or regulate the rights of its owners over it. Nor is there any theory of the basis of property which does not tacitly admit that it is subject to the authority of the community. If derived from occupation, it owes its title to the agreement of the community to support that title. If derived from labor, it is valid only for the life of the laborer, and whoever succeeds to him must take it, not as a gift from a dead man whose rights end with the grave, but as a gift from the state, which deems that there is advantage in encouraging labor by the certainty of transmitting its produce. In every view it must be admitted that the state, by whose regulations and force property is maintained, must have an unqualified right to prescribe the conditions under which it will confer its gifts on private individuals.

The general object of supporting private property in land is to increase its produce, by inducing the owner, through motives of self-interest and affection for his family, to bestow on it the greatest amount of labor. It is agreed by all practical authorities that the soil of Great Britain might be rendered greatly more productive by the increased expenditure of capital, which when explained means in one shape or other the larger employment of labor, both in effecting permanent improvements and in conducting the arts of cultivation. The interest of the public in strengthening the motives which may lead to such additional production is unquestionable. The soil is the support of the nation, furnishing to it primarily both its subsistence, its clothing, its fuel, and the raw materials of its trade with other countries. Some indeed argue that freedom of trade with other countries, permitting unrestricted import of all these articles, has rendered the profitable use of the soil at home comparatively unimportant. But this is inaccurate for several reasons. First, importation involves at all events the expense of all that labor which is devoted to the carrying trade. Secondly, it involves dependence on other nations for other articles than food, to an extent which may easily become fatal. If, for instance, agriculture in England were to employ less labor, because it was more profitable to import wheat for subsistence and cotton on which to employ laborers, there is not only the risk, sufficiently grave, that both may be stopped by war, but the ever present probability that manufacturing industry may be displaced by competition from countries where its raw material can be obtained without the cost of carriage, and where in some cases labor may, owing to climate or a lower standard of living, be cheaper. Such a rivalry is already visible in America, in India, and in Russia. If through these causes the manufactures should decay, and the artisans be driven to emigrate, certainly the depopulated fields of Great Britain would be unable to maintain her in her present rank among nations.

Law of diminishing production.

An entirely opposite school has, however, stated a principle, which, though not applied by it to the question of the tenure of land, would if true be hostile to the application of further capital to the soil. Political economists (see, *e. g.*, Mill, bk. i. chap. xii.) have asserted that every successive application of capital to cultivation must be less profitable than the first. This is called the "law of diminishing production from land," and it has been said to be "the most important proposition in political economy." But the fact is that it is true only if the qualification be added "in the existing state of knowledge." That is to say, it is true that, if a given amount of labor applied in raising wheat, for example, will raise 16 bushels on an ordinary soil, twice the amount of labor will not, *per se*, raise 32 bushels on the same soil, or even 16 bushels on a very inferior soil. But chemistry and experiment tell us that if, instead of spending the second quantity of labor in merely ploughing twice instead of once, we spend it in purchasing and applying nitrogen, phosphoric acid, and potash in proper proportions to the soil, either directly as artificial manures, or still more cheaply as manure from animals whose food has contained these elements, we do get a return considerably more than double for the double amount of labor which the application involves. This is exemplified in the fact that rents rose about 20 per cent. in England when these appliances came into use, in spite of a stationary range of prices, showing that the additional capital thus devoted to agriculture gave a higher return than the capital that had been previously employed.

A further illustration may be found in the fact that the capital that has been expended by the Improvement Companies in England, under the supervision of the Inclosure Commissioners, has yielded on an average a return of 15 per cent. of increased rental on the expenditure, over and above the profit made by the tenant farmer (Caird). Since this average includes a few cases in which defective knowledge has led to loss, it is evident that, when capital is applied to agriculture with reasonable scientific knowledge and skill, it is capable of still yielding returns at a full average rate, even after payment of the salaries earned by the scientific and practical education which has directed its employment. Nor is there any reason to believe that the process has come, or nearly come, to an end. It certainly does not follow that soil is capable of unlimited production; for it is quite certain that its powers in this respect are sharply defined by the amount of light and heat which in any given situation the plants growing on it can receive. But it is becoming daily more probable that up to that limit advancing science and practical skill will tend to equalize the cost of production, making the application of labor to inferior soils as profitable as to superior, and making capital as productive when approaching the limit of its useful application as when it is, in the form of rude labor, applied to soils newly brought under cultivation.

Nationalization of land.

But, on the other hand, the doctrine that the land can be made more productive by the application of more capital, and that the state has a strong interest in increasing production, is fatal to all that variety of proposals which have been made for what is called, in rather uncouth and exceedingly vague phrase, "nationalization of the land." All of these start with the suggestion that the land of the country, being the property of the community, should be resumed by it for a new arrangement or distribution. In some schemes it is proposed that the state shall buy out the present owners, paying them the full value of the fee simple; in others it is proposed that the state shall simply resume the land on the death of the present owners, without paying any compensation to their heirs. Conceding the abstract justice of both propositions, it admits of little doubt that they would not be for the public benefit. Under the first the state would make a very bad bargain. Land, on account of its attractions as a subject of private property, brings a market price nearly 30 per cent. above its actual value. It sells usually at a rate computed to yield a clear return of not more than 3 per cent. But in order to bring this return the owner is obliged to lay out, in maintenance of buildings, drains, roads, fences, and other incidents, sums which on an average are not much less than a third of the net produce. If then the state is to buy at the rate of 3 per cent. what actually yields only 2 per cent., it is clear that the public will be a loser on the transaction. On the other hand, if the state is to take possession of land on the death of the present owners, either without compensation or with a compensation less than the market value, the result would be at once to stop all further improvement by the actual possessors. No one would spend money on that which was to pass, not to his own heirs, but to the public, and the land when it reverted to the state would be in a condition requiring enormous outlay to restore its exhausted fertility, and to remedy the general decay into which its appliances would have been suffered to fall. If again it be urged that the state might obviate this evil by offering compensation for the actual value of improvements which might be made, it can only be answered that private landlords and tenants have not yet found a method of satisfactorily ascertaining such value; that even when the principle is accepted tenants frequently prefer, when certain of not obtaining a renewal of their lease, to exhaust the land rather than trust to arbitration giving them an equivalent; and that this tendency would be enhanced when the state became the landlord and the valuers were appointed by it.

Supposing, however, the operation to be accomplished, and the state to have become the universal landowner, the next question is, What is it to do with the land? On this there is a still greater variety of suggestion. Some would have the land let by the state on lease merely, and would apply the rental to extinguish taxation. Others would have the state to sell in fee simple. But in both cases there arises the further question, To whom shall the advantage of a lease or a sale be given? Here there breaks out the dispute between the advocates of large and small estates and of large and small farms. Some would offer the priority of choice to the existing tenants; but, as this would result in the creation of a large proportion of estates or farms extending to hundreds or even thousands of acres, its superiority over the present system can only be considered as partial. Others would break up the whole land of the country into peasant properties, and even go so far as to furnish each with a house. But, considering that this scheme would further involve the abandonment of most of the existing farm houses and farm buildings, which would be quite useless to peasant proprietors, it would impose a heavy financial loss on the nation.

It must be further kept in view that there are only 47 millions of cultivable acres to be divided among 35 millions of persons, and that the acres are of every conceivable difference of value, dependent not merely on soil but on situation, climate, cropping, capability for improvement, and a thousand other circumstances. To divide these into plots of equal value would be a task of enormous expense, and perhaps scarcely possible to be accomplished. But, if the plots are to be of larger size and unequal value, it must be again asked, How is the state to be guided in selecting the individuals to whom its special favors are to be given? And if it be said that the state would exact a rent proportioned to the value, and thus confer no favor, there would then arise the further question whether the rent is to be fixed in perpetuity, which means a gift to the lessees of all capability of improvement in the land, or whether it is to be adjustable by valuation at intervals, which merely leaves the lessees in the same position as the present lessees are. In the latter case nothing would be gained except that some would be dispossessed in order that others might be put in possession.

It is, however, insisted that in any case the state would have the advantage of drawing the rental of the land, and it is argued that this would do no wrong to the lessees, because it would be only the rental derived from the original value of the soil, and would not affect their profits from the capital and labor they employ on it. This principle, if sound, might, however, be applied with equal force to every other species of material wealth. The state would be quite as fully entitled to acquire, by purchase or by annexation on death of the owner, factories and consols, as it is to acquire land for which it has suffered the former owner to pay a price. But there is a greater disadvantage in the state becoming the universal landlord. A farm is dependent not only on the soil but on the seasons and the markets, and its profits cannot be guaranteed. A rent for the use of the mere soil may be fair on an average of years, but occasionally there comes a series of years in which no rent at all can be paid without bankruptcy of the tenant. Private landlords can and do meet these bad times by concession and agreement, but the state can only act by laws, and in justice to the community it must be hard to its debtors. It is in fact the system which has been tried to be carried out in India, with a considerable variety of method, but with uniformity of failure,—a failure to be attributed mainly to the fact that state taxation, necessarily inelastic, is disastrous when applied to income so fluctuating as that from land must be. In fact a tenant, paying full value for the unimproved land to the state, would be in precisely the position occupied at present by an owner who is mortgaged up to the ears; and since the rent is to be in perpetuity also, he would be unable ever to redeem himself from the burden. An occupant so situated is the most unhappy of men, and the worst of cultivators, and that the state should hold the mortgage over him would only make his position the harder.

The unearned increment.

These considerations apply also to the recommendations which have been made that the land tax should be increased and that the "unearned increment in the value of land" should be appropriated by the state. Including tithe and local rates, land is taxed at present to an average of about 30 per cent. on its net profits. An additional tax on land would operate to prevent investment of capital on its improvement, since capital will not be invested where its returns are below the average. The "unearned increment in value of land" is often strikingly apparent in and near towns; but it does not exist in the bulk of agricultural districts. Corn has not risen in price within the last hundred years, and, if meat has, so has the cost of raising and importing the food of cattle. The rise in the value of agricultural land generally is not on the whole more than a fair return for the capital that has been invested in improvements, and for the immense sums that have been lost in the experiments out of which the improvements have sprung. The cases in which it is more than this would be incapable of being discriminated, and would not be worth the trouble if it were possible. The idea would probably not have been started had it not been for the spectacle of the enormous fortunes accruing to those who have had the good luck to inherit or to purchase land useful for building purposes. If limited to such cases, the principle of the right of the community to resume the benefit arising from its own concentration in particular spots may be supported by different and very good reasons, due regard being had to the reimbursement to the private owner of all sums actually expended by him in purchase or building.

Mineral wealth.

The right of the public to mineral wealth under the soil stands on as clear a footing. By the common law gold and silver mines belong to the crown, no matter who is the owner of the soil. The principle obviously applies equally to all minerals. They are a part of the country itself, not merely material from which profit can be extracted, and when they are gone they cannot be replaced. As the law forbids the selling of land to foreigners, it might with equal justice forbid the selling of coal for foreign exportation. The discovery of valuable minerals is often due to mere accident, and they resemble treasure-trove, which by law belongs to the crown. Nor would difficulty arise in working mines by crown lessees or under crown superintendence. Where they already are worked, it would be right to pay the estimated value to the private owner, since hitherto they have been deemed subject of private property, but all future increase or all new discoveries might justly be held to belong to the nation, without compensation to the owner of the surface who had no knowledge of their existence.

Regulation of distribution of land.

Approaching now the question how the state without actual resumption of the land may so regulate its possession as to encourage the maximum production from it, we are in the beginning met with the dispute between the advocates of large and small estates, the former cultivated by tenants, the latter by the owners. But we may first disembarrass this question from one source of confusion. Large estates are never cultivated in a block. They are invariably broken up into farms, sometimes indeed extending to several thousand acres, but far more generally ranging between the limits of 500 and 50 acres. Below 100 acres the tenant is usually himself the cultivator, with more or less assistance, and below 50 acres he will seldom require any assistance outside his own family. Now, as there is no advantage accruing from one landlord holding a number of such farms, we may state the question as regards cultivation as not being between large and small estates, but as being between farms of which the tenant does the work and those in which he only superintends the work of others.

Advantages of small farms.

Thus stated, the answer admits of no dispute. It has been already discussed in the article AGRICULTURE; but it may suffice to advert here to the conclusive argument derived from the superior efficacy and therefore cheapness and productiveness of the labor given by a man in working entirely for his own behoof, as compared with that which he pays others to do for him. It would scarcely be too much to say that capital in the form of personal labor will yield twice the return of capital employed in hired labor. It applies not merely to the man but to his wife, sons, and daughters, and not only to the actual amount of work done, but to the zeal and care with which it is directed.

Against this advantage on the part of the small cultivator there is only to be set in favor of the large that he can better employ machinery. But, though he may be the first, he is not necessarily the only one to employ machinery. Reaping and mowing machines may be (and often are) employed on the smallest holdings; threshing machines are now made to be worked by hand or by one or two horses; even steam-engines are made with power down to one horse or half a horse. These very small machines are slightly more wasteful of coal for the power they give out; but on a small scale this is quite inappreciable, and is far more than balanced by the greater economy induced by their being driven by the owner himself. A very elementary resort to combination among small cultivators affords them in any case the same advantages as the large cultivator. Their energy and aptitude are not less, and with the advance of education may be directed with the same knowledge. Most persons connected with land know of many instances in which even at present the small cultivator is as advanced in his scientific practice as the larger. It is generally admitted that during the recent disastrous seasons the smaller farmers have been better able to meet their engagements than the larger. The reason is, not merely that their outlay is smaller in cost of labor, but that by close attention and the power of availing themselves of every opportunity they have suffered less actual loss than the farmer on a more extensive scale.

It is of course understood that, to enable a farmer of a small acreage to produce the same result as a larger holder, he must have the same advantages provided to him by investment of owner's capital. He needs the same buildings for farm purposes, the same drains and fences, in proportion to his extent of farm. But he does not need more; and, as his own house is only an equivalent for the laborer's cottage, which must in any case be provided, there is the saving of the more expensive residence which a farmer cultivating several hundred acres thinks himself entitled to. Again, the tenant's capital invested must also be as much in the one case as in the other. The small tenant ought to have as much and as good stock on the farm in proportion to its extent as the large. But he saves much capital in the item of wages, because, till profits come in, his own labor costs him only his own food, and even the rent of his house is postponed, so that it is probable that he will be able to spend on the land a capital larger in proportion than the extensive farmer at a greatly less actual outlay of money. Those who argue that the capital invested by the larger tenants is greater than that invested by the small cultivator forget that capital in agriculture must be measured not solely by expenditure of money but in a great measure by expenditure of labor to which a whole family may cheaply but effectively contribute.

Joint interests of landlord and tenant.

The importance of encouraging investment of capital forms perhaps the main argument in favor of the system of cultivation by the joint interests of landlord and tenant. In this combination the landlord furnishes the land and (in Scotland always, in England frequently) the buildings, etc. The tenant's capital is therefore limited in its application to operations of tillage and manuring. The landlord's contribution is commonly estimated at five-sixths, the tenant's at one-sixth of the total capital employed, and while the landlord's yields less than 3 per cent. interest, the tenant's has, by Mr. Caird, been estimated as bringing in 10 per cent. per annum. This, however, on an average of years and of farmers, is probably too high an estimate. The conclusion, however, is drawn that the system is beneficial to the farmer because the capital required for permanent investment is advanced by the landlord at a low rate of interest, while the whole of the tenant's capital is invested at a high rate of interest. But in this argument it seems to be forgotten that the tenant's 10 per cent. includes not merely interest on capital subject to risk, but salary for time and skill, and is, therefore, not really 10 per cent. on capital. Now, undoubtedly, if any one desires to risk his whole capital in trade, he is entitled to at least 10 per cent. on it, and he makes, while prosperous, a large income. But if he prefers to invest five-sixths of it in a secure investment, yielding only 3 per cent., and to risk only one-sixth, while at the same time giving his personal labor and skill, his income may be considerably smaller, but it will be to the same extent the more secure. It is entirely a question for each person to solve for himself, and it would be no national loss if a certain number of farmers were to elect to purchase farms of only one-sixth the extent of those which they occupy as tenants, and to cultivate them with their own labor. Or, if the present tenants should be reluctant to exchange their higher incomes, subject to the greater risk, for smaller but more secure incomes, it cannot be said that there is any national gain in their occupying land which in the hands of small owners would yield crops as large and at no greater cost, though with a different distribution of profits.

What is true in the argument appears to be this. It would be a distinct loss to the nation if landlords were to withdraw their capital from the land before other persons are prepared to put as much in. At present tenants in general can not put in more capital, because they have not got more. They could not, therefore, buy their present farms. But they could buy farms of smaller extent, and on these raise crops fully as good. And if there were enough of other persons prepared to buy the remainder of the land, and to cultivate it themselves with equal skill, there would be equal advantage in their doing so. But, since skill in farming needs both education and practice, there are not enough persons as yet possessed of these qualifications and also of the needful capital. Hence any sudden break in the present system of tenure by landlord and tenant would be hurtful to the country, leading to abstraction of capital, and worse cultivation and less produce. But a gradual process of change, permitting all persons who had capital (however small) and aptitude to become owners and cultivators, would be a national benefit, since it would not diminish the capital employed, but would render it on the contrary more productive through the stimulus of being applied wholly for the benefit of the cultivator himself.

Owners should be cultivators.

There is no doubt that the system of division of capital and rights between landlord and tenant is intrinsically bad. Neither is full owner, nor can do even with his own share exactly what is best for himself and the public. The landlord is generally short of means with which to make permanent improvements; in any case he can make none without the tenant's sanction, and, of course, he makes none unless the tenant agrees to pay him at least 3 but more often 5 per cent. The tenant, on the other hand, having only a temporary interest, spends nothing except when he sees a certainty of being repaid before the end of his term. Land, however, yields only slow returns, and much is thus left undone because the full profit cannot be reaped until after a lapse of years. The system of leases, universal in Scotland, palliates but does not remedy the mischief. It is recognized that the tenancy, usually of nineteen years, is in practice divided into three equal portions. The first is spent in restoring the exhaustion of the soil by the preceding tenant, the second gives a full profit, the third is (if no renewal of lease be expected) devoted to the gradual withdrawal of capital, with corresponding reduction of fertility. Compensation for unexhausted outlay is an excellent principle; but it has not yet been found so trustworthy in application as to afford sufficient security to induce the continuous application of capital till the end of the lease.

It is very doubtful whether any form of legislative interference, passing beyond a mere enactment of equitable presumptions in absence of express contract, would improve the relation between the two parties, because such enactments when not agreeable to both parties can always be indirectly broken through. It is only cultivation by the actual owners that gives at once the freedom and security necessary for full development of the capacity of the land and the adoption of the results of modern science.

Illustration from Ireland.

The history of land tenure in Ireland illustrates these principles, and they in turn afford a standard by which to judge recent legislation. Leaving out of view a certain number of estates on which the landlord supplied, in addition to the land, the capital represented by buildings, drains, etc., in the greater part of Ireland he supplied nothing. The tenant, under a general custom of permanence of holding, in many cases did a great deal; but, as the custom was not enforced by law, the occasional seizure of his improvements caused a sentiment of alarm and distrust which seriously limited them. The Act of 1870 aimed at giving him additional security by not merely recognizing his right to compensation for his own outlay if he should be removed, but by imposing a fine on the landlord if he should evict a tenant. But, as it avoided to prohibit the landlord from raising the rent, the insecurity was just as great as before, while the introduction of a legal relation between the two parties led many landlords to restrict more than ever their expenditure on improvements. The Act of 1881, therefore, proceeded to the necessary consequence of fixing the rent, by means of a court of valuation, and of giving to the tenant a positive right to permanent occupancy, subject to a revaluation every fifteen years. But it is obvious that this scheme also, though valuable as an immediate palliative, fails to have the elements of a permanent settlement. The landlord will be less and less inclined to spend on improvements; and even if he desired to do so the tenant can, and in nearly every case will, prevent him, for the plain reason that he will not desire the landlord's share in the joint property to be increased. Yet the tenant will on his part be impeded from full confidence in making improvements, even when he has the means, lest at the next valuation his own outlay may be valued against him. The interests are no longer joint but conflicting. Thus far the remedial legislation has only succeeded in reaching the stage in which Prussia stood before the reforms of Stein and Hardenberg were proposed, when nobles and serfs had both certain legal rights, which neither could attack, but which neither could convert into independent property. But the Prussian method of reform, by apportioning the land to each party in absolute property, but in fractions representing their respective interests, could not be applied in Ireland, both because the holdings are in general too small to bear partition, and because the landlords have not, as in Prussia, been in the habit of cultivating their own domain, and they would, therefore, again introduce the vicious system of letting to tenants even that part which might be assigned to them in unincumbered fee. The state will, therefore, have to become the intermediary of transfer, but the better course would probably have been that it should at the first have assumed this function on the over-rented and ill-managed estates, leaving those which were fairly rented and liberally managed unaffected by legislation which they did not need.

The legal basis of the recent land legislation in Ireland is, however, as it was in Prussia, the recognition that prescriptive possession, even under a title of mere tenancy, confers a right to continuance of such possession. The same principle formed the basis of the conversion of copyholds in England from being tenancies at will into tenancies in perpetuity. It might justly be applied still in cases in Great Britain in which tenancies have continued without change for a long period. Especially might it be applied to check the system of "clearances" in the Highlands, where the right of the crofters to continue in possession rests on the original community of possession by the tribe, and is fortified by an almost immemorial continuance of possession by each family.

Mortgages objectionable.

In any view of ownership, however, whether on a large or small scale, it is obviously of prime importance that the owner should be possessed of cash sufficient to make the improvements required. This is a situation in which an owner who is already in debt cannot possibly be. To hold land subject to a mortgage is, therefore, to hold it under conditions disadvantageous to the owner, the tenant, and the nation. The evil is intensified by the fact that an owner so burdened possesses an apparent estate far in excess of his real means, and occupies a social station involving an expenditure that exhausts his resources in every way. It would be greatly for his pecuniary advantage if the law were such as would compel him to sell sufficient land to pay off his debts, for he would thus relieve himself of interest at the rate of 4 to 5 per cent. by selling property which gives only 2 or 2½ per cent. on the price that would be obtained. His net income would then not only be greater, but as his apparent estate would be smaller, he would not be tempted to live in so expensive a style, and he would thus have the means of gaining larger returns from his property by improving it. It has, therefore, been proposed to abolish mortgages by prohibiting land from being made security for special debts. It would then form part of the general assets of the owner, liable equally for all his debts; and any one who desired to raise money would practically be obliged to do it by sale instead of by pledge. Land would be confined to its proper purpose as a means of production, instead of being injured for that purpose by being used as a means of credit.

Life interests objectionable.

The same principle forbids that life interests in land should be permitted. The mere tenant for life or holder under settlement or entail has actually in frequent instances a motive against cultivating his estate to the best advantage. If he is not on good terms with the next in succession, or if, as so often happens, the next successor is a distant relative, while the present tenant has only daughters, his motive, and often indeed his duty, must be to impoverish the estate in order to save money for those whom he loves best. In a less degree, if he has a large family, he must save money out of the rents of the estate to provide for his younger children, and he is correspondingly disinclined to lay out money on improvements which must accrue only to the benefit of his eldest son.

All these considerations are equally applicable to small as to large estates in land. It is as injurious to the peasant cultivator as to the extensive landowner to be hampered by a burden of debt, or to be deprived of the power of directing who shall be his successor. In France, in Germany, in Switzerland, in America, and in India, indebtedness is the great curse of the small farmer. The money-lender is a far harder master than the landlord, for he has less mercy and less interest in being merciful.

Devotion of land to purposes of luxury.

It has been assumed throughout these observations that land is to be applied to its natural use, the production of the materials of food and clothing. In the hands of rich persons it is, however, sometimes devoted to purposes of luxury and enjoyment, such as the formation of large parks, game preserves, and deer forests. Within moderate limits such purposes may be defended on the plea that man does not live by bread alone but by all the enjoyments which he is framed for appreciating, and which in moderation contribute to mental health. But they are most defensible when open to the most general enjoyment, and it is peculiarly to the credit of many of the English nobility that they open their parks to the resort of the neighboring villagers and townspeople, often at some inconvenience to the owners themselves. On the other hand, the conversion of large tracts of ground to the object of preserving game, which implies at the same time exclusion of the public, and diminution of production of food, for the sole recreation of one or two individuals, is a use of national resources which has, since the formation of the New Forest by William the Conqueror, been generally reprobated. The latest phase of its development has been in the conversion of immense areas of the Highlands of Scotland into grouse shootings and deer forests, a process which involves the removal of the small tenantry, and even, in the case of deer forests, the ceasing to graze cattle and sheep. The landowners find that the game rents are much more profitable to them than the farming rents, but it is at the cost of the nation, which suffers a diminution in the employment of labor and in the production of food, and which consequently must see its inhabitants emigrate, and pay for imported grain, wool, and meat grown by foreign labor. The ultimate remedy of this abuse will probably be found in measures tending to break up large estates into small ones, for the system requires the reservation of extensive areas free from the presence of man, and the interposition of small cultivated holdings would effectually destroy it.

Grazing.

It may, however, be well to notice here an argument which has been sometimes pushed to excess. It has been urged that even grazing should be prohibited, on the ground that from the same area a much larger production of food can be obtained in the shape of corn than meat. The difference is indeed very striking. An acre of good land will yield 40 bushels of wheat, weighing 2500 ℔, while in grass it would yield only 250 ℔ of meat, and it is still more striking if we deduct the water from each, when we have 2200 ℔ of dry grain against 188 ℔ of dry flesh and fat. But man being semi-carnivorous, must have a proportion of flesh, and the value he assigns to meat as compared with corn shows very correctly its relative importance in the human economy. The fact is that the test of market prices, which are now regulated by the production and demand of the whole world, assigns to dry meat and fat a value just about twelve times as great as that of corn, and consequently an acre of grass land gives a profit quite equal to that of an acre of wheat. Nor could the equality be impaired even if we were all to become vegetarians. For the most ardent disciples of that faith admit the necessity of using milk, and about 2 pints of milk is a necessary addition to the daily allowance of 2 ℔ of grain for health and the performance of work. But to furnish this quantity of milk throughout the year nearly an acre of ordinary land would be required, or as much as would give about half a pound of meat per day, so that there are no means by which we can dispense with the use of a considerable extent of land for the feeding of animals, by which its produce is converted into the proximate products demanded by the human constitution; and the amount to be so used is best determined by the demand of the public.

The conclusion to be drawn from the review of the whole questions relating to tenure of land is that they are best solved by freedom of action of individual owners, guided by self-interest and family affection, and only restrained by law when the special circumstances of a high civilization introduce abnormal conditions. Since these motives operate most fully and healthily when land is held in small estates, it only remains to glance at the methods which in different countries and by different authorities have been suggested to encourage subdivision.

Methods of subdivision.

The most general method is that of equal division of the inheritance among children. It is compulsory in the Channel Islands, in France, and several other European countries, and it forms the rule of intestacy under the law of gavelkind in Kent, in most of the British colonies, and in the United States. To its existence in the latter form no reasonable objection can be taken. To its compulsory enforcement there applies, though in a modified degree, the same objections that apply to a compulsory rule of primogeniture, with the additional objection that it tends to limit the growth of population. Parents who are compelled to give an equal portion to every child avoid the risk of subdivision by not having many children, a course which, if commendable when the Old World seemed in peril of overpopulation, is a source of national impoverishment when the world affords profitable employment for hundreds of millions more than exist. Among the children themselves the certainty of succession abates the sentiment of filial duty, and the desire to bestow a special bounty on one child who is favored above the rest may sometimes induce the parents to spend less than they otherwise would in the improvement of the whole estate.

Subdivision of property may, however, be gradually effected by prohibiting excessive bequests. It has always been recognized that the state has an unquestionable right to deal with property at the moment of its transmission from the dead to the living, and no objection could be made to a rule that no one should leave by will or through intestacy more than a certain sum, or land of equivalent value, to one individual. This would not generally affect the desire during life to amass and improve property, because the improved value would still be available for division among all whom the owner wished to benefit. But it would in one generation reduce all estates of abnormal size to properties of such dimension as in the opinion of parliament would be most serviceable for cultivation, and consequently most conducive to national benefit.

The abolition of the right to raise money by mortgage of land would also tend to promote its subdivision, since an owner in debt would be obliged to sell a portion of his estate in order to pay his debts. The improvement of conveyancing, which would follow from the general abolition of all interests in land except that of simple and absolute ownership, would also facilitate the sale of land. The leading principle which should guide legislation is in short that land should be made capable of the easiest transmission from one owner to another, and of the fullest use by him to whom for the time it belongs. The ordinary motives of human nature will then concur in transferring it from those who are least to those who are most capable of making it productive, and of inducing each successive owner to bestow on it the labor and outlay by which the maximum of beneficial production will be secured.

See Mommsen, *History of Rome*; Von Maurer, *Geschichte der Markenverfassung in Deutschland*; Id., *Geschichte der Dorfverfassung*; Id., *Geschichte der Städteverfassung*; Id., *Geschichte der Frohnhöfe, der Bauerhöfe, und der Hofverfassung*; Nasse, *Ueber die Mittelalterliche Feldgemeinschaft in England*; Landau, *Die Territorien in Bezug auf ihre Bilding*; Von Haxthausen, *Ueber die Agrarverfassung in Norddeutschland*; Laveleye, *Primitive Property*; Maine, *Village Communities in the East and West*; Cobden Club, *Systems of Land Tenure*; Reports of H. M. Representatives on Tenure of Land, Parl. Papers, 1860–1; *Statistique de la France*; Marx, *Das Capital*; Herbert Spencer, *Social Statics*; George, *Progress and Poverty*; Brodrick, *Land in England*; Boyd Kinnear, *Principles of Property in Land*.

LANDAU, the chief town of an official district in the Palatinate of the Rhine, Bavaria, is situated on the Queich, about 18 miles northwest of Carlsruhe. Among its various interesting buildings are the Gothic church, dating from 1285, and the monastery, founded in 1276, and now converted into a brewery. There is a considerable trade, and some manufacture. The population in 1875 was 7579.

Landau was taken no less than seven times in the Thirty Years' War. At the peace of Westphalia it was ceded to the French, and was generally held by France till 1815, when it was restored to Germany; in 1816 it was annexed to Bavaria. In 1871 its fortifications were finally destroyed.

LANDEN, John (1719–1790), a distinguished mathematician of the 18th century, was born at Peakirk, near Peterborough, in Northamptonshire in 1719, and died 15th January, 1790, at Milton in the same county. Most of his time was spent in the pursuits of active life, but he early showed a strong talent for mathematical study, which he eagerly cultivated in his leisure hours. In 1762 he was appointed agent to the Earl Fitzwilliam, and held that office to within two years of his death. He lived a very retired life, and saw little or nothing of society; when he did mingle in it, his dogmatism and pugnacity caused him to be generally shunned. He was first known as a mathematician by his essays in the *Ladies' Diary* for 1744. In 1766 he was elected a Fellow of the Royal Society. He was well acquainted and *au courant* with the works of the mathematicians of his own time, and has been called the English D'Alembert. In his *Discourse* on the "Residual Analysis," in which he proposes to substitute for the method of fluxions a purely algebraical method, he says, "It is by means of the following theorem, viz.,

$$\frac{x^{\frac{m}{n}} - v^{\frac{m}{n}}}{x - v} = x^{\frac{m}{n}-1} \times 1 + \frac{v}{x} + \left(\frac{v}{x}\right)^2 \ldots (m \text{ terms}$$

$$\div 1 + \left(\frac{v}{x}\right)^{\frac{m}{n}} + \left(\frac{v}{x}\right)^{\frac{2m}{n}} \ldots (n \text{ terms})$$

(where *m* and *n* are integers), that we are able to perform all the principal operations in our said analysis; and I am not a little surprised that a theorem so obvious, and of such vast use, should so long escape the notice of algebraists." The idea is of course a perfectly legitimate one, and may be compared with that of Lagrange's *Calcul des Fonctions*. His memoir (1775) on the rotatory motion of a body contains (as the author was aware) conclusions at variance with those arrived at by D'Alembert and Euler in their researches on the same subject. He reproduces and further develops and defends his own views in his *Mathematical Memoirs*, and in his paper in the *Philosophical Transactions* for 1785. But Landen's capital discovery is that of the theorem known by his name (obtained in its complete form in the memoir of 1775, and reproduced in the first volume of the *Mathematical Memoirs*) for the expression of the arc of an hyperbola in terms of two elliptic arcs. To find this, he integrates a differential equation derived from the equation

$$t = gx\sqrt{\frac{m^2 - x^2}{m^2 - gx^2}},$$

interpreting geometrically in an ingenious and elegant manner three integrals which present themselves. If in the foregoing equation we write $m = 1$, $g = k^2$, and instead of t consider the new variable $y = t \div (1 - k')$, then

$$y = (1 + k')x\sqrt{\frac{1 - x^2}{1 - k^2x^2}},$$

which is the form known as Landen's transformation in the theory of elliptic functions; but his investigation does not lead him to obtain the equivalent of the resulting differential equation

$$\frac{dy}{\sqrt{1 - y^2 . 1 - \lambda^2y^2}} = \frac{(1 + k')dx}{\sqrt{1 - x^2 . 1 - k^2x^2}}, \text{ where } \lambda = \frac{1 - k'}{1 + k'},$$

due it would appear to Legendre, and which (over and above Landen's own beautiful result) gives importance to the theorem as leading directly to the quadric transformation of an elliptic integral in regard to the modulus.

The list of his writings is as follows:—*Ladies' Diary*, various communications, 1744–1760; papers in the *Phil. Trans.*, 1754, 1760, 1768, 1771, 1775, 1777, 1785; *Mathematical Lucubrations*, 1755; *A discourse concerning the Residual Analysis* 1758; *The Residual Analysis*, book i., 1764; *Animadversions on Dr. Stewart's Method of computing the Sun's Distance from the Earth*, 1771; *Mathematical Memoirs*, 1780, 1789.

LANDER, Richard (1804–1834) and **John** (1807–1839), two brothers, African explorers, were natives of Cornwall. Richard Lander accompanied the Niger expedition of 1825–27 as Clapperton's attendant, and on the death of his master at Sokoto on the Niger, in April, 1827, returned to England, and published an account of the expedition in 1830. He exhibited such capacity for the work of African exploration that the British Government decided to send him out to determine the course of the Lower Niger, which was then unknown. In the expedition he was accompanied by his brother John, who was better educated than Richard, and who went as an unsalaried volunteer. Leaving England in January, 1830, the brothers landed at Badagry, on the Guinea coast, on March 22. They then travelled northeast to Boosa on the Niger, and after a trip north as far as Yaoorie they proceeded down the river in canoes. At Kirree they were taken prisoners by the natives, and after some delay were conveyed down the river and managed to escape in a brig, the river journey lasting about five months. The Landers were thus able to lay down with approximate correctness the lower course of the Niger, and to prove that it discharged by a delta into the Gulf of Guinea. They lost many of their records at Kirree, but published a detailed narrative of their exploration in three volumes, in 1832 (*Journal of an Expedition to Explore the Course and Termination of the Niger*, by John and Richard Lander). In 1832 Richard went out again at the head of a well-equipped expedition, organized by Liverpool merchants for the purpose of opening up trade in the Niger, and founding a commercial settlement at the junction of the Binué with the main river. After making several successful journeys, he was again on his way up the river in January, 1834, when on the 20th the party were attacked by natives and Lander was wounded. He died of his wounds at Fernando Po on February 6. John Lander died November 16, 1839.

LANDES, a department in the southwest of France, formed of portions of the ancient provinces of Guyenne, Béarn, and Gascony, lies between 43° 30′ and 44° 32′ N. lat., and 0° 8′ E. and 1° 30′ W. long., and is bounded on the N. by Gironde; on the E. by Lot-et-Garonne and Gers; on the S. by the Basses Pyrenées; and on the W. (for 68 miles) by the Bay of Biscay. Its greatest length, from the mouth of the Adour in the southwest to Arx on the border of Lot-et-Garonne in the northeast, is 89 miles; its greatest breadth from east to west is about 62 miles, and the area 3599 square miles. The department takes its name from the *landes*, sandy plains formerly covered by the sea, which occupy its greatest portion, and extend into the departments of Gironde and Lot-et-Garonne. South of the Adour, the chief river of the department, the country changes in character, and is called *La Chalosse*,—a hilly region, which the various rivers coming down from the Pyrenées intersect like the rays of a fan. The Gabas, Luy, and Gave de Pau are the principal tributaries of the Adour on the left. On the right it is joined by the Midouze, formed by the junction of the Douze and the Midou. North of the Adour the plain of Landes slopes gently to the northwest, and empties its waters partly by the Leyre, which flows into the Arcachon basin, partly by brooks, which run into the lakes at the foot of the dunes which fringe the coast. The soil of this plain is naturally sterile. It is composed of a mixture of sand, clay, and organic debris, and rests on a subsoil of tufa (*alios*) which is impermeable to water; for three-quarters of the year, consequently, the waters, settling on the almost level surface and unable to filter through, transform the country into marshes and morasses, while in summer the heat of the sun, drying up the marshes, produces malarious fevers. But during the last twenty-five years much labor has been expended in draining operations. More than

1350 miles of ditches have been dug, and of the 1,112,000 acres which were uncultivated in 1850 two-thirds have now been reclaimed, or planted with forest trees. The coast, for a breadth of about 4 miles, is bordered by a succession of dunes or sand hills, in several ranges parallel to the shore, and from 150 to 300 feet in height. Driven by the west wind, which is most frequent in these parts, the dunes were slowly advancing year by year towards the east, burying the cultivated lands and even the houses. Bremontier, towards the end of the last century, devised the plan of arresting this scourge by planting the dunes with maritime pines. At the present time upwards of 98,000 acres have been thus treated, and the forests already supply some fine timber to the navy. In the southwest, cork trees take the place of the pines. On the eastern side of the dunes is a series of lakes (Cazau or Sanguinet, Biscarosse, Aureilhan, St. Julien, Léon, and Soustons), which have been separated from the sea by the heaping up of the sand. The salt water has escaped by defiltration, and they now are quite fresh. The climate of Landes is the Girondine, which prevails from the Loire to the Pyrenées. Snow is almost unknown, even in winter; the spring is rainy, the summer warm and stormy. The prevailing wind is the southwest, and the mean temperature of the year is 53.6° Fahr., the thermometer hardly ever rising above 82° or falling below 14° Fahr. The annual rainfall in the south of the department in the neighborhood of the sea reaches 55 inches, but diminishes by more than half as we proceed to the northeast. Most of the department is still in the condition of *landes*, traversed by flocks of sheep, which are kept by shepherds perched upon stilts. These *landes* are gradually giving place to forests, and in extent of forest land this department occupies the first place in France. In the *Chalosse*, the richest portion of the department, the vine, maize, wheat, millet, tobacco, vegetables, hemp, and flax are cultivated; yet small though the population is, the department does not produce corn enough for its own consumption. The exploitation of the forests forms the chief industry. The resin obtained from the maritime pine furnishes by distillation the essence of turpentine, and from the residue we have various qualities of resin, which serve to make varnish, tapers, sealing-wax, and lubricants. Tar and an excellent charcoal for smelting purposes are also obtained from the pine-wood. From the numerous iron furnaces in the department there was, in 1878, an output of 17,000 tons smelted with charcoal, and 8139 tons during the first six months of 1881. The cultivation of the cork tree is also very important; its produce is much sought after both by French and by foreign manufacturers. There are also a number of brick and tile works, and potteries. The department has several mineral springs, the most important being those of Dax, which were frequented even in the time of the Romans. The population of Landes in 1876 was 303,508, or 84 inhabitants to the square mile. In 1801 the population was only 224,272. The department includes three arrondissements (Mont-de-Marsan, Dax, and St Sever), 28 cantons, and 333 communes. Mont-de-Marsan is the capital of the department. It is noticeable that in its long extent of coast, it has no considerable port. Opposite Cape Breton, however, where the Adour formerly entered the sea, there is, close to land, a deep channel where there is safe anchorage. It was from this once important harbor of Cape Breton that the discoverers of the Canadian island of that name set out.

LANDLORD AND TENANT. It has been explained in the article LAND that in the United Kingdom no such thing as the absolute private ownership of land is recognized. The absolute and ultimate owner of all lands is the crown, and the highest interest that a subject can hold therein is a tenancy. The largest estate known to the law, that in fee simple, is after all only a holding in which the owner of the fee stands to the lord in the relation of a tenant. All estates in land would therefore fall under this heading, but on the present occasion as in common parlance, it is restricted to those holdings which amount to the hiring of land. That tenure has nowhere the same importance as in the British Isles,[1] where practically the whole agricultural land of the community is cultivated by persons who merely hire it for a limited time from the owners. The social and political bearing of this fact does not fall within the scope of the present article, but it shows the important application of the rules of law, which we proceed to state.

Dismissing the tenant character of the landlord, and regarding him as owner pure and simple, we have to deal with him as contracting to give up the occupation of his land to another person, the tenant, for a consideration. In Roman law, the tenure of *emphyteusis* (a kind of perpetual lease originally used by corporations but afterwards by private owners), and *precarium* (or tenancy-at-will) occupied to some extent the place of the law of landlord and tenant in our system. The proper contract of letting and hiring (*locatio-conductio*) as applied to land had the following incidents. The *conductor* (tenant) was not technically regarded as possessor; *i. e.*, he had not the aid of the interdicts in case of eviction either by the landlord or by strangers. The *locator* alone could sue in respect of the land, but the conductor had a personal action against the locator on the contract. The landlord was bound to make delivery to the tenant and permit him to occupy for the term agreed upon, and to keep the premises in proper repair. The landlord was answerable for any injury arising to the tenant from the defective condition of the premises. Finally, "the landlord must permit the tenant to carry away not only movables but even fixtures placed by the tenant, provided the tenant did not injure the house. A tenant of land was entitled to compensation for unexhausted improvements except such as he had specially agreed to execute in consideration of a lower rent" (see Hunter's *Introduction to Roman Law*, p. 121). On the other hand, the *conductor* had to pay the rent subject to deductions for the total or partial loss of the crops, to exercise due care during his term, and give up possession at its expiration.

In English law the following terms are of fundamental importance. The landlord so contracting is said to *demise* his lands, and the instrument by which the contract is expressed would be a *demise* or *lease*. The word lease is very generally limited to the writing in which the agreement to let is expressed, but any contract of letting is as on the side of the landlord a *demise*, and as between the parties a *lease*. A lease or demise means a grant of the exclusive possession of the thing in question for a definite time; permission merely to use the thing for a particular purpose or on a particular occasion is a license and not a lease. A lease further implies that the lessor intends to give up possession to the defendant for a determinate time, no matter how it may be expressed, and is so distinguishable from a mere agreement contemplating that the parties shall on some future occasion enter into the relations which a lease creates. The consideration promised by the tenant or lessee is termed the *rent*. The period of occupation prescribed is the *term*.

The Statute of Frauds (29 Car. II. c. 3) enacts that "all leases, estates, interests of freehold, or terms of years, not put in writing by the parties so making or creating the same or their agents thereunto lawfully authorized by writing, shall have the effect of leases or estates at will,"—except leases for a term not exceeding three years, whereon the reserved rent amounts to two-thirds of the improved value. When rent is accepted by the landlord, the tenancy-at-will is enlarged into a tenancy from year to year. By a later Act, 8 & 9 Vict. c. 106, a lease required by law to be in writing must now be made by deed.

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[1] In the United States the law is substantially the same as in England. The remedy by distress is said to be "becoming unpopular in the United States, as giving an undue advantage to landlords over other creditors." In New England the law of attachment on mesne process has superseded the law of distress. In New York, North Carolina, Georgia, Ohio, Alabama, Tennessee, Mississippi, and Louisiana, it is modified or abolished (see Bouvier's *Law Dictionary*, art. "Distress"). On the other hand, a speedier remedy than ejectment has been provided for landlords, by which they may be "reinstated, upon notice of a day or two, in cases where the tenant abandons the premises before the end of the term without surrendering the lease, leaving rent in arrear, continues to hold over after the expiration of his term, or has become unable or unwilling to pay for the use of the premises." (Bouvier, art. "Landlord and Tenant").

A lease, like other written contracts, should clearly indicate the parties to and the effect of the contract. A date is not necessary, and, in the absence of a date, it will take effect from the day of delivery. But it must contain the names or other sufficient description of the parties, a description of the premises to be demised, words appropriately expressing the fact of a present demise (*demise* or *lease* being the usual words), the date at which the term is to begin and end, and the rent. The rent or other services created in favor of the landlord by the lease are said to be *reserved*. And when things that would otherwise belong to the tenant under the lease, as woods, timber, trees, minerals, etc., are expressly withheld, they are said to be *excepted*. But these expressions do not apply to conditions giving to the landlord the right of shooting, fishing, and so on over the land, or any right of way or other easement thereon. That can be vested in the landlord only by a re-grant from the tenant, no matter by what expression the right is created. Such grant must be by deed; and, where a lease of the land would be effectual without a deed, a reservation of such rights as we have mentioned would not. There is a good deal of misconception on this point, for landlords are not generally understood to hold their right to game on grant from their tenants.

In point of length of term tenancies are distinguishable as being either at sufferance, or at will, or from year to year, or for a term of years. A tenancy by sufferance exists where a person having obtained possession on a lawful title holds over after the title has determined, *e.g.*, a tenant on lease for a term of years after the expiration of the lease. It has been said that this is not an estate at all but a fiction to prevent the continued possession being regarded as a trespass. It is not created by contract, but arises by implication of law; it is not assignable; and possession of the land can be resumed without previous demand to the so-called tenant. A tenancy-at-will exists when the tenant holds by agreement with the landlord, determinable at the will of either. Any signification of a desire to terminate the tenancy, whether expressed as "notice" or not, will bring it to an end. A tenancy from year to year is a tenancy for one year certain, and is determinable only by a six months' notice to quit, such notice terminating on an anniversary of the date of the beginning of the tenancy. A tenancy from year to year must last at least one year, but may be determined then, if a six months' notice have been given; if not so determined it must endure for another year, again determinable in like manner, and it will so endure until terminated by such a notice. Apart from express agreement, it will be implied in law when, for example, the landlord accepts rent yearly or by parts (*e.g.*, quarters) of a year. Similarly monthly tenancies, chiefly of furnished houses or lodgings, would be implied from the fact of rent being paid once a month. But that is a matter of presumption only. If it were proved that the parties agreed to a tenancy-at-will only, payment of rent by the quarter or any other period would not enlarge the nature of the tenancy. Lastly, a lease may be for a specified term, and the tenancy in that case comes to an end by the lapse of time, without notice to quit or any other formality.

These are the agreements by which the relations of landlord and tenant, as the phrase is generally understood, are created, and they are the agreements under which most of the buildings and nearly the whole of the agricultural land are held by their occupiers. There are tenancies, however, in which the granter would not be spoken of as the landlord. Such is the position of the person to whom land is granted for his own life, or, it may be, for the life of another, called in technical language tenant for life and tenant *pur autre vie*. These are not cases of letting and hiring—to which the relation of landlord and tenant is confined—but are modes of holding property. The same may be said of the terms for long periods of years created for carrying out trusts in the settlement of estates. The tenant in such cases is the person who, when we come to the agreement of letting and hiring, stands in the place of the landlord. It may be observed that the law-books distinguish in point of dignity between estates for life, the lowest kind of freehold estates, and estates for any term of years, however long, which are only leasehold estates.

Reverting to the agreement of letting and hiring, it may be laid down that any person having an interest in land may, to the extent of that interest, create a valid tenancy. A tenant for years or even from year to year only may stand in his turn as landlord to another tenant. If he profess to create a tenancy for a period longer than that to which his own interest extends, he does not thereby give to his tenant an interest available against the reversioner or remainder man. The subtenant's interest will expire with the interest of the person who created it. But as between the subtenant and his immediate lessor the tenancy will be good; and, should the interest of that lessor become greater than it was when the subtenancy was created, the subtenant will have the benefit of it. In the same way as between lessor and lessee—landlord and tenant—the latter has no right to look beyond the grant of the former so as to call in question his title. Be that title what it may, the tenant, by accepting that position, is *estopped* from denying that it is good. It may be notoriously bad, but that is nothing to him. The landlord is not obliged to prove his title as against the tenant or any person claiming through his tenant. In an action of ejectment (for the recovery of land) the person claiming possession must in general prove his own title—mere possession being a *prima facie* sufficient defence, until a better title be shown. But a landlord seeking to secure possession of land from his tenant is not obliged to prove anything, except his right to resume possession under the agreement. The tenant, however, may, without disputing the validity of the title under which he entered, show that it has since been determined by lapse of time or by operation of law.

A large portion of the land of the country being held under settlements whereby the person in possession for the time being had only the legal interest of a tenant for life, there were until recently great difficulties in the way of letting such land advantageously. The Leases and Sales of Settled Estates Act, 1856, now empowers any person entitled to the rents and profits of a settled estate to demise the same by deed for any term not exceeding twenty-one years to take effect in possession and at the best rent obtainable. Settlements containing express directions to the contrary will, however, avoid the statute; and on the other hand a settlement may contain powers to the tenant for life to grant leases for even longer terms.

The legal rights and duties of landlord and tenant respectively are in most cases defined by the contract of tenancy. The policy of the law has hitherto been to allow the landlord, who is virtually if not technically absolute owner of the land, to do as he pleases with it. The contract of tenancy has hitherto been a free contract, and, although in the absence of contract the law itself defines the rights of the parties, there is hardly one of these which may not be displaced or modified by the agreement. This, it may be said in passing, is the seat of the very widespread dissatisfaction that exists in all the three kingdoms with what are vaguely termed the land laws. A small class has been allowed to acquire absolute dominion over the land of the country, and may impose what terms it pleases on the rest of the community for the right to use the land. The law governing the devolution of land is intricate and perplexing no doubt, and by making conveyances expensive, hinders the free distribution of the land among a larger class of owners. But that is not the real root of the present discontent. Its real root is the absolute dominion of the class of owners who are not cultivators, but who, having the monopoly of the land, may load the cultivators with what burdens they please. As for the law of landlord and tenant, it is still greater misconception to suppose that to be in fault. It is what the landlord or tenant choose to make it. There is very little of it, independently of contract, and what little there is may be altered as the parties please. No law can be better than one which allows men to make their own contracts and limits itself to enforcing them. That is what the law of landlord and tenant does. If its effects are bad, it must be because the original conditions of the contracting parties are other than they ought to be. We shall have to show that practical evils have led to a demand for an alteration of the law of landlord and tenant in the direction of limiting the power of the landlord to impose terms on the tenant.

One privilege imposed by the law on the landlord must be excepted from what has just been said. The right to distrain for rent is a special interference of the law for the protection of the landlord. Besides suing for his rent as a man may for any other right, besides taking advantage of whatever covenants he may have made for entry on default of payment, a landlord may enter upon the demised premises and help himself to whatever articles of personal property he may find there, to an amount sufficient to satisfy his claim. Distress as a general rule extends to all movable property found on the premises, whether belonging to the tenant or not; but there are certain well-defined exemptions, as, for example, goods sent to a man publicly carrying on a trade to be worked at or dealt with in the way of his trade. And some things have the benefit of a conditional exemption, as horses employed to work the ground, which should not be taken so long as there is any other property to satisfy the distress. This privilege is an injurious inteference with the property and rights of third persons. It exposes persons dealing with the tenant to the danger of losing whatever property of their own they may permit to be on his premises, and of having their claims against him postponed to those of the landlord. This is a wide departure from the general principle of the law, which is to leave the parties alone; but even here the right to distress may be expressly abolished in the contract of tenancy if the parties please.

Again, the land, on the expiration of the tenancy, becomes the absolute property of the landlord, no matter how it may have been altered or improved during the occupation. In certain cases the law has discriminated between the contending claims of landlord and tenant. (1) In respect of *fixtures* (which may be shortly defined as movables so affixed to the soil as to become part thereof), the tenant may sometimes remove them, *e. g.*, when they have been brought on the premises for the purpose of being used in business. This, it is said, is done by way of encouraging trade, but it is curious that no similar principle has been admitted for the encouragement of agriculture. (2) In respect of *emblements*, *i. e.*, the profits of sown land, a tenant may be entitled to these whose term comes to an end by the happening of an uncertain contingency. (3) A similar right is very generally recognized by custom in tenants whose term expires in the ordinary way. The custom of the district, in the absence of stipulations between the parties, would be imported into their contract—the tenant going out on the same conditions as he came in. But with these exceptions the land in its improved condition passes over to the landlord. The tenant may have added to its value by buildings, by labor applied to the land, or by the use of fertilizing manures, but, whatever be the amount of the additional value, he is not entitled to any compensation whatever. This again is a matter which the parties may, if they please, regulate for themselves. As a matter of fact, landlords never allow a compensation clause to be inserted in their leases.

The Agricultural Holdings Act, 1875, attempts to remedy this injustice by enacting that compensation shall be paid to tenants for improvements the benefit of which has not been exhausted at the end of the lease. These are of three classes:—(1) Drainage of land, erection or enlargement of buildings, laying down permanent pasture, making and planting osier beds, making water meadows or works of irrigation, making gardens, roads, or bridges, water-courses, ponds, wells, or reservoirs, making fences, planting hops, planting orchards, reclaiming waste lands, and warping land. The tenant to establish a claim for compensation must have the landlord's consent in writing to the improvements. The compensation is a sum equal to the amount originally expended, less one-twentieth for every year that has elapsed since, and the whole benefit of the improvement is taken to be exhausted in twenty years. (2) Boning lands with undissolved bones, chalking land, clay burning, claying, liming, and marling land, after notice in writing given to the landlord. They are deemed to be exhausted at the end of seven years, and the compensation is the sum expended, less one-seventh for every year. (3) Artificial or other purchased manure applied to the land, and cake or other feeding stuff consumed thereon by cattle, etc. Exhausted in two years, compensation to be a sum representing its fair value to an incoming tenant. The Act, however, has no application if the parties agree in writing, either on the contract of tenancy or otherwise, that it shall not apply. In point of fact, landlords insist upon the renunciation of the Act as a condition of granting a lease. The Act has accordingly been a dead letter.

The mutual rights of the parties are, as we have already said, regulated to a large extent by special provisions or covenants in the lease. The most usual of these are the following:—(1) The landlord covenants that the tenant shall have quiet enjoyment of the premises for the time agreed upon, and in the absence of such a proviso a covenant to this effect will be implied from the fact of letting. The obligation makes the landlord responsible for any lawful eviction of the tenant during the term, but not for wrongful eviction, unless he is himself the wrongdoer, or has expressly made himself responsible for evictions of all kinds. (2) The tenant is presumed to undertake to use the property in a reasonable manner according to the purposes for which it was let, and to do reasonable repairs. The landlord is not presumed to have undertaken to put the premises in repair, nor to execute repairs. But the respective obligations of parties where repairs are, as they always are in leases for years, the subject of express covenant, may vary indefinitely. The obligation is generally imposed on the tenant to keep the premises in "good condition" or "tenant-like repair," and it will be construed with reference to the character of the premises demised, their age, and their condition. A covenant to repair, unless limited specially, makes the tenant liable to rebuild houses destroyed by accident. A covenant to keep in repair requires the tenant to put the premises in repair if they are out of repair, and to maintain them in that condition up to and at the end of the tenancy. A breach of the covenant gives the landlord an action for damages, which will be measured by estimated injury to the reversion if the action be brought during the tenancy, and by the sum necessary to execute the repairs if the action be brought later. (3) The improper user of the premises to the injury of the reversioner is *waste*. *Voluntary* waste is when the tenant by some positive act of his own has injured the premises; *permissive* waste is when the injury is caused by some omission. Tenants-at-will or from year to year are not liable for the latter. What is or is not waste is in some instances dependent on the custom of the country, but in general anything which damages the freehold or alters its nature is waste. Even the erection of new buildings would, strictly speaking, be waste unless the lease could be construed as authorizing them. Besides these general conditions implied in law, the use of the premises may be restricted indefinitely by special provisos. Covenants against using the premises for the carrying on of particular trades or businesses are the most usual. In this category may be placed the rules as to cultivation to be found in agricultural leases, in which also an obligation to cultivate in conformity with the custom of the district would be implied. (4) Covenants by the tenant to insure and keep insured the premises are also common, and if the premises are left uninsured for the smallest portion of the term, although there may be no damage by fire, the covenant is broken. (5) The rates and taxes are generally the subject of special covenants. One tax, the property tax, is specially excepted. It must be paid by the landlord, and if the tenant should pay it the landlord must deduct it from the rent. The parties cannot by contract make any different arrangement. Another charge on lands—the rent-charge fixed under the Tithe Commutation Acts in lieu of tithes—is not a personal charge against either landlord or tenant, but is leviable by distress. Apart from agreement, the charge, if paid by the tenant, may be deducted from the rent. Other rates and charges, whether primarily imposed on landlord or tenant, may be imposed by the contract upon one or other as the parties may agree. (6) The incidents of rent—its amount, whether fixed or fluctuating, its nature, whether in money or otherwise, time and mode of payment, etc.—are fixed by the agreement of the parties. When the land has been occupied without a letting, the owner has an action against the occupier for compensation for use and occupation, an undertaking to pay being implied from the fact of occupation. But in other cases the rent due is a matter of agreement between the parties, the law interpreting the terms when necessary. Thus an agreement to pay a rent of £100, no times of payment being mentioned, would be construed as an agreement to pay that rent annually. Rent is said to be *due* at the first moment of the day appointed for payment, and in arrear at the first moment of the day following. It has already been said that, in addition to the right of action as for an ordinary debt, the landlord has a special right of distress. The covenant may also give him the right to enter and eject the tenant on nonpayment.

Covenants are said to "run with the land" when the liabilities and rights created by them pass to the assignees of the original parties. At common law it was said that covenants "ran with the land" but not with the reversion, the assignee of the reversioner not having the rights of the original lessor. But the assignees of both parties have been on the same footing since the statute 32 Henry VIII. c. 34. The following covenants "run with the land:"—(1) all implied covenants; (2) all expressed covenants concerning something in being at the time of the covenant and "parcel of the demise;" (3) covenants relating to things not in being but to be built or done on the premises, if the covenant be for the covenanter himself and "his assigns." But things merely collateral do not bind the assigns, even if they be named.

The right of the tenant to assign his lease—as well as his right to make an underlease—may itself be restricted by agreement, and covenants to that effect are not uncommon. Sometimes the tenant covenants not to assign or underlet without consent, and it may be provided that such consent will not be refused except on reasonable grounds. The lessee is not discharged from liability by the assignment unless the landlord accepts the assignee as his tenant, and even then the original lessor will remain liable on his own express covenants.

The term may be forfeited either for breach of some condition on which the lease was granted, or in virtue of a specific provision for re-entry on breach of any covenant. Such a proviso is generally attached to the covenants, and the effect of a breach of a covenant so protected is to make the lease voidable at the option of the landlord. The tenant cannot take advantage of his own default to terminate the tenancy. The landlord must signify his intention to avoid the lease by some specific act. If he accepts rent, or, it seems, if he even asks for it after notice of an act of forfeiture, he waives any breach of covenant up to that time, but not forfeiture for future or continuing breaches. The condition of forfeiture on breach may be attached to any covenants the parties choose to make, and may therefore in many cases press hardly on the tenant, who for a trifling default may lose the whole value of his term. The courts in some few instances will relieve a tenant from forfeiture. Thus they may relieve once against a forfeiture for breach of covenant to insure, when no damage has occurred and an insurance is in effect at the time of application. Relief will also be given for forfeiture by non-payment of rent, if the arrears be paid up. And on the ground of fraud, accident, or mistake forfeitures may be relieved against in other cases. The determination of a lease by forfeiture has the same effect as its determination in any other way, in destroying subtenancies or other rights created under it.

It will be seen that with a few insignificant exceptions the contract is left by law to be regulated by the parties. In one particular an important change has been made by a recent Act. The right to the game, as we have already pointed out, can only be taken out of the tenant by an express grant made by him. The Ground Game Act, 1880, enacts that "any occupier of land shall have as incident to and inseparable from his occupation of the land the right to kill and take ground game thereon, concurrently with any other person who may be entitled to kill and take ground game on the same land,"—subject to certain conditions which need not be recounted here. And "every agreement, condition, or arrangement which purports to divest or alienate the right of the occupier, so declared, given, and reserved to him by this Act, or which gives to such occupier any advantage in consideration of his forbearing to exercise such right, or imposes upon him any disadvantage in consequence of his exercising such right, shall be void." Another clause provides that, when the right to kill and take ground game is at the passing of the Act vested in any person other than the occupier, under a *bona fide* contract, the occupier's rights under the Act shall not come into existence until the determination of that contract. "Ground game" means "hares and rabbits."

Scotland.—In Scotch law, "the contract of location is consensual and in its own nature merely personal; but by statute it is made real against singular successors" (*i. e.*, purchasers). A lease for any greater term than one year must be in writing. The lessor and his representatives are bound by a written lease which is "authenticated in terms of the statutes and delivered, or fortified by *rei interventus*,[1] or sanctioned by homologation," or which is an offer, followed by real evidence of acceptance, or written articles or conditions proved by written evidence to have been adopted by the parties, or even a written obligation to grant a lease. The singular successors of the lessor will be bound where he is bound, provided (1) that the lease is definite as to subject, rent, and term of duration, and (2) that possession shall have followed as a badge of real right under the statute (1449, c. 17). Thus while a lease of any duration will be good against the lessor and his heirs, as against singular successors it must in general have a definite term of duration, unless it be specially warranted and homologated. The usual term in agricultural leases is nineteen years, and longer terms are common for building and mining leases, but there appears to be some uncertainty as to whether any and what limit must be imposed on the length of a term. So, as to rent, it may be as against the grantor a merely nominal sum, or may be retained by the lessee for debt; but as against singular successors it must stand payable. Rent, it is said, may be either in money, grain, or service, but it must not be elusory. Rent in money is generally payable at the "legal terms" Whitsunday and Martinmas. The obligation to pay rent is extinguished by the destruction of the subject, and this principle appears to have been applied to the partial destruction of the subject occasioned by the disastrous failure of a particular season. "When the destruction is partial, the point is more doubtful; and the distinction seems to be that, if it be permanent though partial, the failure of the subject let will give relief by entitling the tenant to renounce the lease unless a deduction be allowed, but, that if it be merely temporary and occasional, it will not entitle the tenant to relief. In the decisions, however, relief has been given to a greater extent than that distinction would authorize; thus devastation of the crop by storms, etc., if *plus quam tolerabile*, has been admitted as a ground of abatement; but as the tenant takes the risk of the seasons, it must at least be some extraordinary event that will justify such a decision" (Bell's *Principles*). And it would appear that the tenant has no relief against such partial destruction of the subject let as may be occasioned by a subsequent law, as for example in the case of a fishing lease, by an Act extending the close time. Rent may be recovered either by personal action or by the equivalent of distress, viz., hypothec. (But see HYPOTHEC.) In Scotch law there is not, as in English, a *prima facie* right in the tenant to assign the lease or sublet the premises. On the principle of *delectus personæ*, the landlord is presumed to have excluded all save those whom he has expressly admitted, at least in ordinary leases, though a different rule prevails in longer leases. Even the heirs of tenants were at one time excluded, but they now succeed to the lease. The obligations of the parties as to mode of cultivation, amount of rent, length of term, repair, and so on, are for the most part regulated as in England by the express provisions of the lease. The tenant is bound to give up the premises at the expiration of the term without compensation for any permanent or unexhausted improvement thereon. "It is implied," says Bell, "in the contract of lease that any buildings, fences, or improvements which the tenant may spontaneously make are made in contemplation of his own interest and for his own use only. And so he has no claim for such meliorations at the end of his lease without special stipulation. But if the tenant's possession be terminated abruptly and prematurely, he ought in equity to be entitled to recompense."

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[1] This is inferred from the fact that the grantor has knowingly permitted acts "not unimportant to be done by the lessor on the faith of the contract."

Ireland.—The law of landlord and tenant has been until recently substantially the same as that which has already been described for England, and it will only be necessary to notice here the more important changes that have been made in Ireland by legislation. It may be pointed out, without touching at all on the vexed Irish land question, that the inconvenience of the situation in which a limited class own the soil, and let it out on hire on what terms they please to cultivators, has been felt with particular force in Ireland. Agriculture is the one industry of the country, and that industry was carried on under conditions which made it all but impossible. The Irish tenant was, equally with the English tenant, at the mercy of his landlord. If he made improvements he did so at the risk of losing them by eviction or by being taxed for them by an increased rent. The insecurity of his tenure gave him the alternative of doing nothing to better his farm or bettering his farm without bettering himself. At the same time there existed in Ireland, in consequence of circumstances peculiar to the people, an excessive competition for land such as has never been paralleled in England. The natural outcome of this condition of things was a demand for some change in the law which could give tenants a reasonable security for their industry. And the way was paved for such changes by the existence in Ulster of a local custom having virtually the force of law, which did provide such a security. This was not a custom of which the courts could take judicial notice, and any landlord who chose to do so might insist upon ignoring it in his dealings with his tenants. Nor was the custom in itself everywhere clear or uniform. "It is a strange thing to say," says Mr. Butt, "but it would be impossible to frame any statement as to the nature and meaning of the custom which would be universally accepted as a correct description of its character."[1] The Ulster custom had, however, two main features—fixity of tenure, and free right of sale by the tenant of his interest. "So long as the tenant pays his rent the landlord will not use his legal powers to put an end to the tenancy," says Judge Longfield, describing the system, and the same authority adds that "the sale by an outgoing tenant of his tenant right is to be with the approbation of the landlord. This approbation is not to be capriciously refused, but on the other hand the tenant is not at liberty to select any substitute that he thinks proper irrespective of his character and possession of sufficient means for the efficient cultivation of the land."[2] The strength of the custom may be estimated from a statement made by one of the witnesses before the Devon commission: "If systematic attempts were made amongst the proprietors of Ulster to invade tenant right, I do not believe there is a force at the disposal of the Horse Guards sufficient to keep the peace of the province." And Mr. Butt estimates that the sum which tenants under the Ulster custom would receive on the sale of their tenant right would amount to more than £20,000,000.

The Landlord and Tenant (Ireland) Act, 1870, enacts, section 1, that "the usages prevalent in the province of Ulster (in this Act intended to be included under the denomination of the Ulster tenant right custom) are hereby declared to be legal, and shall in the case of any holding in the province of Ulster proved to be subject thereto be enforced in the manner provided by this Act." By section 2 like usages elsewhere than in Ulster are in like manner legalized. And a tenant who is not entitled to compensation under sections 1 and 2 is nevertheless declared to be entitled to the following rights:—(1) If holding under a tenancy created after the passing of the Act he is disturbed in his holding by the landlord, he shall be entitled to compensation for the loss which the court shall find to have been incurred by him, subject to a scale of maximum amounts varying from seven years' rent on holdings of the annual value of £10 and under to one year's rent on holdings of the value of £100 and over, and in no case exceeding £250; and (2) he may, on quitting his holding, claim compensation in respect of improvements made by himself or his predecessors in title, subject to certain considerable exceptions, as regards tenancies and improvements. The second part of the Act contains clauses to facilitate the purchase by tenants of the fee simple of their holdings, and the third part authorizes the commissioners of public works in Ireland to advance moneys both to landlords for payment of compensation for improvements and to tenants for the purchase of their holdings. Section 44 enacts that the board, if they are satisfied with the security, may advance to any tenant for the purpose of purchasing his holding, in pursuance of the Act, any sum not exceeding two-thirds of the price of such holding, and upon an order being made by the board such holding shall be deemed to be charged with an annuity of five pounds for every one hundred pounds of such advance, and so in proportion for any less sum, such annuity to be limited in favor of the board, and to be declared to be repayable in the term of thirty-five years. Section 46 requires the Landed Estates Court on the sale of estates to afford as far as may be consistent with the interests of the persons concerned facilities for such purchases by tenants, whether by selling the estate in suitable lots or otherwise. The principle of transferring the occupying tenants into peasant proprietors which these clauses are intended to carry out is associated with the name of Mr. Bright. The Bright clauses have not had the practical success that was hoped for,—a result which is attributed to the unfitness of the Landed Estates Court for working them.[3] And it may be added that the Act of 1870 failed to satisfy the wishes of the Irish people, rackrenting and eviction being still possible, and the process for obtaining compensation being tedious and expensive.

The Land Law (Ireland) Act, 1881, was accordingly passed. Section 1 provides that the tenant for the time being of every holding not specially excepted may sell his tenancy for the best price that can be obtained, subject to certain conditions and provisions specified in sixteen subsections. A tenant from year to year is not permitted to subdivide or sublet his holding without permission of the landlord. A person to whom a tenant has bequeathed the tenancy is in the same position as a purchaser after sale. When a landlord demands an increase of rent from a present or future tenant, then (1), if the tenant submits, his tenancy shall become a statutory tenancy, subject to statutory conditions for the period of fifteen years; (2) a future tenant not accepting increase but selling shall be entitled to receive such amount as a court may fix for depreciation of the selling value by the increased rent; (3) a tenant, not accepting, but not selling, is entitled to compensation as for disturbance; (4) and a present tenant may apply to the court to have a rent fixed. A tenant during a statutory term shall not be compelled to pay a higher rent than the rent payable at the commencement, and shall not be compelled to quit except on breach of the statutory conditions, some of which are as follows:—The tenant must pay rent at the appointed time, must not commit persistent waste, must not subdivide or sublet or erect a dwelling-house otherwise than is provided in the Act. Agistment, or letting for pasture, and letting on conacre for growing potatoes or other green crop are not within this prohibition. The landlord retains the right to enter for the purpose of taking minerals, stone, timber, making roads, hunting, shooting, fishing, and so on. The tenant may not open a public house without the landlord's consent. The section is not to prejudice any ejectment for non-payment of rent in respect of rent accrued due for a holding before the commencement of the statutory term.[1]

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[1] *Practical Treatise on the Law of Compensation to Tenants in Ireland*, by Isaac Butt, Q.C., Dublin, 1871.

[2] An excellent account of the origin and results of the Ulster custom will be found in *The Irish Land Question from* 1829 *to* 1869, by R. Barry O'Brien, London, 1880.

[3] See O'Brien's *Irish Land Question*, chap. vii.

Sections 6 and 7 amend the law as to compensation for disturbance and compensation for improvements as contained in the Act of 1870. Section 8 authorizes the court (to be created by the Act) to fix a fair rent on the application of either party, and such judicial rent shall be the rent of the tenancy for the statutory term of fifteen years as above described. The court is to determine what is a fair rent after hearing parties, having a due regard to their respective interests and to the circumstances of the case, holding, and district. A new statutory term shall not begin until the expiration of a preceding one, and an alteration of judicial rent shall not take place at less intervals than fifteen years. Two important subsections deserve to be specially noticed. It is provided (subsection 2) that the court may disallow the tenant's application if it be satisfied that "the permanent improvements" on the holding, which if executed by the tenant would have entitled him to compensation under the Acts of 1870 and 1881, have been made and maintained by the landlord and his predecessors in title and not made or required by the tenant or his predecessors. On the other hand, no rent shall be allowed or made payable in respect of improvements made by the tenant or his predecessors in title for which, in the opinion of the court, they shall not have been paid by the landlord or his predecessors in title. When application is made to the court to fix a judicial rent on a holding not subject to the Ulster tenant right or other analogous custom, the parties by agreement or the court may fix a value on the tenancy; and, if during the term the tenant should give notice to the landlord of his intention to sell, the landlord may purchase the tenancy at the value so fixed, subject to addition for subsequent improvements and deduction for dilapidations. Subsection 10 provides that "the amount of money or money's worth that may have been paid or given for the tenancy of any holding by a tenant or his predecessors in title, otherwise than to the landlord or his predecessors in title shall not of itself, apart from other considerations, be a ground for reducing or increasing the rent of such holding."

The Act may be excluded by agreement as follows. The landlord and tenant may agree to a "judicial lease" for thirty-one years and upwards, which if approved by the court will take effect, and the holding will be regulated by the lease and not be deemed subject to the Act. The parties may agree to a "fixed tenancy," which shall not be deemed subject to the Act, which shall be held upon such conditions as parties may agree upon, and with reference to which the court shall consider the interest of persons entitled to an estate or interest after a present limited owner. In such a case the tenant shall pay a fee farm rent, which may or may not be subject to revaluation by the court, and shall not be compelled to quit his holding except on breach of some of the conditions previously declared to be statutory.

These are the main provisions of the Act, establishing more or less completely what are known as the three F's—"fair rents," "fixed tenure," and "free sale." Miscellaneous provisions supplemental to these can only be briefly noticed. Section 20 enacts that the "tenancies to which the Act applies shall be deemed to have determined whenever the landlord has resumed possession of the holding either on the occasion of a purchase by him of the tenancy or default of the tenant in selling, or by operation of law or reverter or otherwise." But a tenant holding under an Ulster or other analogous custom shall be entitled to the benefit of such custom, notwithstanding the determination of his tenancy by breach of a statutory condition. Section 21 deals with existing leases, which are to remain in force, but at the expiration of such leases the tenants shall be deemed to be tenants of "present ordinary tenancies from year to year," and therefore subject to the Act. Section 22 allows a tenant whose holding is of the annual value of £150 to contract himself out of this or the previous Act, and there is a special clause dealing with the case in which a landlord has before the Act purchased the Ulster tenant right; but otherwise any provision contained in any lease or contract of tenancy inconsistent with the provisions of the Act shall be void. Part 5 relates to the acquisition of land by tenants, reclamation of land, and emigration. Part 6 describes the form of proceedings to be taken under the Act. In addition to the civil bill court of the county which has "jurisdiction in respect of all disputes arising between landlord and tenant under the Act," a special land commission has been constituted, in which proceedings may be commenced or to which if commenced in the civil bill court they may be transferred. Three commissioners are named in the Act, and an indefinite number of assistant commissioners is authorised. The land commission is vested with the general powers of the Act; but it is directed to grant an appeal to the court of appeal, in proper cases, not including decisions as to fair rent or other matters left to the discretion of the commissioners. (E. R.)

LANDON, CHARLES PAUL (1760-1826), French painter and art-author, was born at Nonant in 1760, entered the studio of Regnault, and carried off the first prize of the Academy in 1792. After his return from Italy, disturbed by the Revolution, he seems to have abandoned painting for letters, but he began to exhibit in 1795, and continued to do so at various intervals up to 1814. His Leda obtained an award of merit in 1801, and is now in the Louvre. His Mother's Lesson, Paul and Virginia Bathing, and Dædalus and Icarus have been engraved; but his works on painting and painters, which reach nearly one hundred volumes, now form his chief title to be remembered. In spite of a complete want of critical accuracy, an extreme carelessness in the biographical details, and the feebleness of the line engravings by which they are illustrated, Landon's *Annales du Musée*, in 33 vols., form a vast repertory of compositions by masters of every age and school, which will always have value for the writer on art. Besides this work and many others of less importance, Landon published *Lives of Celebrated Painters* in 22 vols.; *An Historical Description of Paris*, 2 vols.; a *Description of London*, with 42 plates; and descriptions of the Luxembourg, of the Giustiniani collection, and of the gallery of the Duchesse de Berry. He died at Paris in 1826.

LANDON, LETITIA ELIZABETH (1802-1838), a writer of poetry and fiction, better known by her initials L. E. L. than as Miss Landon or Mrs. Maclean, was descended from an old Herefordshire family, and was born at Chelsea, 14th August, 1802. Her father, an army agent, succeeded in amassing a large property, which he lost by speculation shortly before his death. By this time the daughter by her contributions to the *Literary Gazette* and to various Christmas annuals, as well as by some volumes of verse, had acquired a wide literary fame. Probably her position in society contributed to the interest they awakened, but the gentle melancholy and romantic sentiment her writings embodied would in any case have secured her the sympathy and approval of a wide class of readers. Though deficient in condensation and finish, they occasionally display a richness of fancy and an aptness of language which might have ripened, by more sedulous culture, into true poetical worth. In June, 1838, she married George Maclean, governor of Cape Coast Castle, but she only survived her marriage a few months, dying from an overdose of prussic acid, which, it is supposed, was taken accidentally.

For some time L. E. L. was joint editor of the *Literary Gazette*. Her first volume of poetry appeared in 1820 under the title *The Fate of Adelaide*, and was followed by other collections of verses with similar titles. She also wrote several novels. Various editions of her *Poetical Works* have been published since her death, the last being that with an introductory memoir by W. B. Scott, 1880. *The Life and Literary Remains of Letitia Elizabeth Landon*, by

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[1] The right of ejectment for non-payment of rent was conferred on landlords by special legislation. It is unknown to English law, where non-payment only gives a right of re-entry if protected by a special proviso to that effect in the lease.

Laman Blanchard, appeared in 1841, and a second edition in 1855.

LANDOR, WALTER SAVAGE (1775–1864), born at Warwick, January 30, 1775, died at Florence, September 17, 1864. In the course of this long life he had won for himself such a double crown of glory in verse and in prose as has been won by no other Englishman but Milton. And with that special object of his lifelong veneration he had likewise in common other claims upon our reverence to which no third competitor among English poets can equally pretend. He had the same constancy to the same principles; the same devotion to the same idea of civic and heroic life; the same love, the same loyalty, the same wrath, scorn, and hatred, for the same several objects respectively; the same affection and kinship to the spirit of the Romans, the same natural enjoyment and mastery of their tongue. Not accident merely but attraction must in any case have drawn them to enlist in the ranks and serve under the standard of the ancient Latin army of patriots and poets. But to Landor even more than to Milton the service of the Roman Muse was a natural and necessary expression of his genius, a spontaneous and just direction of its full and exuberant forces. At the age of twenty he published an eloquent and elegant vindication of her claims upon the service and devotion of modern writers,—the first sketch or suggestion of a longer essay, to be published in its final form just fifty-two years later. In 1795 appeared in a small volume, divided into three books, *The Poems of Walter Savage Landor*, and, in pamphlet form of nineteen pages, an anonymous *Moral Epistle, respectfully dedicated to Earl Stanhope*. No poet at the age of twenty ever had more vigor of style and fluency of verse; nor perhaps has any ever shown such masterly command of epigram and satire, made vivid and vital by the purest enthusiasm and most generous indignation. Three years later appeared the first edition of the first great work which was to inscribe his name for ever among the great names in English poetry. The second edition of *Gebir* appeared in 1803, with a text corrected of grave errors and improved by magnificent additions. About the same time the whole poem was also published in a Latin form, which for might and melody of line, for power and perfection of language, must always dispute the palm of precedence with the English version. In 1808, under an impulse not less heroic than that which was afterwards to lead Byron to a glorious death in redemption of Greece and his own good fame, Landor, then aged thirty-three, left England for Spain as a volunteer to serve in the national army against Napoleon at the head of a regiment raised and supported at his sole expense. After some three months' campaigning came the affair of Cintra and its disasters; "his troop," in the words of his biographer, "dispersed or melted away, and he came back to England in as great a hurry as he had left it," but bringing with him the honorable recollection of a brave design unselfishly attempted, and the material in his memory for the sublimest poem published in our language between the last masterpiece of Milton and the first masterpiece of Shelley—one equally worthy to stand unchallenged beside either for poetic perfection as well as moral majesty—the lofty tragedy of *Count Julian*, which appeared in 1812, without the name of its author. No comparable work is to be found in English poetry between the date of *Samson Agonistes* and the date of *Prometheus Unbound;* and with both these great works it has some points of greatness in common. The superhuman isolation of agony and endurance which encircles and exalts the hero is in each case expressed with equally appropriate magnificence of effect. The style of *Count Julian*, if somewhat deficient in dramatic ease and the fluency of natural dialogue, has such might and purity and majesty of speech as elsewhere we find only in Milton so long and so steadily sustained.

In May, 1811, Landor had suddenly married Miss Julia Thuillier, with whose looks he had fallen in love at first sight in a ball-room at Bath; and in June they settled for a while at Llanthony Abbey in Wales, from whence he was worried in three years' time by the combined vexation of neighbors and tenants, lawyers and lords-lieutenants: not before much toil and money had been nobly wasted on attempts to improve the sterility of the land, to relieve the wretchedness and raise the condition of the peasantry. He left England for France at first, but after a brief residence at Tours took up his abode for three years at Como; "and three more wandering years he passed," says his biographer, "between Pisa and Pistoja, before he pitched his tent in Florence in 1821." In 1824 appeared the first series of his *Imaginary Conversations*, in 1826 "the second edition, corrected and enlarged;" a supplementary third volume was added in 1828; and in 1829 the second series was given to the world. Not until 1846 was a fresh instalment added, in the second volume of his collected and selected works. During the interval he had published his three other most famous and greatest books in prose: *The Citation and Examination of William Shakespeare*, 1834; *Pericles and Aspasia*, 1836; *The Pentameron*, 1837. To the last of these was originally appended *The Pentalogia*, containing five of the very finest among his shorter studies in dramatic poetry. In 1847 he published his most important Latin work, *Poemata et Inscriptiones*, comprising, with large additions, the main contents of two former volumes of idyllic, satiric, elegiac, and lyric verse; and in the same golden year of his poetic life appeared the very crown and flower of its manifold labors, *The Hellenics of Walter Savage Landor*, enlarged and completed. Twelve years later this book was reissued, with additions of more or less value, with alterations generally to be regretted, and with omissions invariably to be deplored. In 1853 he put forth *The Last Fruit off an Old Tree*, containing fresh conversations, critical and controversial essays, miscellaneous epigrams, lyrics, and occasional poems of various kind and merit, closing with *Five Scenes* on the martyrdom of Beatrice Cenci, unsurpassed even by their author himself for noble and heroic pathos, for subtle and genial, tragic and profound, ardent and compassionate insight into character, with consummate mastery of dramatic and spiritual truth. In 1856 he published *Antony and Octavius—Scenes for the Study*, twelve consecutive poems in dialogue which alone would suffice to place him high among the few great masters of historic drama. In 1858 appeared a metrical miscellany bearing the title of *Dry Sticks Fagoted by W. S. Landor*, and containing among other things graver and lighter certain epigrammatic and satirical attacks which reinvolved him in the troubles of an action for libel; and in July of the same year he returned for the last six years of his life to Italy, which he had left for England in 1835. Embittered and distracted by domestic dissensions, if brightened and relieved by the affection and veneration of friends and strangers, this final period of his troubled and splendid career came at last to a quiet end on the 17th of September, 1864. In the preceding year he had published a last volume of *Heroic Idyls, with additional poems*, English and Latin,—the better part of them well worthy to be indeed the "last fruit" of a genius which after a life of eighty-eight years had lost nothing of its majestic and pathetic power, its exquisite and exalted loveliness.

A complete list of Landor's writings, published or privately printed, in English, Latin, and Italian, including pamphlets, fly-sheets, and occasional newspaper correspondence on political or literary questions, it would be difficult to give anywhere and impossible to give here. From nineteen almost to ninety his intellectual and literary activity was indefatigably incessant; but, herein at the least like Charles Lamb, whose cordial admiration he so cordially returned, he could not write a note of three lines which did not bear the mark of his "Roman hand" in its matchless and inimitable command of a style at once the most powerful and the purest of his age. The one charge which can ever seriously be brought and maintained against it is that of such occasional obscurity or difficulty as may arise from excessive strictness in condensation of phrase and expurgation of matter not always surperfluous, and sometimes almost indispensable. His English prose and his Latin verse are perhaps more frequently and more gravely liable to this charge than either his English verse or his Latin prose. At times it is wellnigh impossible for an eye less keen and swift, a scholarship less exquisite and ready than his own, to catch the precise direction and follow the perfect course of his rapid thought and radiant utterance. This apparently studious pursuit and preference of the most terse and elliptic expression which could be found for anything he might have to say could not but occasionally make even so sovereign a master of two great languages appear "dark with excess of light;" but from no former master of either tongue in prose or verse was ever the quality of real obscurity, of loose and nebulous incertitude, more utterly alien or more naturally remote. There is nothing of cloud or fog about the path on which he leads us; but we feel now and then the want of a bridge or a handrail; we have to leap from point to point of narrative or argument without the usual help of a connecting plank. Even in his dramatic works, where least of all it should have been found, this lack of visible connection or sequence in details of thought or action is too often a source of sensible perplexity. In his noble trilogy on the history of Giovanna, queen of Naples, it is sometimes actually difficult to realize on a first reading what has happened or is happening, or how, or why, or by what agency,—a defect alone sufficient, but unhappily sufficient in itself, to explain the too general ignorance of a work so rich in subtle and noble treatment of character, so sure and strong in its grasp and rendering of "high actions and high passions," so rich in humor and in pathos, so royally serene in its commanding power upon the tragic mainsprings of terror and of pity. As a poet, he may be said on the whole to stand midway between Byron and Shelley,—about as far above the former as below the latter. If we except Catullus and Simonides, it might be hard to match and it would be impossible to overmatch the flawless and blameless yet living and breathing beauty of his most perfect elegies, epigrams, or epitaphs. As truly as prettily was he likened by Leigh Hunt "to a stormy mountain pine which should produce lilies." His passionate compassion, his bitter and burning pity for all wrongs endured in all the world, found only their natural and inevitable outlet in his lifelong defence or advocacy of tyrannicide as the last resource of baffled justice, the last discharge of heroic duty. His tender and ardent love of children, of animals, and of flowers, makes fragrant alike the pages of his writing and the records of his life. He was as surely the most gentle and generous as the most headstrong and hot-headed of heroes or of men. Nor ever was any man's best work more thoroughly imbued and informed with evidence of his noblest qualities. His loyalty and liberality of heart were as inexhaustible as his bounty and beneficence of hand. Praise and encouragement, deserved or undeserved, came yet more readily to his lips than challenge or defiance. Reviled and ridiculed by Lord Byron, he retorted on the offender living less readily and less warmly than he lamented and extolled him dead. On the noble dramatic works of his brother Robert he lavished a magnificence of sympathetic praise which his utmost self-estimate would never have exacted for his own. Age and the lapse of time could neither heighten nor lessen the fulness of this rich and ready generosity. To the poets of his own and of the next generation he was not readier to do honor than to those of a later growth, and not seldom of deserts far lower and far lesser claims than theirs. That he was not unconscious of his own, and avowed it with the frank simplicity of nobler times, is not more evident or more certain than that in comparison with his friends and fellows he was liable rather to undervalue than to overrate himself. He was a classic, and no formalist; the wide range of his just and loyal admiration had room for a genius so far from classical as Blake's. Nor in his own highest mood or method of creative as of critical work was he a classic only, in any narrow or exclusive sense of the term. On either side, immediately or hardly below his mighty masterpiece of *Pericles and Aspasia*, stand the two scarcely less beautiful and vivid studies of mediæval Italy and Shakespearean England. The very finest flower of his immortal dialogues is probably to be found in the single volume comprising only "Imaginary Conversations of Greeks and Romans:" his utmost command of passion and pathos may be tested by its transcendent success in the distilled and concentrated tragedy of *Tiberius and Vipsania*, where for once he shows a quality more proper to romantic than classical imagination,—the subtle and sublime and terrible power to enter the dark vestibule of distraction, to throw the whole force of his fancy, the whole fire of his spirit, into the "shadowing passion" (as Shakespeare calls it) of gradually imminent insanity. Yet, if this and all other studies from ancient history or legend could be subtracted from the volume of his work, enough would be left whereon to rest the foundation of a fame which time could not sensibly impair. (A. C. S.)

LANDSBERG-AN-DER-WARTHE, chief town of a circle in the government district of Frankfort, in the province of Brandenburg, Prussia, is situated at the confluence of the Warthe and Kladow, 80 miles northeast of Berlin by rail. It has a gymnasium of the first class, a hospital, and a poorhouse, besides the other ordinary educational, charitable, and administrative provisions. The productive industry of Landsberg centres in the engine and boiler works and iron-foundries; but the other manufactures include a considerable miscellany, whose chief items are tobacco, cloth, carriages, wools, and spirits. An active trade is carried on in the manufactures of the town, and in the produce of the surrounding country. Landsberg dates its origin from about the middle of the 13th century. In 1875 its population was 21,379.

LANDSEER, SIR EDWIN HENRY (1802–1873), third son of John Landseer, A.R.A., a well known engraver and able writer on art, was born in London, March 7, 1802. His mother was Miss Potts, who sat to Reynolds as the gleaner, with a sheaf of corn on her head, in Macklin's Family Picture, or the Cottagers.[1] Edwin Henry Landseer began his artistic education under his father so successfully that in his fifth year he drew fairly well, and was acquainted with animal characters and passions. Etchings of his, at South Kensington, dated by his father, attest that he drew excellently at eight years of age; at ten he was an admirable draughtsman, and his etchings show considerable sense of humor. At thirteen he drew a majestic St. Bernard dog so finely that his brother Thomas engraved and published the work. At this date (1815) he sent two pictures to the Academy, and was described in the catalogue as "Master E. Landseer, 33 Foley Street." Youth forbade his being reckoned as an artist in full, and caused him to be considered as the "Honorary Exhibitor" of "No. 443, Portrait of a Mule," and "No. 584, Portraits of a Pointer Bitch and Puppy." Adopting the advice of Haydon, whose pupil he was not otherwise, he studied the Elgin Marbles, the "Wild Beasts" in the Tower and Exeter Change, and dissected every animal whose carcass he could obtain. In 1816, in which year he exhibited with the Society of

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[1] John Landseer died February 29, 1852, aged ninety-one. Sir Edwin's eldest brother Thomas, an A.R.A. and a famous engraver, whose interpretations of his junior's pictures have made them known throughout the world, and will represent them when they have perished, was born in 1796, and died January 20, 1880. Charles Landseer, R. A., and Keeper of the Royal Academy, the second brother, was born in 1799, and died July 22, 1879. John Landseer's brother Henry was a painter of some reputation, who emigrated to Australia.

Painters in Oil and Water Colors, Landseer was admitted a student of the Royal Academy. In 1817 he sent to the Academy a portrait of Old Brutus, a much-favored dog, which, as well as his son, another Brutus, often appeared in subsequent pictures. Even at this date Landseer enjoyed considerable reputation, and had more work than he could readily perform, because his renown had been zealously fostered by his father in Elmes's *Annals of Art*. At the Academy he was a diligent student and a favorite of Fuseli's, who would look about the crowded antique school and ask, "Where is my little *dog* boy?" The prices of his pictures at this time were comparatively small; ten guineas was, in 1818, considered enough for a whole length figure of a horse on a canvas of 27 by 35 inches, which now belongs to Lady C. Wellesley.

In 1818 Landseer exhibited at Spring Gardens Fighting Dogs getting Wind, a picture from which his future might have been predicted. The sale of this work to Sir G. Beaumont vastly enhanced the fame of the painter, who became "the fashion" in a way disclosed by Haydon's account of his own and Wilkie's positions under similar circumstances nearly at the same date. This picture is now at Coleorton, and it illustrates the culmination of the studies of Landseer's youth and the prime strength of his earlier style. Unlike the productions of his later life, this masterpiece of his boyhood exhibits not an iota of sentiment; but it is, in its way, a proof of astonishing vigor in design, and richer in animal character than anything produced since the death of Snyders. Perfectly drawn, solidly and minutely finished, bold in tone, and carefully composed, the execution of this picture attested the skill that had been acquired during ten years' studies from nature, and the learning with which diligent observation of the best antiques and of Raphael had endowed the painter. Looking at the work as a whole, and valuing it on technical grounds, the critic feels that Landseer never produced anything better or so manly. On this level he stood until 1824, when he removed from his father's residence, and set up for himself in the house No. 1 (afterwards 18) St. John's Wood Road, where he lived nearly fifty years, and in which he died. In 1818 it was little more than a cottage, with a barn attached, which was converted into a studio. Between 1818 and 1825 Landseer did a great deal of work, but on the whole gained little besides facility of technical expression, a greater zest for humor, and a larger style. The work of this stage ended with the production of Lord Essex's painting called the Cat's Paw, which is well known by an engraving. It was the price of this picture, £100, that enabled Landseer to set up for himself. He had to borrow a second hundred pounds to pay a premium for the house, and repaid this sum by twenty pounds at a time. Between 1818 and 1825 Landseer's pictures were such as proved the severity of his studies; among them the principal were the Cat Disturbed, which was lately in the possession of Sir P. de Malpas Grey Egerton; Alpine Mastiffs reanimating a Distressed Traveller, a famous work engraved by John Landseer; the Ratcatchers, which is now at Lambton Castle; Pointers to be; the Larder Invaded; and Neptune, the head and shoulders of a Newfoundland dog. The Cat's Paw was sent to the British Institution in 1824, and made an enormous sensation. In this year Landseer and C. R. Leslie made a journey to the Highlands,—a momentous visit for the former, who thenceforward rarely failed annually to repeat it in search of studies and subjects.

In 1826 Landseer was elected an A.R.A. In 1827 appeared the Monkey who had seen the World, a picture which marked the growth of a taste for humorous subjects in the mind of the painter, and had been evoked by the success of the Cat's Paw. Taking a Buck, 1825, was the painter's first Scottish picture. Its execution marked a change in his style which, in increase of largeness, was a great improvement. In other respects there was a decrease of solid qualities; finish, searching modelling, and elaborate draughtsmanship rarely appeared in Landseer's work after 1823. The subject, as such, soon after this time became a very distinct element in his pictures; ultimately it dominated, and in effect the popularity of the artist was extended in a greater degree than technical judgment justified. Sentiment gave new charms to his works, which had previously depended on the expression of animal passion and character, and the exhibition of noble qualities of draughtsmanship. Sentimentality ruled in not a few pictures of later dates, and *quasi* human humor, or pathos, superseded that masculine animalism which rioted in its energy, and enabled the artist to rival Snyders, if not Velazquez, as a painter of beasts. After High Life and Low Life, pictures of 1831, now in the National Gallery, Landseer's dogs, and even his lions and birds, were more than half civilized. It was not that these later pictures were less true to nature than their forerunners, but the models were chosen from different grades of animal society. As Landseer prospered he kept finer company, and his new patrons did not care about rat-catching and dog-fighting, however vigorously and learnedly those subjects might be depicted. It cannot be said that the world lost much when, in exchange for the Cat Disturbed and Fighting Dogs getting Wind, came Jack in Office, the Highland Shepherd's Chief Mourner, and the Swannery invaded by Sea Eagles, three pictures which are types of as many diverse moods of Landseer's art, and each a noble one.

Four years after his election as A.R.A. Landseer was chosen an R.A. (1830). Chevy Chase (1826), which is at Woburn, and the Illicit Whiskey Still (1829), appeared in the interval, and were followed by High Life and Low Life (1831), and Spaniels of King Charles's Breed (1832); the last is a wonder of brush handling. Landseer had by this time attained such amazing mastery that he painted Spaniel and Rabbit in two hours and a half, and Rabbits, which was at the British Institution, in three-quarters of an hour, and the fine dog-picture Odin (1836) was the work of one sitting, *i.e.*, painted within twelve hours. He began and finished a whole-length, life-size study of a fallow deer while Mr. Wells of Redleaf was at church. A more remarkable feat consisted in drawing simultaneously a stag's head with one hand and a head of a horse with the other. Harvest in the Highlands, and that masterpiece of humor, Jack in Office, were exhibited in 1833. In 1834 a noble work of sentiment was given to the world in Suspense, which is now at South Kensington, and shows a dog watching at the closed door of his wounded master. Many think this to be Landseer's finest work, others prefer the Highland Shepherd's Chief Mourner (1837). The over-praised and unfortunate Bolton Abbey, a group of portraits in character, was shown in the same year, and was the first picture for which the painter received £400. A few years later he sold Peace and War for £1500, and for the copyrights alone obtained £6000. Man Proposes (1864) was resold in 1881 for 6300 guineas, and a cartoon for 5000 guineas. A Distinguished Member of the Humane Society, a dog reclining on a quay wall (1838), was succeeded by Dignity and Impudence (1839). The Lion Dog of Malta, and Laying down the Law appeared in 1840. The Defeat of Comus was painted in the summerhouse of Buckingham Palace garden in 1842. In this year was finished the capital Highland Shepherd's Home (Sheepshanks Gift), together with the beautiful Eos, a portrait of Prince Albert's most graceful of greyhounds, to which Thomas Landseer added an ineffable charm and solidity not in the painting. The Challenge, and Coming Events cast their Shadows Before, were accompanied (1844) by Shoeing (Bell Gift), and followed by Peace and War, and the Stag at Bay (1846). Alexander and Diogenes, and a Random Shot, a kid dead on snow, came forth in 1848. This year Landseer received a national commission to paint in the Houses of Parliament three subjects connected with the chase. Although they would have been worth three times as much money, the House of Commons refused to grant £1500 for these pictures, and the matter fell through, more to the artist's profit than the nation's gain. The Sanctuary, and Night and Morning, romantic and pathetic deer subjects, came in due order. For the latter a French jury of experts awarded to the artist the great gold medal of the Exposition Universelle, Paris, 1855.

The Dialogue at Waterloo (1850) commemorated Landseer's first visit to the continent, and showed how he, like nearly all English artists of original power and considerable fertility, owed nothing to French or Italian training. In the same year he received the honor of knighthood. The Monarch of the Glen (1851) was succeeded by Geneva, a group of asses, a mule, and a bull; Titania and Bottom, which comprises a charming queen of the fairies; and the dramatic design of the Combat, or Night and Morning, as above. Then came the Children of the Mist (1853), Deer in Repose, Saved (1856), Braemar, a noble stag, Rough and Ready, Uncle Tom and his Wife for Sale (1857). The Maid and the Magpie, the extraordinarily large cartoon called Deer Browsing, the Twa Dogs, and one or two minor paintings, were equal if not superior to any previously produced by the artist. Nevertheless, signs of breaking health were remarked in Doubtful Crumbs, and a Kind Star (1859). The immense and profoundly dramatic picture called a Flood in the Highlands (1860) more than reinstated the painter before the public, but friends still saw ground for uneasiness. Extreme nervous excitability manifested itself in many ways, and in the choice (1864) of the dreadful subject of Man Proposes, God Disposes, bears clumsily clambering among relics of Sir John Franklin's party, there was occult pathos, which some of the artist's intimates suspected, but did not avow. In 1862 and 1863 Landseer produced nothing; but with Man Proposes came a Piper and a Pair of Nutcrackers. The last triumph of Landseer's career was the Swannery invaded by Sea Eagles (1869). After four years more, mainly of broken art and shattered mental powers, he died 1st October, 1873. He was buried in St. Paul's. See *Sir E. Landseer*, by F. G. Stephens, 1880. (F. G. S.)

LANDSHUT, chief town of a government district in Lower Bavaria, is situated on the right bank of the Isar, about 40 miles northeast of Munich. As the seat of government for the district, it contains all the appropriate administrative offices, and is well supplied with educational and charitable institutions, besides having a convent and several nunneries. Of its numerous ecclesiastical buildings the most interesting are the churches of St. Martin (with a spire 463 feet high), St. Iodocus, and the Holy Ghost, all begun before 1411, and the old Dominican convent, now used as Government offices. The town-house, the former provincial buildings, and the palace are also noteworthy. On a hill commanding the town is the castle of Trausnitz, an ancient stronghold of the dukes of Lower Bavaria. The original castle was built in the 12th century, but the oldest part now extant dates from about 1304. In 1872-73 the upper part was put into habitable order by the king of Bavaria. The manufactures of Landshut are not important; they include beer, cloth, and tobacco. Market gardening and, to a really considerable extent, trade in grain are carried on. From 1800 to 1826, when the university, formerly at Ingolstadt and now at Munich, was located at Landshut, the town woke up to a temporary importance. The name Dreihelm Stadt is sometimes given to Landshut from the three helmets that form its arms. The population in 1875 was 14,780.

LANDSKRONA, one of the principal seaport and garrison towns in Sweden, is situated in the district of Malmö (in Skania) on the Sound (Öresund), about 55 miles west of Christianstad and 15 miles by water from Copenhagen. It is connected by a branch line with the South Swedish railway system. The harbor, protected by the island of Gräen, is the deepest and best on the Skanian coast, and possesses excellent quays. A Swedish line of steamers runs regularly to Lübeck. Wood, grain, and clay are largely exported. In 1880 the number of foreign vessels entering the port was 1954, with a total burden of 135,894 register tons. Landskrona is one of the chief industrial towns of Sweden, the largest manufacture being sugar refining. The population was 7323 in 1868, and 9913 in 1880.

Landskrona, originally called Landora or Landŏr, owes its first importance to King Erik XIII., who introduced a body of Carmelite monks from Germany in 1410, and bestowed on the place the same privileges as those enjoyed by Malmö. In 1428 it was plundered by the forces of the Wendish towns, and during the wars of the 16th and 17th centuries it played too conspicuous a part for its own prosperity. Horn took the town by storm in 1644; Ruyter blockaded the Swedish fleet in its harbor in 1657; and in 1676 was fought in the neighborhood the great battle of Landskrona, which saved Sweden from the Danish invaders.

LANE, EDWARD WILLIAM (1801–1876), one of the greatest of European Arabists, was the son of Dr. Theophilus Lane, a prebendary of Hereford. He lost his father in boyhood, and his character was mainly formed by the influence of his mother, a woman of strong and beautiful nature. He was designed for Cambridge and the church, and became proficient in mathematics, but, abandoning the purpose of proceeding to the university, gave himself for some time to the study of engraving. Weak health, aggravated by intense application to Eastern study, compelled him to throw aside the burin, and in 1825 he started for Egypt, where he spent three years, twice ascended the Nile, proceeding as far as the second cataract, and composed a complete description of Egypt, with a portfolio of one hundred and one drawings. This work was never published, but the account of the modern Egyptians, which formed a part of it, was accepted for separate publication by the Society for the Diffusion of Useful Knowledge. To perfect this work Lane again visited Egypt in 1833–35, residing mainly in Cairo, but retiring to Luxor during the plague of 1835. An interesting journal of this visit to Egypt is included in the memoir by his grand-nephew prefixed to the sixth part of his great *Lexicon*. Perfected by the additional observations collected during these years, the *Modern Egyptians* appeared in 1836, and at once took the place which it has never lost as the best description of Eastern life and an Eastern country ever written. In accuracy, completeness, and graphic simplicity of description the book approaches ideal perfection. It was followed from 1838 to 1840 by a translation of the *Arabian Nights*, with a mass of valuable notes and illustrations, designed to make the book a sort of encyclopædia of Eastern manners, and rivalling the merit of his first work. The translation itself is an admirable proof of scholarship, but is characterized by a somewhat stilted mannerism, which is not equally appropriate to all parts of the motley-colored original. The character of some of the tales, and the tedious repetitions of the same theme which are found in the Arabic collection, induced Lane to leave considerable parts of the work untranslated. In 1840 Lane married a Greek lady. A useful volume of *Selections from the Kur-án* was published in 1843, but before it passed through the press the indefatigable author was again in Egypt, where he spent seven years (1842–49) collecting materials for a great Arabic lexicon, which the munificence of Lord Prudhoe (afterwards duke of Northumberland) enabled him to undertake. The most important of the materials amassed during this sojourn (in which he was accompanied by his wife and by his sister Mrs. Poole, authoress of the *Englishwoman in Egypt*; with her two sons, afterwards well known in Eastern letters) was a copy in 24 thick quarto volumes of Sheikh Murtadá's great lexicon, the *Táj et 'Arús*, which, though itself a compilation, is so extensive and exact that it formed the main basis of Lane's subsequent work.

The author, who lived in Egypt in last century, used more than a hundred sources, interweaving what he learned from them with the *Kámús* of Firuzabády in the form of a commentary. By far the larger part of this commentary was derived from the *Lisán el 'Arab* of Ibn Mokarram, a work of the 13th century, which Lane was also able to use while in Cairo.

Returning to England in the year 1849, Lane devoted the whole remainder of his life to the task of digesting and translating his Arabic material in the form of a great thesaurus of the lexicographical knowledge of the Arabs. In spite of weak health he continued this arduous task with unflagging diligence till a few days before his death, which took place at Worthing, 10th August, 1876. The work remains unfinished; five parts appeared during his lifetime (1863–1874), and two smaller parts have since been published from his papers. Even in its imperfect state the *Lexicon* is an enduring monument, the completeness and finished scholarship with which it is executed making each article an exhaustive monograph. All Lane's work has the stamp of masterly perfection. He produced no occasional writings, and two essays contributed to the magazine of the German Oriental Society complete the record of his publications. Lane was not an original mind; his powers were those of observation, industry, and sound judgment. He had singular tact in accommodating himself to the Eastern character; he lived in the East as an Oriental; and his familiarity with Eastern life and ways of thought was unique. His personal character was elevated and pure, his strong sense of religious and moral duty being of the type that characterized the best circles of English evangelicalism in the early part of this century.

LANFRANC (*c.* 1005–1089), thirty-fourth archbishop of Canterbury, and first after the Conquest, one of the ablest churchmen and scholars of his time, was the son of Hambald or Hanbald, one of the principal citizens of Pavia, and was born there about the year 1005. Deprived of his father at an early age, he seems to have been educated at Pavia with a view to taking his hereditary place in the governing class, but to have developed a love of learning for its own sake, which induced him to visit other schools; on his return, after a long absence, he became teacher of jurisprudence in his native town. About 1039, driven from home by the disturbances then prevalent in Italy, and attracted by what he had heard of the need and demand for a supply of competent scholars in Normandy, he with some learned companions migrated thither and set up a school at Avranches, which met with great success. Some three years afterwards (1042), having formed the resolution to become a monk, he suddenly withdrew from his promising career as a secular teacher. The causes which led to this change in the plan of his life are not known. Hook thinks it was suggested by the death of his wife, which there is some reason to believe happened about this time; but, however it may have been occasioned, the fact that a man of his energy and strength of will should, although somewhat late in life, have transferred himself to a career which not only was universally supposed to involve great spiritual advantages, but must also have been seen to offer a peculiarly favorable field for the exercise of his special talents and acquirements, need cause no surprise. After a lengthened novitiate of ascetic humiliation and seclusion in the Benedictine monastery of Bec, then under the presidency of abbot Herluin, Lanfranc was at last called upon to resume the work of teaching, his fame speedily attracted numerous pupils, and it became necessary to enlarge the conventual buildings. He now became prior, with full control of the internal discipline of the establishment (1046). Among those who became his pupils about this time are mentioned Witmund (afterwards bishop of Aversa), Anselm of Aosta (afterwards of Canterbury), and Anselm of Lucca (afterwards Pope Alexander II.). It was during his priorship at Bec that Lanfranc began to figure somewhat prominently in the eucharistic controversy associated with the name of Berengarius of Tours. This able but unfortunate controversialist, while maintaining the doctrine of a real presence of Christ in the Eucharist, had denied that presence to be one of essence, or the change effected to be one of substance. In doing so he had placed himself in an attitude of opposition not so much to the lately formulated theory of Paschasius Radbertus as to the entire current of ecclesiastical opinion then prevalent. The earliest extant letter of Berengarius to Lanfranc implies a previous friendship, but is written in a tone of remonstrance, beseeching the latter not to treat as heretics those who had Scripture on their side and could also claim the support of Ambrose, Augustine, and Jerome. It is to be regretted that we are not in possession of more of the correspondence, and especially that we are left entirely to conjecture with regard to the circumstances which occasioned it. It seems to have been somewhat compromising to Lanfranc, for at the Easter synod held at Rome in 1050, which he had been summoned to attend, the prior of Bec was after the condemnation of the absent Berengarius, called upon to vindicate his own orthodoxy by a public confession of his faith. He had no difficulty, however, in thus purging himself of all suspicion of heretical pravity, and was afterwards present in September, by special request, at the synod of Vercelli, where Berengarius, again absent, was excommunicated. A personal controversy was renewed by Berengarius, from time to time, but, so far as we know, Lanfranc's share in it came to an end with the composition (probably some time between 1063 and 1069) of his *Liber de Corpore et Sanguine Domini Nostri contra Berengarium.* Other events of much more exciting and absorbing personal interest to him had meanwhile intervened. In 1053 William of Normandy, in spite of the express prohibition of the council of Rheims (1049), had married his cousin Matilda, daughter of Baldwin, duke of Flanders,—a defiance of ecclesiastical authority which involved the highest ecclesiastical censures. The now powerful prior of Bec was not slow to express his condemnation, which he further accentuated by his contemptuous treatment of Herfast, the duke's chaplain, who had been sent on some errand of conciliation. Peremptorily ordered to leave the duchy, Lanfranc, when setting out on his journey into exile on an excessively lame horse, whether by accident or design came across the path of William; some genial touch of humanity and good humor suddenly converted them (such is the import of the Chronicles) into firm friends; the prior accompanied the duke to his castle, and shortly afterwards undertook a mission to Rome for a papal dispensation which should legalize the obnoxious marriage. This was obtained in 1059; Lanfranc's influence with William and Matilda steadily increased, and soon the abbeys of St. Stephen and of the Holy Trinity at Caen—part of the price of the papal grace—began to rise. In 1062 the former building was sufficiently far advanced to be fit for use, and, at the urgent request of the founder, Lanfranc became its first abbot. In this position he was one of the most intimate advisers of William during the anxious times which immediately preceded and followed the Conquest. Already destined for the more splendid if more arduous see of Canterbury, he, doubtless with the royal approval, declined that of Rouen, which had been put within his reach in 1067. In 1070 he was, at the Whitsungemot held at Windsor, chosen to the primacy of England, vacant by the deposition of Stigand; and, at a synod in Normandy where the legatees of the pope were present, he was constrained to accept, vainly pleading "his weakness and unworthiness, his ignorance of a foreign tongue, and the barbarism of the nations he was thus compelled to visit." His consecration took place on August 29, 1070, in a temporary structure raised on the site of the cathedral which had been destroyed by fire three years before; and in the following year he went to Rome to receive the pallium from his former pupil Alexander II. The pope received him with great cordiality, giving him a second pallium for old friendship's sake; but he did not thereby succeed in attaching the new archbishop to the ultramontane policy; during the nineteen years of the primacy of the brilliant Lombard it became ever more apparent that neither Hildebrand's, nor Lanfranc's, but William's was the master mind in England. Lanfranc ably seconded the Conqueror in the line of action which resulted in the subordination of York to Canterbury, and also in the gradual removal from power of all English prelates and abbots, and their replacement by foreigners, until at last Wolfstan of Worcester was the only Anglo-Saxon left undisturbed; but, if these measures were fitted in some ways to denationalize the English Church, and bring it into closer relation with the central authority at Rome, any such tendency was more than counterbalanced by the legislation, also supported by Lanfranc, which placed the royal supremacy on a footing which it had never before attained. Thus it was enacted that bishops, like barons, were to pay homage to the crown, and the clergy were to acknowledge no one as pope until the royal consent had first been obtained; that no letters from Rome were to be published until approved by the king; that no council was to pass laws or canons except such as should be agreeable to the king's pleasure; that no bishop was to implead or punish any of the king's vassals without the king's precept; and that no ecclesiastic was to leave the country without leave obtained. As regarded church discipline the Hildebrandine reforms were followed, but with wisdom and moderation; thus strict regulations against simony were enforced, but with respect to clerical celibacy a distinction was drawn between the parochial and the capitular clergy, the former being permitted to retain their wives. A striking illustration of the recognized ecclesiastical independence of England under William and his able minister is furnished in the fact that, in the very year (1076) of the synod of Winchester at which so important a modification of the decrees of a Roman council had been resolved on, Lanfranc along with Thomas of York and Remigius of Dorchester presented themselves at the holy see in a mission from the king to seek a confirmation of certain ancient privileges, and that they were successful in their application. No less eloquent is the fact that, after William's rejection of Gregory's demand for his homage, Lanfranc had the courage to refuse the papal summons to appear at the threshold of the apostles. After his return from Rome in 1076 and the consecration of the new buildings at Bec in which he took part in 1077, he does not appear to have again left England. As regards his administration of his own diocese, Lanfranc's principal achievements were the rapid rebuilding of the metropolitan church (1072–79), the reforms he introduced among the monks of Christ Church, and his successful recovery of the estates of the see, which had been encroached on by the king's brother bishop Odo, earl of Kent. Lanfranc died at Canterbury in May, 1089.

The extant works of Lanfranc are not voluminous. The *Epistolarum Liber* contains fifty-five of his own letters, many of them of considerable interest and importance, as well as some of those of his distinguished correspondents,—Berengarius, William, Popes Alexander II. and Gregory VII. The short *Oratio in concilio habita* represents his argument before the synod of Winchester in 1072 in support of his claims to the primacy. *Statuta pro ordine Benedicti* are an adaptation and expansion of the ordinary Benedictine rules, written, when he was primate, especially for his own monks; *Sermo sive Sententiæ* also relates to the duties of monks. *Libellus de celanda confessione* has no special interest. *Commentarius in B. Pauli epistolas* seems rather to be a collection of some student's notes than to have been prepared for publication by himself. *Elucidarium sive dialogus de summa totius Christianæ theologiæ*, the most voluminous of all the works assigned to him, is of more than doubtful genuineness, but it certainly is an adequate sketch of the scholastic theology in its infantile stage. Most important is the *Tractatus de Corpore et Sanguine Domini*, a vigorous and even violent defence of the dogma of transubstantiation, for which it helped to secure currency and permanency, but it adds little to what had already been said by Paschasius Radbertus.

The Benedictine edition of the works of Lanfranc by D'Achery, in one folio volume (Paris, 1648), was reprinted at Lyons in 1677. A new edition by Giles appeared at Oxford in two octavo volumes in 1844. The authorities for the life and times of Lanfranc are the *Chronicon Beccense*, and *Vita Abbatum Beccensium* (which are printed in both editions of the *Opera*), and the *Historia Ecclesiastica* of Ordericus Vitalis. See Hook, *Lives of the Archbishops of Canterbury*, vol. ii., and Freeman's *Norman Conquest*, vols. ii.-v. (J. S. BL.)

LANFREY, PIERRE (1828-1877), the historian who has done the most to destroy the Napoleonic legend of M. Thiers, was born at Chambéry, the capital of Savoy, on the 26th October, 1828. His father came of a warlike race, which had been noble for four centuries, and had himself served in the army of Napoleon as a captain of hussars. On the fall of Napoleon he had left the French army, and retired to Chambéry, where he married a milliner. When young Pierre was but six years old, his father died, cursing the priest who came to bring him consolation, and his education was left to his mother. She sent him first to the Jesuit college of Chambéry, from which he was expelled for writing an attack on the Jesuits, then to another ecclesiastical seminary, which equally disgusted him, and at last to the Lycée Bourbon at Paris. After completing his studies at Paris he went to Grenoble in 1847 to study law, and while there took the keenest interest in the Revolution of 1848 at Paris. Even at that age he shows in his letters the hatred of democracy which was always to characterize his sincere love of liberty, and above all his intense feeling that Paris should not always dominate the provinces. His law studies finished at Grenoble, he went to Turin, and qualified himself to act as *avocat* in his native country; but, on the news of the coup d'état, his passion to go to Paris and take his part in the inevitable struggle which he saw must arise between the second empire and the spirit of liberty was not to be restrained, and in 1853 he once more took up his abode in Paris. He at first tried in vain to get work on various newspapers, and then to get his first book, which had been sketched out for some years, published. No publisher was to be found, and *L'Église et les Philosophes au XVIIIème Siècle* was printed eventually at his own expense. It appeared in 1855, and at once achieved a great success, and introduced its author to some of the best literary society in Paris. It was followed in 1857 by an *Essai sur la Révolution française*, and in 1860 by the *Histoire politique des Papes*, and the *Lettres d'Éverard*. The latter are a revelation of what Lanfrey thought and felt at this time, of his despair that France would ever get free from the enervating rule of the second empire, of his disgust at the literary sterility of the time in confining itself to vague philosophy and vaguer criticism; and through them he first became known outside the literary world. He had hitherto been intimate with such choice spirits as Ary Scheffer, Gleyre, and the Comtesse d'Agoult, better known as Daniel Stern; but the *Lettres d'Éverard* introduced him to the most fashionable Parisian society of the time, and the position he held in it is best to be found in the description of him contained in the souvenirs of his friend, Madame Clara Jaubert. In 1860 also he was appointed by M. Charpentier editor of the new *Revue National*, in which he wrote the fortnightly chronicle of affairs for four years, besides various articles and reviews, collected in 1864 under the title of *Études et Portraits politiques*. After resigning his editorship in 1864, he set to work on his great *Histoire de Napoléon I.*, in which he intended to overthrow the monument M. Thiers had erected to Napoleon in his *Histoire du Consulat et de l'Empire*, and to show the demigod uncle of Napoleon III. to have been but an immoral man and bad politician. The fourth volume of his history had not been published three months when the war of 1870 broke out. At first Lanfrey knew not what view to take, but on the defeats of the French, and the declaration of the republic, he enlisted as a simple volunteer, and marched to Lyons with his battalion. While there he heard first that his vigorous opposition in the press to the powerful influence of M. Gambetta had lost him his election to the Constituent Assembly in his native province, and next that he had been elected by the department of the Bouches du Rhône, in which he had never set foot. In the Assembly he warmly supported the Government of M. Thiers, and opposed the radical party as vehemently as he had opposed the empire, saying that both savored of tyranny. In 1871 M. Thiers appointed him French minister in Switzerland, where he remained till 1874, when he insisted on his resignation being accepted by the Duc de Broglie, and once more took his seat as a moderate republican. In 1875 he published the fifth volume of his *Histoire de Napoléon*, and in 1876 was elected a life senator; but his strength was fast failing, and, before he could give his sixth volume the careful revision he considered indispensable, he died at Pau on the 16th November, 1877.

The first predominant idea of Lanfrey, both as a politician and an historian, was a love of liberty, which was perpetually putting him in opposition to all parties in turn. In his first book he attacked the church, not because of its doctrines so much as because of its attempts to stifle liberty of thought. In his *Essai sur la Révolution*, on the other hand, he assailed Robespierre and the democrats because they defended attempts on individual liberty with the assertion that they were necessary for liberty in general. His second leading idea was a belief in strictest morality in politics; by this standard in his *Études* he condemns M. Thiers for slurring over the political immorality of Napoleon, Daunou for giving up his old Girondin standpoint to defend the concordat, and Carnot for putting his name to measures of the committee of public safety which he abhorred, in order to maintain himself in power. These two ideas, love of liberty, involving a hatred alike of despotism and democracy, and a stern standard of political morality, are to be seen throughout Lanfrey's great work on Napoleon. No military success ever to him seems to compensate for immoral means to gain an end; no glamour is for him cast over evil actions by glory or fine words; no sarcasm is too severe for the man who cared not for truth but only for effect. Before such a judge Napoleon appears but a small man; and, if at times the judgment seems almost too severe, it must be remembered that the author lived through a time when an emperor ruled entirely owing to the influence that the great deeds of his uncle had thrown over the minds of the French people, and that he wrote with the intention of for ever breaking down that influence by exhibiting the naked truth, and destroying forever the Napoleonic legend.

For Lanfrey's life consult three articles by the Comte d'Haussonville in the *Revue des Deux Mondes* for September, October, and November, 1880; the biographical notice of M. de Pressensé, prefixed to the last edition of his works; and the numerous letters from him contained in the *Souvenirs* of Madame Jaubert.

LANGENSALZA, chief town of a circle in the government district of Erfurt, in the province of Saxony, Prussia, is situated on the Salza, about 20 miles north-east of Erfurt. It has an old castle, several schools of various grades, and three hospitals; and near it are the remains of the old monastery of Homburg. The manufacture of cloth is the chief industry, but lace, starch, and chemicals are also produced. The population of the town in 1875 numbered 9855. There is a sulphur bath in the neighborhood. Near Langensalza the Prussians and Hanoverians had a long and bloody engagement, June 27–29, 1866, which ultimately resulted in the capitulation of the latter.

LANGLAND, or LANGLEY, WILLIAM, the author of a remarkable poem belonging to the close of the 14th century, of which the full title is—*The Vision of William concerning Piers the Plowman, together with Vita de Do-wel, Do-bet, et Do-best, secundum Wit et Resoun.*[1]

The author's name is not quite certain, and the facts concerning his life are few and scanty. As to his Christian name we are sure, from various allusions in the poem itself, and the title *Visio Willelmi*, etc., in many MSS.; and we may at once reject the suggestion that his name may have been Robert. In no less than three MSS. occurs the following colophon: "Explicit visio Willelmi W. de Petro le Plowman." What is here meant by W. it is difficult to conjecture; but it is just possible that it may represent Wychwood (of which more presently), or Wigorniensis, *i.e.*, of Worcester. As to the surname, we find the note that "Robert or William Langland made pers ploughman," in a handwriting of the 15th century, on the fly-leaf of a MS. copy belonging to Lord Ashburnham; and in a Dublin MS., is the note: "Memorandum, quod Stacy de Rokayle, pater Willielmi de Langlond qui Stacius fuit generosus, et morabatur in Schiptone-under-Whicwode, tenens domini le Spenser in comitatu Oxon., qui predictus Willielmus fecit librum qui vocatur Perys Ploughman." Nevertheless, it would seem that Langland should rather be Langley, since there is no trace of any Langland family in the midland counties, while the Langley family were wardens of Wychwood forest in Oxfordshire between the years 1278 and 1362. The question has been fully discussed by Professor Pearson in the *North British Review*, April, 1870, p. 244. According to Bale, our author was born at Cleobury Mortimer, which is quite consistent with the supposition that his father may have removed from that place to Shipton in Oxfordshire, as there seems to have been a real connection between the families in those places. It must not be omitted that in the parish of Shipton-under-Wychwood there is a hamlet named Langley, from which he may have received his name.

The internal evidence concerning the author is fuller and more satisfactory. By piecing together the various hints concerning himself which the poet gives us, we may compile the following account. His name was William (and probably Langley), and he was born about 1332 perhaps at Cleobury Mortimer in Shropshire. His father, who was doubtless a franklin or farmer, and his other friends, put him to school, made a "clerk" or scholar of him, and taught him what Holy Writ meant. In 1362, at the age of about thirty, he found himself wandering upon the Malvern hills, and fell asleep beside a stream, and saw in a vision a field full of folk, *i.e.*, this present world, and many other remarkable sights which he duly records. From this supposed circumstance he named his poem *The Vision of William*, though it is really a succession of visions, since he mentions several occasions on which he awoke, and afterwards again fell asleep; and he even tells us of some adventures which befell him in his waking moments. In some of these visions there is no mention of Piers the Plowman, but in others he describes him as being the coming reformer who was to remedy all abuses, and restore the world to a right condition. It is remarkable that his conception of this reformer changes from time to time, and becomes more exalted as the poem advances. At first he was no more than a ploughman, one of the true and honest laborers who are the salt of the earth; but at last he is identified with the great reformer who has come already, the regenerator of the world in the person of Jesus Christ. We may, in fact, consider Piers the Plowman as representing Christ himself, or, in the author's own phrase—"Petrus est Christus." If this be borne in mind, it will not be possible to make the mistake into which so many have fallen, of speaking of Piers the Plowman as being the author, not the subject, of the poem. The author may best be called William, or we may even give him the nickname of Long Will, which, as he himself tells us, was bestowed upon him from his tallness of stature—just as the poet Gascoigne was familliarly called Long George. Though there is mention of the Malvern hills more than once near the beginning of the poem, it is abundantly clear that the poet lived for "many years in Cornhill (London), with his wife Kitte and his daughter Calote."

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[1] The title is usually given in Latin as *Visio Willelmi de Petro Plowman*, etc., and the whole work is sometimes briefly described as *Liber de Petro Plowman*.

He seems to have come to London not long after the date of the first commencement of his work, and to have long continued there. He describes himself as being a tall man, one who was loath to reverence lords or ladies or persons in gay apparel, and not deigning to say "God save you" to the sergeants he met in the street, insomuch that many people took him to be a fool. He was very poor, wore long robes, and had a shaven crown, having received the clerical tonsure. But he seems only to have taken minor orders, and earned a precarious living by singing the *placebo*, *dirige*, and seven psalms for the good of men's souls. The fact that he was married may explain why he never rose in the church. But he had another source of livelihood in his ability to write out legal documents, and he was extremely familiar with the law courts at Westminster. His leisure time must have been entirely occupied with his devotion to his poem, which was essentially the work of his lifetime. He was not satisfied with rewriting it once, but he actually rewrote it twice; and from the abundance of the MSS. which still exist we can see its development from the earliest draught, written about 1362, to its latest form, written after 1390. It is remarkable that the intermediate form, written later than 1370, is, perhaps, taken upon the whole, the best of the three.

In 1399, just before the deposition of Richard II., appeared a poem addressed to the king, who is designated as "Richard the Redeles," *i.e.*, devoid of counsel. This poem, occurring in only one MS., in which it is incomplete, breaking off abruptly in the middle of a page, may safely be attributed to the same author, who was, at the time, passing through Bristol. As he was then about sixty-seven years of age, we may be sure that he did not long survive the accession of Henry IV. It may here be observed that the well-known poem entitled *Pierce Ploughman's Crede*, though excellently written, is certainly an imitation by another hand, viz., by the anonymous author of *The Plowman's Tale*, which is inserted in the black-letter editions of Chaucer, though it is none of his. The Pierce Ploughman of the *Crede* is very different in conception from the subject of William's vision.

As regards the poem itself, it has been already said that it exists in three forms. If we denote these by the names of A-text, B-text, and C-text, we find, of the first, twelve MSS.; of the second, sixteen; and of the third, also sixteen MSS. A few of these show confusion between the different types, but they may roughly be classed as above; and it will be seen that we thus have abundance of material, a circumstance which proves the great popularity of the poem in former times. Owing to the frequent expressions which indicate a desire for reformation in religion, it was, in the time of Edward VI., considered worthy of being printed. Three impressions were printed by Robert Crowley in 1550; and one of these was badly reprinted by Owen Rogers in 1561. In 1813 the best MS of the C-text was printed by Dr. Whitaker in an expensive form. In 1842 Mr. Thomas Wright printed an edition from an excellent MS. of the B-text in the library of Trinity College, Cambridge (second edition, 1856). A complete edition of all three texts was undertaken, for the Early English Text Society, by the Rev. W. W. Skeat, but is not yet finished (1881). Vols. i., ii., and iii., containing the three texts, and the poem of *Richard the Redeles*, appeared in 1866, 1869, and 1873 respectively, and a part of vol. iv., containing full notes to all three texts, with some indexes, in 1877.

The general contents of the poem may be inferred from a brief description of the latest text. This is divided into twenty-three passus, nominally comprising four parts, called respectively Visio de Petro Plowman, Visio de Do-wel, Visio de Do-bet, and Visio de Do-best. Here *Do-bet* signifies "do better" in modern English; and the author's own explanation of the names is that he who does a kind action *does well*, he who teaches others to act kindly, *does better*, but he who combines both practice and theory, both doing good himself and teaching others to do the same, *does best*. But the visions by no means closely correspond to these descriptions; the poet really gives us a set of eleven visions, which may be thus enumerated:—(1) Vision of the Field Full of Folk, of Holy Church, and of the Lady Meed (passus i.–v.); (2) Vision of the Seven Deadly Sins, and of Piers the Plowman (pass. vi.–x.); (3) Wit, Study, Clergy, and Scripture (pass. xi., xii.); (4) Fortune, Nature, Recklessness, and Reason (pass. xiii., xiv.); (5) Vision of Imaginative (pass. xv.); (6) Conscience, Patience, and Activa-Vita (pass. xvi., xvii.); (7) Free-will, and the Tree of Charity (pass. xviii., xix.); (8) Faith, Hope, and Charity (pass. xx.); (9) The Triumph of Piers the Plowman, *i. e.*, the Crucifixion, Burial, and Resurrection of Jesus Christ (pass. xxi.); (10) The Vision of Grace (pass. xxii.); (11) The Vision of Antichrist (pass. xxiii.)

This bare outline gives but little idea of the real nature of the poem. The general plan of it is slight and somewhat vague, but the execution is vivid and remarkable. The author's object was to afford himself opportunities by the way (of which he has amply availed himself) of describing the life and manners of the poorer classes; of inveighing against clerical abuses and the rapacity of the friars; of representing the miseries caused by the great pestilences then prevalent and by the hasty and ill-advised marriages consequent thereupon; and of denouncing lazy workmen and sham beggars, the corruption and bribery then too common in the law-courts, and all the numerous forms of falsehood which are at all times the fit subjects for satire and indignant exposure. In describing, for example, the seven deadly sins, he gives so exact a description of Glutton and Sloth that the readers feel that these are no mere abstractions, but drawn from the life, and it becomes hardly more difficult to realize Glutton than it is to realize Sir John Falstaff. The numerous allegorical personages so frequently introduced, such as Scripture, Clergy, Conscience, Patience, and the like, are all mouthpieces of the author himself, uttering for the most part his own sentiments, but sometimes speaking in accordance with the character which each is supposed to represent. The theological disquisitions which are occasionally introduced are somewhat dull and tedious, but the earnestness of the author's purpose and his energy of language tend to relieve them, and there are not many passages which might have been omitted without loss. The poem is essentially one of those which improve on a second reading, and as a linguistic monument it is of very high value. Mere extracts from the poem, even if rather numerous and of some length, fail to give a fair idea of it. The whole deserves, and will repay, a careful study; indeed, there are not many single works from which a student of English literature and of the English language may derive more substantial benefit.

The metre is alliterative, and destitute of final rhyme. It is not very regular, as the author's earnestness led him to use the fittest words rather than those which merely served the purpose of rhythm. The chief rule is that, in general, the same letter or combination of letters should begin *three* emphatic syllables in the same line, as, *for* example, in the line which may be modernized thus: "Of all manner of men, the mean and the rich." Sometimes there are but *two* such rhyme-letters, as: "*M*ight of the commons made him to reign." Sometimes there are *four*, as: "In summer season, when soft was the sun." There is invariably a pause, more or less distinct, in the middle of each line.

See the editions already referred to; *The Deposition of Richard II.*, ed. T. Wright (Camden Society), which is the same poem as *Richard the Redeles*; Warton, *Hist. of Eng. Poetry*; Milman, *Hist. of Latin Christianity*; Marsh, *Lectures on English*; H. Morley, *English Writers*, etc. A long and careful summary of the whole poem is given in *Illustrations of English Religion*, by H. Morley, ch. iii.
(W. W. S.)

LANGRES, a town in the department of Haute-Marne, France, 186 miles southeast from Paris, stands at a height of some 1550 feet, upon a jutting promontory of the table-land to which it gives its name (Plateau de Langres), and overlooks, eastward and westward respectively, the valleys of the Marne and its tributary the Bonnelle. Its situation involves a rigorous climate, but also gives it strategic importance. The citadel stands to the south of the town, where it joins the table-land. From the ramparts and the cathedral tower there is an extensive view over the valley of the Marne, the Vosges, and the Côte d'Or; and in clear weather Mont Blanc (160 miles distant) is visible. Several detached forts and numerous batteries make Langres one of the strongest fortified camps of the country. The cathedral, the choir and nave of which date from the 12th and 13th centuries, possesses some fine features, but has been debased by a front in the style of the 17th century. The church of St. Martin possesses a Christ, which is one of the finest wood-carvings known. The Gallo-Roman gate, one of the four entrances to the town in the time of the Romans, is conjectured to have been intended as a triumphal arch to some victorious emperor, perhaps Marcus Aurelius. The gate "des moulins" is now the most noteworthy in the town. Langres possesses an antiquarian museum and a rather important library, as well as a picture gallery. The cutlery which bears the name of Langres is manufactured in the neighborhood. Population, 10,375.

The town takes its name from the *Lingones*, who occupied it in the time of Cæsar. Under the Capets its bishop was an ecclesiastical peer of the kingdom, and held the sceptre at royal coronations.

LANGTON, STEPHEN (*c.* 1150-1228), cardinal, forty-fourth archbishop of Canterbury, was born about the middle of the 12th century; the place of his birth is unknown, but his family almost certainly belonged to Yorkshire. He had already been made a prebendary of York, most probably at an early age, when he went to France and entered the university of Paris; there he soon rose to distinction alike in philosophy and theology, and ultimately, it is said, became chancellor or at least attained high rank in the governing body. One of his fellow-students and intimate friends in Paris was Lothario, the nephew of Clement III., who when he in 1198 succeeded Celestine III. as Innocent III. forthwith appointed Langton to a post in his household. In 1206 he became cardinal priest of St. Chrysogonus, a promotion on which he received the written congratulations of his sovereign King John. It was shortly after this that he first became involved in the great constitutional struggles with which his name is so honorably associated. In 1205 Hubert Walter of Canterbury had died, and there were urged at Rome the claims of two rival candidates for the vacant see,—Reginald the subprior of Christ Church, Canterbury, who had been the sudden and unauthorized choice of a majority of the monks, and John de Gray, bishop of Norwich, whom the dissenting minority had subsequently elected with the royal sanction. Setting aside both claims, and also the appeal of the suffragans of Canterbury with the chapter, who maintained that the right of election was theirs, Innocent commanded the monks then present in Rome to proceed to a new election in his presence, Langton being the candidate set before them. Elected he accordingly was, and afterwards consecrated by the pope himself at Viterbo, in June, 1207. John immediately retaliated by banishing the monks of Canterbury, afterwards writing an angry and threatening letter to the pope. Innocent replied with firmness, but, finding John immovable, ultimately declared his resolution to enforce submission to his will by laying England under an interdict, a resolution which was carried into effect in March, 1208. For the next few years, all negotiations for his admission to his see having failed, Langton had his home in the Cistercian monastery of Pontigny near Sens in France, which thus became a principal resort of English malcontents and refugees. In the summer of 1212 he accompanied the bishops of London and Ely to Rome, and it was in consequence of their representations that deposition was passed upon John; the same prelates were also present at the great assembly of Soissons (April, 1213), where a crusade against the king of England was set on foot, under the leadership of Philip of France. In the following May John made his peace, agreeing to recognize Langton, receive the exiled clergy, and restore the property which he had confiscated. Langton did not actually reach England till July, when (July 20, 1213) he performed his first episcopal act by pronouncing the absolution of the excommunicated John, who swore that all the laws of his grandfather Henry I. should be kept by all throughout the kingdom, and that all unjust laws should be utterly abolished. This oath the king was held by the archbishop to have violated almost immediately in levying war irregularly against the barons who had, not illegally, deserted him at Portsmouth; and at the meeting held in St. Paul's, London, on August 25, 1214, it was Langton who produced the old charter of Henry I., and suggested the demand for its renewal, a suggestion which in the following year issued in the concession of Magna Charta at Runnymede. Soon afterwards the archbishop left England for Rome to attend the fourth Lateran council, but not before he had by the commissioners of the pope been pronounced contumacious, and declared to be suspended for his refusal to publish the excommunication of the English barons who had joined in obtaining the great charter. At Rome, where the sentence of his suspension was confirmed, he remained from November, 1215, till May, 1218; in September of the latter year he presided in the council held at London, where Magna Charta was solemnly confirmed; and on May 17, 1220, he officiated at the re-coronation of Henry III. In the same year the "translation" of St. Thomas of Canterbury took place. Among the fragmentary notices we possess of the remainder of Langton's life are mentioned his demand in name of the barons for royal confirmation of the charter at London in 1223. He died at Slindon on July 9, 1228.

The principal authority for the events of the life of Langton is the *Chronicle* of Roger of Wendover. See Hook's *Lives of the Archbishops of Canterbury*, vol. ii.; Pearson's *History of England*, vol. ii.; and Pauli's continuation of Lappenberg's *Geschichte von England*, vol. iii.

LANGUAGE. See PHILOLOGY.

LANGUEDOC, a province of France, which lay between the Garonne on the west and the Rhone on the east, with the Pyrenees and the Mediterranean on the south. It was divided into the three sénéchaussées of Toulouse, Carcassonne, and Beaucaire; and it comprised, besides the province proper, the districts of Gevaudan, Vellai, Vivarez, Cevennes, and Foix. It contained the important cities of Toulouse, Carcassonne, Narbonne, Montpellier, Nismes, Cette, Viviers, Alby, and Foix. The southwestern spurs of the Cevennes run across the province from the northeast to meet the first slopes of the Pyrenées. In spring and early summer no part of France possesses a more delightful climate than Languedoc, while Montpellier and its neighborhood, in spite of the mistral, was up to recent times considered as an excellent retreat for consumptive patients. The Roman remains of Nismes, the lagoons and decayed towns of the Gulf of Lyons, the historical associations of Montpellier, the fine mediæval fortress of Carcassonne, the old towers and the hôtel de ville of Narbonne, the little-known scenery of the Eastern Pyrenées, with the castles of Foix and Tarascon, and Toulouse with its churches, fairs, floral games, and winding streets, make the country one of the most interesting in the whole of France. Here may still be heard the soft accents of the Langue d'Oc, a language which has not, even yet, spoken its last word in the poetry of the world.

Gallia Narbonensis, one of the seventeen provinces into which the empire was divided at the death of Augustus, occupied nearly the same extent as the province of Languedoc. It was rich and flourishing, crowded with great towns, densely populated, with schools of rhetoric and poetry, theatres, amphitheatres, and splendid temples. From Narbo Martius came the rhetorician and poet Montanus, who was exiled by Tiberius to Majorca; from Nismes came Domitius Afer; and the emperors Carinus and Numerianus were also natives of Narbonne. The planting of Christianity though doubtless the Greeks of Massilia heard of it before, was accomplished, according to tradition, by St. Trophimus of Arles, St. Paul of Beziers, and Saint Saturnin of Toulouse. It is characteristic of the country that its ecclesiastical historians lament even in the earliest ages a tendency to heresy among its people. At the break up of the Roman empire the Visigoths founded the kingdom of Toulouse (412 A.D.), and in a few years spread their conquests over Narbonensis, Novempopulana (Gascony), and Aquitania in France, as well as over the whole of the Spanish peninsula. They were driven out of France by Clovis, but retained "Septimania" the country of the seven cities—Narbonne, Carcassonne, Elne, Beziers, Maguelonne, Lodève, and Agde—that is, very nearly the area occupied later by the province of Languedoc. At the council of Narbonne (589) five sorts of people are mentioned as living in the province:—the Visigoths, then the ruling race, Romans, Jews, of whom there were a great many, Syrians, and Greeks. It was not until the year 759, when Pippin took their chief town, Narbonne, that the Visigoths were forced across the Pyrenées, and the country became part of the great empire bequeathed by Pippin to his great son Charles. Septimania became part of the kingdom of Aquitaine, but was separated from it and constituted a special duchy in the year 817. Two or more invasions of the Saracens took place in the 9th century, and the Normans made a descent upon the coast in the year 859. Early in the 10th century we find the whole province in the power of the counts of Toulouse, and one of the great fiefs of the crown of France. While the Normans were ravaging the north of France and laying siege to Paris, the Saracens from the mouths of the Rhone were plundering and harrying the county of Toulouse. Neither in the south nor in the north of the country was there during the terrible 10th and 11th centuries any peace or comfort. A frightful pestilence desolated Aquitaine and Toulouse in the year 1000; and in 1032 a famine began which lasted for three years. Yet the court of Toulouse was already remarkable for its "luxury," as the ecclesiastical writers call it, —rather for its love of art and literature, combined with extravagance of dress and fashions. Constance, wife of King Robert, and daughter of the count of Toulouse, gave great offence to the monks by her following of gallant countrymen. They owed their tastes, not only to their Roman blood and the survival of their old love for rhetoric and poetry, but also to their intercourse with the Saracens, their neighbors and enemies, and their friends when they were not fighting. On the preaching of the crusade, no part of France responded with greater enthusiasm than the south. A hundred thousand men followed Raymond de Saint Gilles. A century later their own country was to be the scene of another crusade even more bloody than that against the Saracen.

The heresies which were the cause of so much bloodshed may, perhaps, be said to have begun with Peter de Brueys, who preached in Languedoc for twenty years, until he was silenced by the usual method. He denied infant baptism, respect for churches, the worship of the cross, transubstantiation, and prayers for the dead. His follower, Henry the Deacon, most eloquent of preachers, denied a great deal more. Wherever he taught he left deserted churches and contempt for the clergy. Although Bernard himself was invited to lend his persuasive powers to restore the cause of the church, he succeeded for a time only. Toulouse, for instance, was brought back to orthodoxy; yet when the great preacher went away the citizens relapsed. Again, there were the poor men of Lyons, the followers of Peter Waldo, of whom there were many in Languedoc; and there were the Manichæans, under the name of Puritans, Paterines, or Populars. In Languedoc and Provence the ground was ready for the seed of heresy. The towns were wealthy and free, the people had been in continual intercourse with Saracens of Palestine and Moors in Spain; they had never entirely rid themselves of pagan customs; their poetry taught the joys of life rather than the fear of death; their restless inquiring minds prompted them to ask whether there were any other solution of the problem of life than that offered by the church. The whole province—the county of Toulouse, with its fiefs of Narbonne, Beziers, Foix, Montpellier, and Quercy—was in open and scornful secession. It seems incredible, but it is doubtless true, that the churches were universally deserted, sacraments denied, and clergy despised. The history of the crusade, in the reign of Raymond VI., against the heretics of Languedoc contains every element of cruelty and horror. The count made haste to submit, but it was of no avail. Bishops, papal legates, and ecclesiastics of all ranks headed the vast armies which were gathered together against the freethinkers. All the cities, one after the other, the castles, and the strongholds of Languedoc were taken by the crusaders. Raymond was made to submit to the lowest abasement; the country was wasted; the people were destroyed by fire and sword. When all was over, when Raymond and Simon de Montfort were dead, and King Louis VIII. had led a vast army of conquest through the country, the council of Toulouse was held, in order to subject the people to total spiritual submission. They chose the method, which seems so easy but is so difficult, of universal espionage and delation. They succeeded in enforcing apparent submission; but the spirit of religious freedom lingered among the people, and yet survives, for nearly half the Protestants in France belong to the south. The pacification of Languedoc was completed by the annexation of the county to the crown of France. In 1229 Count Raymond VII. renounced his claim to seven provinces, and swore fealty to the king.

Languedoc had for two centuries no other history apart from that of France. The long wars with the English affected the country little. The province, comparatively safe from war, continued to increase and prosper in wealth. When it begins again to have a history of its own, it appears to be the home of the most bigoted orthodoxy. The university of Toulouse burns a professor, Caturce, for supposed heresy, and exiles a scholar, Dolet, for daring to sympathize with him. At the east of the province, however, Rabelais, who carries with him an atmosphere of free thought, is lecturing and dissecting; and in the west of the province Gerard Roussel is already preaching the doctrines of a purer faith. In the wars of religion, the great recruiting ground of Coligny was in those southern provinces against which Simon de Montfort had led his crusade. The insurrection of the Camisards belongs to the history of Languedoc, but the struggle was confined to the north part of the province. The pacification by Villars and the duke of Berwick, the horrible cruelties practised upon the people, and the singular story of the Cavalier are noticed elsewhere.

A special interest attaches to the history of two towns, at least, of Languedoc. Both Montpellier and Toulouse present very remarkable features of interest to the student of municipal histories. The literature of the country is the literature called after its neighbor PROVENCE (*q. v.*). Probably no great future remains for the literature of a dialect slowly dying out, yet examples have not been wanting of late to prove that there is still vitality in the language of the people. (W. BE.)

LANGUET, HUBERT (1518–1581), diplomatist, and one of the boldest political writers of the 16th century, was born in 1518 at Viteaux, near Autun in Burgundy, where his father held a good official position. He early manifested an inclination for study, and his tastes were encouraged by able masters; at Poitiers he devoted himself not only to law but also to natural science, history, politics, and theology. On leaving that university, after a sojourn at Leipsic, where he became the friend of Camerarius, he visited Padua and Bologna, and saw many other parts of Italy. Having been introduced in the course of his Italian journey to the *Loci Theologici* of Melanchthon, he in 1549 set out for Wittenberg to make the acquaintance of that author, and thus originated a friendship which terminated only with the death of the latter in 1560. Between 1551 and 1557 Languet travelled extensively in Germany, Denmark, Sweden, Finland, and Lapland, and in 1559 he entered the diplomatic service of the elector of Saxony, where he remained until his death. During the greater part of this period he was employed chiefly in negotiations with France and in the interest of the

Huguenots. He was present in Paris on St. Bartholomew's Day (1572), and was the means of saving his friends Wechel the printer, and Duplessis-Mornay; but his efforts drew on him the attention of the mob, and he himself in turn became indebted for his life to the chancellor Morvilliers. From 1573 to 1576 his mission lay chiefly at the imperial court; here he gained the acquaintance and ultimately the close friendship of Sir Philip Sidney. About 1578 he went to Ghent on the invitation of John Casimir, whom he accompanied to England, and the rest of his days he spent chiefly in the Low Countries, watching the course of political events. There seems to be no ground, however, for the assertion that in 1577 he had resigned his connection with the court of Saxony, and formally attached himself to the prince of Orange. Languet died at Antwerp on September 30, 1581.

His correspondence with Augustus of Saxony (three hundred and twenty-nine letters, from November 17, 1565, to September 8, 1581) and with Mordeisen, the chancellor of the duchy (one hundred and eleven letters, from November, 1559, to the summer of 1565), were published by Ludovicus at Halle in 1699 under the title *Arcana sæculi XVI. Huberti Langueti Epistolæ politicæ et historicæ ad Philip. Sydnæum* (ninety-six letters, from April 22, 1573, to October 28, 1580) appeared at Frankfort in 1633, and have since been reprinted. *Langueti Epistolæ ad Joach. Camerarium, patrem et filium* (one hundred and eight letters) were published by L. Camerarius at Groningen in 1646. The *Historica Descriptio* of the siege and capture (1567) of Gotha appeared in 1568. The work by which Languet is best known is pseudonymous, and its authorship has not been undisputed. It is entitled *Vindiciæ contra tyrannos, sive de principis in populum populique in principem legitima potestate, Stephano Junio Bruto Celta auctore*, and bears to have been published at Edinburgh in 1579. By Edinburgh is most probably to be understood Basel. A French translation appeared in 1581; the original has been frequently reprinted, most recently at Leipsic in 1846. The work, which discusses with much freedom various points connected with the then familiar doctrine of passive obedience, attracted much attention, but its author was very successful in concealing the somewhat dangerous secret of his identity. It has been attributed to Beza, Hotman, Casaubon, and Duplessis-Mornay, by divers writers on various grounds—to the last-named on the very respectable authority of Grotius. The grounds on which Bayle (who has been followed almost unanimously by later writers) assigned it to Languet will be found in the form of a supplement to the *Dictionnaire*. The *Apologie ou défence de Guillaume, Prince' Orange, contre le ban et l'édit du roi d'Espagne* (Antwerp, 1581) is sometimes attributed to Languet. There seems little doubt, however, that it was really the work of the prince himself, with the help either of Pierre de Villiers (see Motley, *Rise of Dutch Republic*) or of Languet (Groen van Prinsterer, *Archives*).

LANNES, Jean (1769–1809), marshal of France, was born at Lectoure, 11th April, 1769. He was the son of a livery stables keeper, and was himself in early life apprenticed to a dyer. He had had but little education, but notwithstanding this his great strength and proficiency in all manly sports caused him in 1792 to be elected sergeant-major of the battalion of volunteers of Gers, which he had joined on the breaking out of the war between Spain and the French republic. He served through the campaigns in the Pyrenées in 1793 and 1794, and in the latter year was elected chef de brigade. However, in 1795, on the reform of the army introduced by the Thermidorians, he was dismissed from his rank. Not discouraged by this check, he re-enlisted as a simple volunteer in the army of Italy. In the famous campaign of 1796 he again fought his way up to high rank, being eventually made once more chef de brigade by Bonaparte. He was distinguished in every battle, and was wounded at Arcola. He was chosen by Bonaparte to accompany him to Egypt as general of one of Kléber's brigades, in which capacity he greatly distinguished himself, especially on the retreat from Syria. He went with Bonaparte to France, assisted at the 18th Brumaire, and was appointed general of division, and commandant of the consular guard. He commanded the advanced guard in the crossing of the Alps in 1800, was instrumental in winning the battle of Montebello, from which he afterwards took his title, and bore the brunt of the battle of Marengo. In 1801 Napoleon tried his favorite general as a diplomatist, and sent him as ambassador to Portugal. Opinions differ as to his merits in this capacity, but it may be presumed that Napoleon did not believe in them, as he never made such use of him again. On the establishment of the empire he was created a marshal of France, and commanded once more the advanced guard of a great French army in the campaign of Austerlitz. At Austerlitz he commanded the left, at Jena the centre, and at Friedland the centre of the French army, showing himself a general of division of the greatest merit, carrying out the orders given him to the letter, and never thinking them impossible. He was now to be tried as a commander-in-chief, for Napoleon took him to Spain in 1808, and gave him a corps d'armee, with which he won a victory over Castaños on November 22. In January, 1809, he was sent to attempt the capture of Saragossa, and by February 21 was in possession of the place. Napoleon then created him Duc de Montebello, and once more, for the last time, gave him the command of the advanced guard of an army of invasion. At Aspern he was ordered with two divisions to cut the Austrian army under the archduke Charles in half; he succeeded entirely, though under a heavy fire, but finding himself unsupported by Napoleon, who had been thrown into confusion by the news that his bridges over the Danube had been broken, he had to retreat. During the retreat he exposed himself as usual to the hottest fire, and received a mortal wound. As he was being carried from the field to die at Vienna, he is said to have met and reproached his old general for his ambition; but this, to say the least, is a contested statement. Napoleon said of him that "he had found him a pigmy, and made him a giant;" and there can be no doubt of his marvellous ability on the field, and his extraordinary courage. His eldest son was made a peer of France by Louis XVIII.

A *Vie militaire de J. Lannes* was published in 1809 by René Perin, but details can be found in all the military histories of the time.

LA NOUE, François de (1531–1591), surnamed Bras-de-fer, one of the gallant Huguenot captains of the 16th century, was born near Nantes, in 1531, of an honorable and ancient Breton family. His first exploit was the capture of Orleans at the head of only fifteen cavaliers in 1567, during the second Huguenot war. At the battles of Jarnac in March, 1569, and of Moncontour in the following October, La Noue was taken prisoner; but he was exchanged on the latter occasion in time to resume the governorship of Poitou, and inflict a signal defeat on the royalist troops before Rochefort. At the siege of Fontenay (1570) his left arm was shattered by a bullet; and the iron limb that replaced it won him from his soldiers the sobriquet of Iron-Arm. When peace was made in France in the same year, La Noue carried his sword against the Spaniards in the Netherlands, but was taken at the recapture of Mons by the Spanish in 1572. Permitted to return to France, he was commissioned by Charles IX. to attempt to reconcile the inhabitants of La Rochelle, the great stronghold of the Huguenots, to the king. But the Rochellois were too much alarmed by the recent massacre of St. Bartholomew to come to any terms; and La Noue, perceiving that war was imminent, and knowing that his post was on the Huguenot side, gave up his royal commission, and from 1574 till 1578 acted as general of La Rochelle. When peace was again concluded, La Noue once more went to aid the Protestant estates of the Netherlands. Holding a high rank in their army, he took several towns and captured Count Egmont in 1580; but a few weeks afterwards he himself fell into the hands of the Spaniards. Thrust into a loathsome prison at Limburg, La Noue, the admiration of all, of whatever faith, for his gallantry, honor, and purity of character, was kept confined for five years by a powerful nation, whose reluctance to set him free is one of the sincerest tributes to his reputation. At length, in June, 1585, La Noue was exchanged for Egmont and other prisoners of consideration, while a heavy ransom and a pledge not to bear arms against his Catholic majesty were also exacted from him. Till 1589 La Noue took no part in public matters, but in that year he joined Henry of Navarre and Henry VIII. against the Leaguers. He was present at both sieges of Paris, and at several of the chief battles; but at the siege of Lamballe in Brittany he received the wound of which he died some days later at Moncontour, August 4, 1591.

Bentivoglio exaggerates in saying that La Noue was as famous by his pen as by his sword. What writings he has left are of value enough, but it is not by them that he is remembered. He was the author of *Discours Politiques et Militaires*, 1587; *Déclaration pour prise d'armes et la défense de Sedan et Jamets*, 1588; *Observations sur l'Histoire de Guicciardini*, 2 vols., 1592; and notes on *Plutarch's Lives*, which have not been published. His *Correspondence* was published in 1854. See *La Vie de François, seigneur de La Noue*, by Moyse Amirault, Leyden, 1661; Brantôme's *Vies des Capitaines Français;* C. Vincen's *Les Héros de la Réforme: Fr. de La Noue* (1875); and Haag, *La France Protestante.*

LANSDOWNE, William Petty Fitzmaurice, first Marquis of (1737–1805), better known as a statesman while earl of Shelburne, was born at Dublin, May 20, 1737. He was a descendant of the lords of Kerry, and his grandfather, who was created earl of Kerry, married a daughter of Sir William Petty. On the death without issue of Sir William Petty's son, the first earl of Shelburne, the estates passed to his nephew John Fitzmaurice (afterwards advanced to the earldom of Shelburne), the father of the subject of the present notice. The latter spent his childhood "in the remotest parts of the south of Ireland," and according to his own account, when at the age of sixteen he entered Christ Church, Oxford, he had both "everything to learn and everything to unlearn." From a tutor whom he describes as "narrow-minded" he received advantageous guidance in his studies, but he attributes his improvement in manners and in knowledge of the world chiefly to the fact that, as was his "fate through life," he fell in "with clever but unpopular connections." Shortly after leaving the university he served as an officer in Wolfe's regiment during the Seven Years' War, and so distinguished himself at Minden and Kloster-Kampen that he was raised to the rank of colonel and appointed aide-de-camp to the king. Being thus brought into near communication with Lord Bute, he was in 1761 employed by that nobleman to negotiate for the support of Charles Fox. For a few months in the same year he sat in the House of Commons as member of Wycombe, until he succeeded his father as earl of Shelburne in the Irish peerage, and Baron Wycombe in the peerage of Great Britain. Though he declined to take office under Bute, he undertook negotiations to induce Fox to gain the consent of the Commons to the peace of 1763. Fox affirmed that he had been duped by the terms offered, and, although Shelburne always asserted that he had acted in thorough good faith, Bute spoke of the affair as a "pious fraud." Shelburne joined the Grenville ministry in 1763 as president of the Board of Trade, but failing in his efforts to replace Pitt in the cabinet, he in a few months resigned office. Having moreover on account of his support of Pitt on the question of Wilkes's expulsion from the House of Commons incurred the serious displeasure of the king, he retired for a time to his estate. After Pitt's return to power in 1766 he became secretary of state, but during Pitt's illness, his conciliatory policy towards America was completely thwarted by his colleagues and the king, and in 1768 he was dismissed from office. In 1782 he consented to take office under the marquis of Rockingham on condition that the king would agree to recognize the United States, and on the death of Lord Rockingham in the same year, he became premier; but the secession of Fox and his supporters led to the famous coalition of Fox with North, which caused his resignation in the following February, his fall perhaps hastened by his proposed plans for the reform of the public service. He had also in contemplation a bill to promote free commercial intercourse between England and the United States. When Pitt acceded to office in 1784, Shelburne, instead of receiving a place in the cabinet, was created marquis of Lansdowne. Though giving a general support to the policy of Pitt, he from this time ceased to take an active part in public affairs. He died May 7, 1805.

During his lifetime the marquis of Lansdowne was blamed for insincerity and duplicity, but the accusations came chiefly from those who were dissatisfied with his preference of principles to party, and it is beyond doubt that, if he had had a more unscrupulous regard to his personal ambition, his career as a statesman would have had more outward success. His autobiography indicates that he was cynical in his estimates of character, but no statesman of his time possessed more enlightened political views, while his friendship with those of his contemporaries eminent in science and literature must be allowed considerable weight in qualifying our estimate of the moral defects with which he has been credited. See Fitzmaurice, *Life of William, Earl of Shelburne*, 3 vols., London, 1875–76.

LANSING, a city in Ingham county, Michigan, U. S., and capital of the State, is situated at the confluence of the Grand and Cedar rivers, 85 miles W.N.W. of Detroit. In 1847, when it was made the seat of government, forests covered the site. The city has broad streets, arranged in the regular rectangular system; and seven iron and three wooden bridges connect the parts of the city, which lies on both sides of the rivers above mentioned. Lansing is the seat of the State reform school, the school for the blind, and the State agricultural college. The last-named, opened in 1857, received 240,000 acres granted by Congress for the endowment of a college of agriculture and the mechanical arts; and its income is derived from the interest of the price of part of the land, and from an annual grant from the State legislature. In 1880–81 it had a faculty of 23 members and 221 students. A graded system of public schools and a State library of 40,000 volumes are among the other educational resources of the city. Its most conspicuous building is the new State capitol, erected at a cost of one and a half million dollars. The leading manufacture is of agricultural implements; but there are extensive manufactories of carriages, wagons, wheelbarrows, and steam-engines, and four large flouring-mills. Good water-power is afforded by the Grand river, and four lines of railway offer ample shipping facilities. The city was incorporated in 1859, and in 1880 had a population of 8319.

LANSINGBURGH, a village in Rensselaer county, New York, U.S., is situated on the east bank of the Hudson, close to Troy, and nearly opposite Waterford, to which a bridge extends. The village was organized in 1774. Its staple product is brushes, known all over the States; but oil-cloth and crackers are also made. The population in 1880 was 7437.

LANTARA, Simon Mathurin (1729–1778), French landscape painter, was born at Oncy, 24th March, 1729. His father was a weaver, and he himself began life as a herdboy; but, having attracted the notice of M. Gille de Reumont, a son of his master, he was taken by him to Paris, and placed under a painter at Versailles. Endowed with great facility and real talent, his powers found ready recognition; he might have amassed fortune and earned distinction, but he could not divest himself of the habits acquired in early childhood. He found the constraint of a regular life and the society of educated people unbearably tiresome; he painted to please himself, and as long as the proceeds of the last sale lasted lived careless of the future in the company of obscure workmen, with whom he had made friends. Rich amateurs more than once attracted him to their houses, only to find that in ease and high living Lantara could produce nothing. Fatal sickness came upon him when in extreme indigence; he entered the hospital of La Charité—in which he had previously been the object of the kindliest cares—on the morning of 22d December, 1778, and six hours after he was dead. His works, now much prized, are not numerous; the Louvre has one landscape, Morning, signed and dated 1761. As he was not a member of the Academy, his pictures were not admitted to its exhibitions, and notices of his works by his contemporaries are rare. Bernard, Joseph Vernet, and others are said to have added figures to his landscapes and sea-pieces. Engravings after Lantara will be found in the works of Lebas, Piquenot, Duret, Mouchy, and others. In 1809 a comedy called *Lantara, or the Painter in the Pothouse*, was brought out at the Vaudeville with great success.

See E. Bellier de la Chavignerie, *Recherches sur le peintre Lantara*, Paris, 1852.

LANTERN-FLY, a name applied to certain insects belonging to the Homopterous division of the order *Hemiptera*, which may be broadly placed in the genus *Fulgora*, although this is now subdivided into many genera. They are mostly large insects, and gayly colored, remarkable for the forehead being produced into the semblance of a snout or muzzle (often upturned at the tip), the so-called "lantern." This snout is hollow, and is merely an inflated production of the head. Much interest, as well as mystery, has surrounded these insects, originating in a statement by Madame Merian in her work on the insects of Surinam (*Metamorphosis insectorum Surinamensium*, etc.), of which the first edition appears to have been published in 1705, but which subsequently passed through many editions with varying titles and in several languages. Madame Merian stated that the common South American species, now known as *Fulgora laternaria*, L., was highly luminous at night, so much so that she was enabled to read by the light of one only, and that when several were confined together the interior of the box appeared all ablaze. No one doubted these statements, and the illustrious Linnæus used the words "Prominente fronte noctu lucem vivacissimam spargit" in diagnosing the insect in his *Systema Naturæ*. Moreover, it was believed that, because one species had been asserted to be luminous, others allied thereto must possess the same power; the specific names used by Linnæus, such as *candelaria*, *phosphorea*, *noctivida*, *lucernaria*, and *flammea*, may be adduced as instances. Of these one only, the *F. candelaria* of China, has become (with the original *laternaria*) a subject of controversy, for it also was asserted to be luminous. As time wore on many intelligent naturalists and other travellers visited both South America and China, and they concluded that the light must be produced only under very exceptional conditions, or that the original statement was an error, for they could not detect any luminosity, nor, as a rule, was such a property believed in by the natives of the regions. Quite recently many naturalists of undoubted authority have resided for years in the districts where these insects occur without having personally detected luminosity (though directly in search of it), and without obtaining any indications of the existence of such a belief in the minds of the natives. On the other hand, there have been a few travellers who have professed to be able to confirm Madame Merian's statements, both from personal observation and from information derived from native sources. Possibly the last of these was within the last twenty years, and his assertion concerned *F. candelaria*, and upon his statement an entomologist of repute, lately deceased, maintained to the last his belief in the luminous powers. With him all faith in this direction has probably passed away. It is not for us to attempt to define the reasons for Madame Merian's positive and circumstantial statements. The preponderance of negative testimony is so crushingly great that *Fulgora* may be regarded as eliminated from the category of luminous insects.

LANTHANUM. It will be convenient to notice under this heading the group of closely allied metals—LANTHANUM, CERIUM, and DIDYMIUM.

In an abandoned copper mine at Riddarhyttan, Westmanland, in Sweden, there occurs a heavy compact mineral, which, though pretty abundant there, is hardly met with anywhere else. This mineral was long mistaken for tungsten (syn. scheelite), until Klaproth of Berlin in 1803 found in it a peculiar earth, which he called *ochroite earth*, as it becomes yellow when heated in air. About the same time Berzelius and Hisinger made the same discovery; and, (rightly) presuming the new earth to be an oxide of a new metal, they called the latter *cerium* (after the planet Ceres, the then latest discovery in astronomy) and the mineral *cerite*, which names have been retained to this day. Only the name "cerium" now has a more specific meaning, it having been shown by Mosander (in 1839–41) that Berzelius's cerium is a mixture of three metallic radicles, namely, cerium proper, lanthanum (from λανθάνειν, "to be concealed"), and didymium (from δίδυμος, "twin"). These metals are very closely related to one another in their chemical character, and may be conveniently treated together. The extraction from cerite, of the oxide group, offers no difficulty. According to Marignac (*Ann. Chim. Phys.* [3], vol. xxvii.), the powdered mineral is made into a thick paste with oil of vitriol, and the reaction which sets in allowed to accomplish itself. The remaining dry white powder is placed in a crucible, and kept there for a long time at a temperature below redness, but sufficient to chase away the bulk of the free sulphuric acid. The residue is added in small instalments to a quantity of cold water, and the gangue (ferruginous silica) filtered off. The solution is boiled, when the greater part of the *cerite-oxides* comes down in the form of sulphate almost free from foreign oxides. The sulphates can be purified by redissolving them in the least quantity of water at 5° to 6° C., filtering and reprecipitating by boiling. What remains in the mother-liquors is recovered by precipitation with sulphate of potash (which must be added as a solid and in sufficient quantity to saturate the solution) as an alum-like double sulphate. The purified sulphates are dissolved in cold water, precipitated as oxalates by means of oxalate of ammonia, and the washed oxalates ignited, when the pure cerite-oxide mixture remains. The separation of the three oxides from one another offers very great difficulties. Comparatively easy is the extraction of approximately pure oxide of cerium—by Berzelius's method. Dissolve the mixed oxide (which must be free of sulphate if the method is to succeed) in nitric acid, evaporate to dryness, ignite the residue, and treat it with nitric acid diluted with one hundred times its weight of water. Only lanthanum and didymium dissolve, impure binoxide of cerium (CeO_2) remaining, which can be further purified by treatment with more concentrated nitric acid, which, however, besides the lanthanum and didymium, dissolves a good deal of the cerium itself. This method (like any of the rest) is founded upon the fact that salts of sesquioxide of cerium (Ce_2O_3) are readily oxidized into salts of the feebly basic binoxide CeO_2 under circumstances which effect no higher oxidation in La_2O_3 or Di_2O_3.

For the preparation of the oxides of lanthanum and didymium we may utilize the nitric mother-liquors obtained in the extraction of cerium-oxide. These are evaporated to dryness, the residue is ignited, and treated with very dilute nitric acid, which dissolves the lanthanum and didymium with only little cerium (Mosander, Marignac). A more complete elimination of the cerium is effected (Bunsen) by converting the nitrates into sulphates (by evaporation with sulphuric acid to dryness, and igniting the residue), dissolving these in sulphuric acid water, and boiling with powdered magnesite ($MgCO_3$). From the filtrate the lanthanum and didymium are precipitated (after acidulation by muriatic) with oxalic acid, and the oxalates filtered off, washed, and ignited. By repeating the magnesia and oxalic acid process two or three times, the oxides are obtained cerium free. They are then made into anhydrous, neutral sulphates; these are dissolved in a minimum of water at 0° to 5° C., and the solution is heated to 30° to 35° C., when lanthanum sulphate chiefly separates out in small crystals, which are filtered off with the help of a filter-pump. A relatively lanthanum-free didymium sulphate remains dissolved (Mosander).

The metals were known only in a powdery form up to 1876, when Hillebrand and Norton succeeded in preparing them in a compact form by the electrolysis of the fused chlorides. The three metals are very similar to one another; they are steel-gray ductile true metals, melting at a somewhat lower temperature than silver. Specific gravities range from 6.1 to 6.6. They are more readily inflammable than magnesium.

The atomic weights of the three elements are now (1882) quoted as Ce=141, La=139, Di=147.

Oxides and Salts.—Cerium has long been known to form two oxides, namely, a lower ("cerous") oxide, which is a pretty strong, and a higher ("ceric") oxide, which is a feeble base. 16 (=O) parts of oxygen are combined, in the former with 92 (= "F") parts, in the latter with $\frac{3}{4}$F parts of metal. Formerly F was looked upon as the atomic weight, and the oxides formulated as FO and F_3O_4 respectively. But Mendelejeff on theoretical grounds insisted that the lower oxide must be looked upon as a sesquioxide Ce_2O_3, where Ce_2=3F or Ce=$\frac{3}{2}$F, and the higher (accordingly) as a binoxide, Ce_2O_4 or rather CeO_2. And he asserted the same in regard to the reputed monoxides of lanthanum and didymium. These remarks were little heeded even by the specialists until Hillebrand (partly in conjunction with Norton) succeeded in obtaining the three metals as such, and in a truly metallic condition, which admitted of an exact determination of the specific heats. The specific heats were found to be—for Ce .04479, for La .04485, for Di .04563; and these numbers must be multiplied with Mendelejeff's atomic weight to produce "atomic heats" (6.6; 6.23; 6.6), approximating to values obtaining for other metals of established atomic weight. Hence Mendelejeff was right.

Cerous oxide, Ce_2O_3, is obtained by heating the oxalate in an atmosphere of hydrogen, as a bluish-gray powder. The higher oxide, CeO_2, is obtained when any certain salt of a volatile acid (*e.g.*, nitric) is ignited in air; it is a white powder, which when cold has only a slight touch of yellow in it, but at high temperatures assumes a deep orange-red color. Cerous chloride, $CeCl_3$, is obtained by heating the metal, or a mixture of either oxide and charcoal, in dry chlorine gas, as a yellowish-white sublimate, uniting with water into indistinct crystals $Ce_2Cl_6+5H_2O$. The cerous sulphate, $Ce_2(SO_4)_3$, separates out when its solution is heated. It is soluble in 6 parts of cold and in about 60 of hot water, and forms a difficultly soluble double salt with sulphate of potash. To obtain the ceric sulphate, when the dioxide is treated with cold concentrated sulphuric acid, and the solution formed by addition of water allowed to evaporate, the salt $Ce_2(SO_4)_3$(ous)$+2Ce(SO_4)_2$(ic)$+25H_2O$ separates out in red crystals looking like bichromate of potash. The mother-liquor yields yellow crystals of $=Ce(SO_4)_2+4H_2O$. The most characteristic test for cerium salts is that the colorless cerous solutions, on addition of hypochlorite of soda, give a red precipitate of a ceric hydrate.

Didymium (Di_2O_3) solutions have an astringent sweetish taste and a rose-red or violet color. But their most characteristic property is their beautiful absorption-spectrum, which comes out distinctly with as little as half an inch deep of a solution containing $\frac{1}{160}$th of a per cent. of the oxide (Gladstone).

Lanthanum (La_2O_3) solutions have a similar taste to those of didymium salts. They are colorless. The chloride when volatilized between the poles of an induction coil yields a highly characteristic rich line-spectrum, by means of which the least traces of the metal can be detected (Bunsen).

Of higher oxides of lanthanum or didymium we had hitherto only indications; but quite lately Dr. Brauner (*Chem. News* for 1881, December 23), in Roscoe's laboratory, succeeded in preparing a definite pentoxide, Di_2O_5, of didymium, and also a hydrate of it, $Di_2O_5.3H_2O$.

Sources.—Cerite, though the most abundant, is not the only native source of cerium, lanthanum, and didymium. A. Cossa has found traces of the metals in the ashes of numerous plants, and even in the human body. But it is more important to state that there are a number of rare minerals, of which the chief are known by the names of gadolinite, euxenite, samarskite, which, along with more or less of cerite metals, contain other rarer earth metals similar to these. Until lately the handbooks of chemistry quoted only three such rarer members of the family under the names of yttrium, erbium, and terbium; but these reputed individual elements have, during the last few years, been searchingly analyzed by Marignac, M. Delafontaine, L. F. Nilson, P. T. Clève, J. L. Smith, and others, and under their hands resolved themselves into about a dozen separate elements. The rare earth-metals in fact bid fair to multiply like the little planets in astronomy; and, although in chemistry no firmly established fact can justly be called unimportant, the minor rare earths, in the meantime, are of no general interest, even to the general chemist.

See Würtz, *Dictionnaire de Chimie*, 1876; Roscoe and Schorlemmer, *Handbook of Chemistry*, 1879; Marignac's and Delafontaine's Memoirs in the *Archives des Sciences physiques et naturelles;* Liebig's *Annalen der Chemie*, 1858-64; Poggendorff's *Annalen*, 1875; *Journal f. prakt. Chemie*, 1858-62; *Zeitschrift f. Chemie*, 1862. The *Jahresbericht der Chemie* is the surest guide to all the literature. (W. D.)

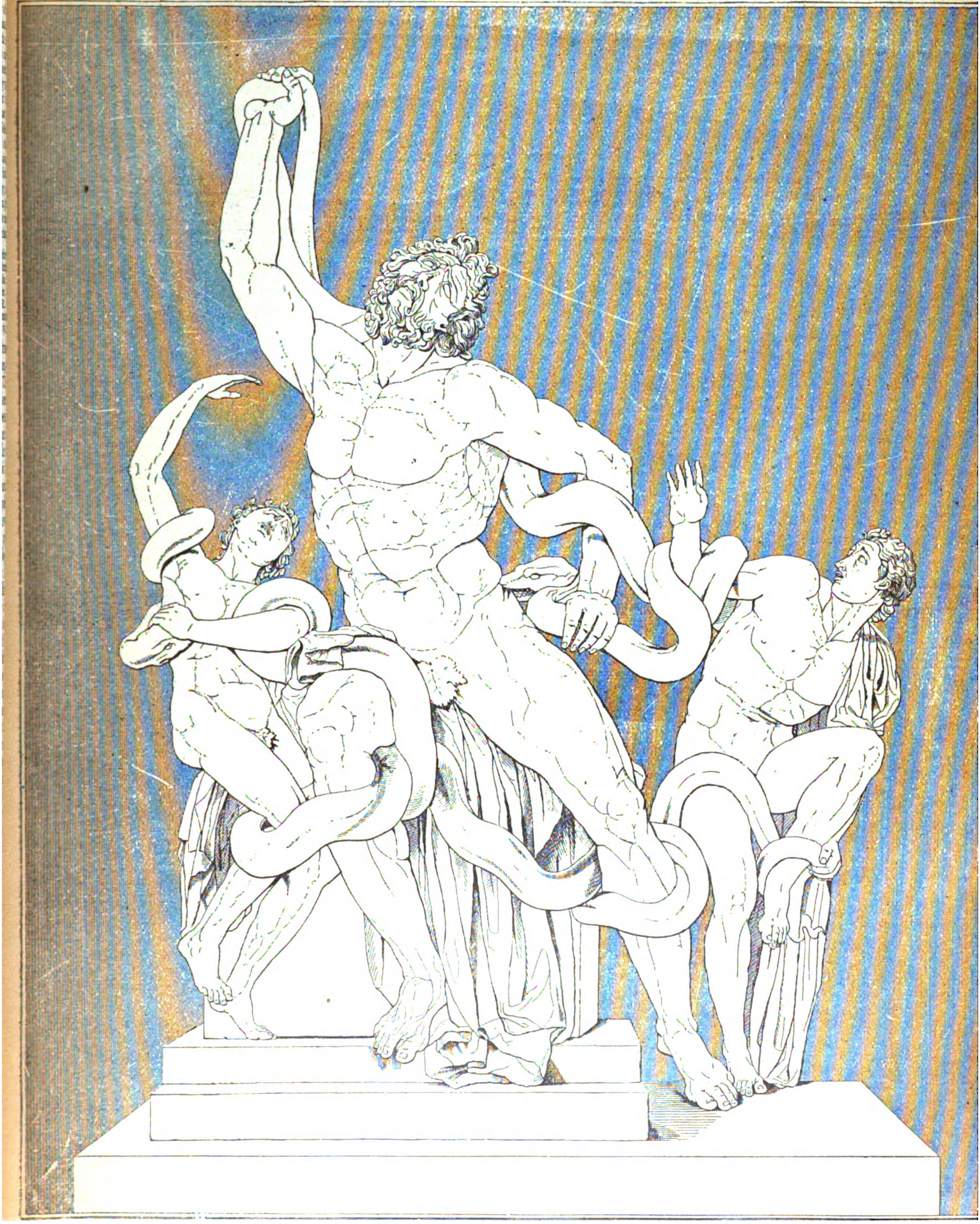
LANZI, Luigi (1732-1810), a writer on Etruscan antiquities and on the history of Italian painting, was born in 1732, and educated as a priest. In 1773 he was appointed keeper of the galleries of Florence, from which time his attention seems to have been divided between the study of Italian painting and the study of Etruscan antiquities and language. In the one field his labors are represented by his *Storia Pittorica della Italia*, the first portion of which, containing the Florentine, Sienese, Roman, and Neapolitan schools, appeared in 1792, the rest in 1796. The work is translated by Roscoe. In archæology his great achievement was the work entitled *Saggio di lingua Etrusca*, 1789, followed by *Saggio delle lingue Ital. Antiche*, 1806. In his memoir on the so-called Etruscan vases (*Dei vasi antichi dipinti volgarmente chiamati Etruschi*, 1806) Lanzi rightly perceived their Greek origin and characters. What was true of the antiquities would be true also, he argued, of the Etruscan language, and the object of the *Saggio di lingua Etrusca* was to prove that this language must be related to that of the neighboring peoples—Romans, Umbrians, Oscans, and Greeks. It is admitted that he was wanting in critical method after a certain point, though at the same time much of the impulse he gave to study arose from his general method of inquiry. It is a sign of the recognition he received that he was allied with E. Q. Visconti in his great but never accomplished plan of illustrating antiquity altogether from existing literature and monuments. His notices of ancient sculpture and its various styles appeared as an appendix to the *Saggio di lingua Etrusca*, and arose out of his careful and minute study of the treasures then added to the Florentine collection from the Villa Medici. The abuse he has often met with from modern writers in the Etruscan language led Corssen (*Sprache der Etrusker*, i. p. vi.) to protest in the name of his real services to philology and archæology. Among his latest productions may be mentioned his edition of Hesiod's *Works and Days*, with valuable notes, and a translation in *terza rima*. It had been begun as far back as 1785, but was recast and completed in 1808. The list of his works closes with his *Opere Sacre*, a series of treatises on spiritual subjects. Lanzi died of apoplexy, March 30, 1810, in the seventy-eighth year of his age. He was buried in the church of the Santa Croce at Florence, by the side of Michelangelo.

LAOCOON, in Greek legend, was a brother of Anchises, and had been a priest of Apollo, but having married against the will of the god, he and the two sons of this marriage were attacked by serpents while preparing to sacrifice a bull at the altar of Poseidon, in whose service Laocoon was then acting as priest. An additional motive for his punishment consisted in

VOL. XIV

LAOCOON

PLATE V.



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his having warned the Trojans against the wooden horse left by the Greeks. But, whatever his crime may have been, the punishment stands out even among the tragedies of Greek legend as marked by its horror—particularly so as it comes to us in Virgil (*Æneid*, ii. 199 *sq.*), and as it is represented in the marble group in the Vatican (see Plate V.). In the oldest existing version of the legend—that of Arctinus of Miletus, which has so far been preserved in the excerpts of Proclus—the calamity is lessened by the fact that only one of the two sons is killed; and this, as has been pointed out (*Arch. Zeitung*, 1879, p. 167), agrees with the interpretation which Goethe in his *Propylæa* had put on the marble group without reference to the literary tradition. He says: "The younger son struggles and is powerless, and is alarmed; the father struggles ineffectively, indeed his efforts only increase the opposition; the elder son is least of all injured; he feels neither anguish nor pain, but he is horrified at what he sees happening to his father, and he screams while he pushes the coils of the serpent off from his legs. He is thus an observer, witness, and participant in the incident, and the work is then complete." Again, "The gradation of the incident is this: the father has become powerless among the coils of the serpent; the younger son has still strength for resistance but is wounded; the elder has a prospect of escape." Lessing, on the other hand, maintained the view that the marble group illustrated the version of the legend given by Virgil, with such differences as were necessary from the different limits of representation imposed on the arts of sculpture and of poetry. These limits required a new definition, and this he undertook in his still famous work, *Laokoon* (see the edition of Hugo Blümner, Berlin, 1876, in which the subsequent criticism is collected). The marble group in the Vatican was found in 1506 near the baths of Titus, and there is no question[1] of its being the same which Pliny (*Nat. Hist.*, xxxvi. c. 5) speaks of as in the palace of Titus, and as the work of three Rhodian sculptors, Agesander, Polydorus, and Athenodorus. They made it, he says, *de consilii sententia*, which, according to the highest Latin authorities, must refer not to a standing imperial council but to a council selected *ad hoc*. This suits the theory of the sculpture being a work of the time of Titus[1]—not an original conception of that time, but a variant of a conception more or less familiar to Greek art since the time of Alexander, such as may be seen in marble reliefs, on gems, in a painting found at Pompeii (see Blümner's *Laokoon*, pls. 2, 3), and on a terra cotta Etruscan urn in the British Museum. The names of Agesander and Athenodorus have been found repeatedly on bases of sculptures in Italy, and the date of the writing is that of the time of Titus. Still the opinion is very generally held that the Vatican group is altogether a work of the Rhodian school during its supremacy after the death of Alexander, and that the artists named by Pliny had lived then, and were apparently a father and two sons, for which reason Pliny may have thought it necessary to add *de consilii sententia*, in the sense of "according to the decision of their combined thoughts," to prevent any one supposing that the artists had each made one of the figures, selecting them possibly in accordance with their own relationship to each other, the father taking Laocoon, and the sons taking respectively the sons of Laocoon. As yet, however, the characteristics of the Rhodian school are not sufficiently known for a final settlement of this long-standing question. In Plate V. the right arm of Laocoon with the coils of the serpent which he holds up is restored,[1] as is also the right arm of the younger son.

(A. S. M.)

LAODICEA (Greek Λαοδίκεια) is the name of at least eight cities, founded or renovated in the later Hellenic period. Most of them were founded by the Seleucid kings of Syria. Seleucus, founder of the dynasty, is said by Appian to have named five cities after his mother Laodice. Many other women of the family bore the same name, which also passed by marriage into the family of the Pontic kings. The victories of Alexander introduced Greek civilization over Asia; the organizing and city-building energy of his successors established and consolidated it. They either founded new cities in favorable situations or reorganized native cities after the Greek model; thus over the immense realm of the Seleucidæ from the Ægean Sea to the borders of India we find numberless cities called Seleucia, Laodicea, etc. So long as Greek civilization held its ground, these were the great commercial and social centres of the country. We find a Laodicea *ad Lycum* in the Mæander valley, on the borders of Phrygia, Caria, and Lydia; another surnamed *Combusta* on the borders of Phrygia, Lycaonia, and Pisidia; a third in Pontus; a fourth, *ad mare*, on the coast of Syria; a fifth, *ad Libanum*, beside the Lebanon mountains; and three others in the far east —Media, Persia, and the lower Tigris valley. In the latter countries Greek civilization was overwhelmed in Orientalism after a century or two, and the last three cities disappeared; the other five continued great throughout the Greek and Roman period, and the second, third, and fourth retain to the present day the ancient name under the pronunciation Ladik, Ladikiyeh, or Latakia (see LATAKIA).

Laodicea ad Lycum was founded probably by Antiochus II. Theos (261–46 B.C.), and named after his wife Laodice. Its site, called by the Turks *Eski Hissar*, "the old castle," is now solitary and deserted; but it retains an undying interest as one of the oldest homes of Christianity and the seat of one of the seven churches of the Apocalypse. Pliny tells us (v. 29) that the town was called in older times Diospolis and Rhoas; but it is certain that at an early period Colossæ, a few miles to the east, and Hierapolis, six miles to the north, were the great cities of the neighborhood, and that Laodicea was a place of no importance till the Seleucid foundation (Str., p. 578). A favorable site was found on some low hills of alluvial formation, about 2 miles south of the river Lycus (Churuk Su) and 9 miles east of the confluence of the Lycus and Mæander. Smaller rivers of the neighborhood are the Asopus, Caprus, and Cadmus, the last named after the lofty range of Mount Cadmus (Baba Dagh), which overhangs the Mæander valley on the south. The great trade route from the Euphrates and the interior passed through Apamea to Laodicea. There it forked, one branch going straight down the Mæander valley to Magnesia and thence north to Ephesus, a distance of about 90 miles, and the other branch crossing the mountains by an easy pass to Philadelphia and the Hermus valley, Sardis, Thyatira, and at last Pergamus. St. Paul (Col. iv. 15) alludes to the situation of Laodicea beside Colossæ and Hierapolis; and the order in which the last five churches of the Apocalypse are enumerated (Rev. i. 11) is explained by their position on the road just described. Placed in this important situation, in the centre of a very fertile district, Laodicea became a rich city. It was famous for its money transactions (Cic., *Ad Fam.*, ii. 17; iii. 5), and for the beautiful soft wool grown by the sheep of the country (Str., 578). Both points are referred to in the message to the church (Rev. ii. 17, 18).

Little is known of the history of the town. It suffered greatly from a siege in the Mithridatic war, but soon recovered its prosperity under the Roman empire. The Zeus of Laodicea, with the curious epithet Azeus or Azeis, is a frequent symbol on the city coins, and is one of the widest-known deities of Western Asia Minor. He is represented standing, holding in the extended right hand an eagle, in the left a spear, the *hasta pura*. Not far from the city was the temple of Men Karou, with a great medical school; while Laodicea itself produced some famous Skeptic philosophers, and gave origin to the royal family of Polemon and Zenon, whose curious history has been illustrated in recent times (Waddington, *Mélanges de Numism.*, ser. ii.; Mommsen, *Ephem. Epigraph.*, i. and ii.; Rayet, *Milet et le Golfe*

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[1] [This identity is doubtful. Inscriptions indicate an origin *c.* 100 B. C. Pliny's statue was of one piece, the Vatican is of several. A replica shows the old Laocoon with right hand behind the head.—AM. ED.]

Latmique, chap. v.). The coinage of Laodicea continues in a rich and unbroken series to the time of the emperor Diocletian. Under the Byzantine rule its greatness remained, but finally the city fell into decay in the frontier wars with the Turkish invaders. Its ruins are of wide extent, but not of great beauty or interest; there is no doubt, however, that much has been buried beneath the surface by the frequent earthquakes to which the district is exposed (Str., 580; Tac., *Ann.*, xiv. 27). For an account of the ruins see the works of Leake, Hamilton, Arundel, Texier, etc., and especially the beautiful drawings of Cockerell in the *Antiquities of Ionia*, vol. iii. pl. 47–51.

LAON, capital of the department of Aisne, France, is situated 87 miles N.E. of Paris, on an isolated and singularly buttressed hill, which rises some 330 feet above the surrounding plain and the little river of Ardon, which flows into the Lette, a tributary of the Oise. From the railway station, which is situated in the plain to the north, a straight staircase of several hundred steps leads up to the gate of the town, but all the roads connecting Laon with the surrounding district are cut in zigzags on the steep slopes, which are crowned by the old and partly ruinous ramparts. At the eastern extremity of the hill rises the citadel; at the other end is a parade ground, and on the south stands the ancient abbey of St. Vincent. Between the latter and the town is the Cuve St. Vincent, the slopes of which are covered with trees, vegetable gardens, and vineyards. From the promenade along the line of the ramparts there is an extensive view northward to beyond St. Quentin, westward to the forest of St. Gobain, and southward over the wooded hills of the Laonnais and Soissonnais.

The cathedral of Laon is one of the most important creations of the art of the 12th and 13th centuries. It took the place of the old cathedral, burned at the beginning of the communal struggles mentioned below. The building is cruciform, and the choir, instead of being apsidal, terminates in a straight wall. Each of the three façades formerly had two towers with spires, and there was also a great central tower. Of these only four remain, and, being without spires, they give the building the aspect of a strong castle. The west front ranks next to that of Notre Dame at Paris in purity. The chapter house and the cloister contain beautiful specimens of the architecture of the beginning of the 13th century. The old episcopal palace, contiguous to the cathedral, is now used as a court-house. The front, flanked by turrets, is pierced by great Pointed windows. There is also a Gothic cloister and an old chapel of two stories, of a date anterior to the cathedral. The church of St. Martin dates from the middle of the 12th century. The old abbey buildings of the same foundation are now used as the hospital. The old 12th century chapel of the Templars now forms part of the establishment of the Brothers of Christian Doctrine. The church of the suburb of Vaux near the railway station dates from the 11th century. Numerous cellars of two or three stories have taken the place of the old quarries in the hill-side. The old ramparts have been demolished, but the 13th century gates of Ardon, Royer, and Chenizelles have been preserved. The Société Académique of Laon has collected in its museum of arts and antiquities many archæological treasures, among others a striking Roman mosaic of the 2d century, representing Orpheus charming the animals by his lyre, and some Roman ewers, noticeable for quality of metal and purity of form. The communal library contains 30,000 volumes, mostly from the neighboring convents; it has also interesting manuscripts and autographs, the most ancient of which, signed by Lothair, bears date 972. Laon owes its rank as capital of the department to its central position and to its age; it numbers only 12,000 inhabitants, and has hardly any trade. The surrounding district produces vegetables and beet-root; the latter crop supplies the sugar-works, which come close to the foot of the hill; but in the town itself the only industries are coopering and the manufacture of blankets and common woollen stuffs.

In virtue of its geographical position, the hilly district of Laon has always had some strategic importance. Even in the time of Cæsar there was a Gallic village where the Remi (inhabitants of the country round Rheims) had to meet the onset of the confederated Belgi. Whatever may have been the precise locality of that battlefield, Laon was fortified by the Romans, and successively checked the invasions of the Franks, Burgundians, Vandals, Alani, and Huns. St. Remigius, the famous archbishop of Rheims who baptized Clovis, was born in the Laonnais, and it was he who instituted the bishopric of the town. Thenceforward Laon was one of the principal towns of the kingdom of the Franks, and the possession of it was often disputed. Charles the Bald had enriched its church with the gift of very numerous domains. After the fall of the Carlovingians Laon took the part of Charles of Lorraine, their heir, and Hugh Capet only succeeded in making himself master of the town by the connivance of the bishop, who in return for this service was made second ecclesiastical peer of the kingdom. Early in the 12th century the communes of France set about emancipating themselves, and the history of the commune of Laon is one of the richest and most varied. The citizens had profited by a temporary absence of Bishop Gaudri to secure for themselves from his representatives a communal charter, but he, on his return, purchased from the king of France the revocation of this document, and recommenced his oppressions. The consequence was a revolt, in which the episcopal palace was burnt and several of his partisans were put to death. The fire spread to the cathedral, and reduced it to ashes. Uneasy at the result of their victory, the rioters went into hiding outside the town, which was anew pillaged by the people of the neighborhood, eager to avenge the death of their bishop. The king alternately interfered in favor of the bishop and of the inhabitants till 1239. After that date the liberties of Laon were no more contested. But it retained its strategic importance, and during the Hundred Years' War it was attacked and taken by the Burgundians, who gave it up to the English, to be retaken by the French after the consecration of Charles VII. Under the League Laon took the part of the Leaguers, and was taken by Henry IV. During the campaign of 1814 Napoleon tried in vain to dislodge Blücher from it. In 1870 an engineer blew up the powder magazine of the citadel at the moment when the German troops were entering the town. Many lives were lost; and the cathedral and the old episcopal palace were damaged by the explosion. At the Revolution Laon permanently lost its rank as a bishopric.

LAOS, or LAWA, a large Indo-Chinese nation occupying the northern and eastern provinces of Siam, known as the Laos states, mainly between 15° and 24° N. lat., 98° and 106° E. long. There are two main divisions—the Lau-pang-kah, or "White Paunch" Laos, and the Lau-pang-dun, or "Black Paunch" Laos, the former between the Deng-Phya-Phai range and the river Mekong, the latter about the middle and upper course of the river Menam, and so called from the habit of tattooing a black pattern about the navel. The Laos are closely related in physique and speech to the Siamese proper, and are by some writers regarded as the primitive stock of that race. They are an historical people who were formerly constituted in an ancient and powerful kingdom, whose capital Vinh-khianh (Vienshan) was taken and destroyed by the Siamese about the year 1828. Since then they have been entirely subject to Siam, and are governed partly by khiao, or native hereditary princes, partly by mandarins or governors directly nominated by the Bangkok authorities. The present khiao of the province of Bassak north of Camboja is the last surviving descendant of the ancient Lao dynasty. The khiao are invested by means of the gold dish, betel-box, spittoon, and teapot, which are sent from Bangkok, and returned at their death or deposition. Of all the khiao the most powerful is the prince of Ubon (15° N., 105° E.), whose jurisdiction extends nearly from Bassak on the Mekong northwards to the great southern bend of that river.

The many contradictory accounts of the Laos that have been published by travellers are due to the fact that quite three-fourths of the race have become mixed with the surrounding Khas or aboriginal inhabitants of the peninsula. The half-castes that have thus sprung from alliances with the Bolovens, Thêhs, Redehs, Sui, and other wild tribes of Caucasic stock present every variety between that type and the Mongolian. But those that have preserved the purity of their blood are still distinguished by the high cheek bones, small flat nose, oblique eyes, wide mouth, black lank hair, sparse beard, and yellow complexion of the Tai and other branches of the Mongol family. These are also a semi-civilized people with a knowledge of letters, followers of the Buddhist teachings, settled in small towns and villages, and engaged chiefly in agriculture. They have domesticated the elephant and buffalo, and are peaceful and industrious, being skilled in the production of lacquered wares, and silk and cotton fabrics for local use. Trading relations have also long been established with China, Siam, Burmah, and Camboja, with which countries their ivory, gold dust, tin, gums, lac, benzoin, raw silk, skins, and sapanwood are bartered for cotton cloth, chintzes, silks, opium, hardware, and porcelain. At present a large portion of this trade is in the hands of itinerant Burmese dealers and hawkers, who are met everywhere between the Irawadi and Mekong valleys, organized in small caravans with a headman and porters all well armed, like the Povindahs of Afghanistan.

The civilized Laos have long been addicted to slave hunting, not only with the sanction but even with the co-operation of the authorities. When times are hard and tribute cannot otherwise be raised, "the Lao mandarins organize regular expeditions against the wild tribes. On some slight pretext a favorable camping ground is chosen, whence attacks are made in all directions on villages, which they hope to surround or surprise. The savages live only in small hamlets consisting of a few huts, and they are powerless to resist the attacks of men armed with guns. These razzias are usually made only against the independent savages who reject the authority of the Lao princes and refuse to pay tribute. But I have noticed that the compact by which the savages consent to surrender a part of their independence, in order to preserve their wives, children, and themselves, is far from being always respected; and the unfortunate Gnia-heuns, for example, who dwell within a few leagues of Bassak, are in the greatest terror of the prince, refusing on any consideration to leave their forests or inaccessible villages."[1] The convoys of slaves, purchased chiefly by Chinese and Malay dealers from Camboja, are forwarded mainly to Bangkok, Korat, and Phnom-penh, the present capital of Camboja. This organized slave trade is the great curse of the nation, and tends more than all other causes combined to retard the natural development of the Lao country.

The mixed Lao peoples are distinguished from the pure stock chiefly by their more regular features, tall stature, lighter complexion, sub-dolichocephalic crania, and generally lower social condition. Most of them, although nominal Buddhists, are in reality still nature-worshippers, who make offerings of sticks and stones to the local genii, and guard their homes against evil spirits by means of brooms, cotton threads, bunches of herbage, and other curious devices. Some of them are quite as savage as the wild tribes, and, although acquainted with the use of firearms, still use the characteristic crossbow, a formidable weapon, which in skilled hands will kill a buffalo with a simple bamboo arrow at considerable distances. In some parts the confusion of types and usages is so great that the true Khas can be distinguished from the Laos only by the lobe of the ear, which is pierced for the insertion of large bone, ivory, or wooden ornaments, like those worn by many of the Oceanic races.

Apart from the passions associated with the infamous slave trade, encouraged by their rulers, the Laos are an inoffensive, unwarlike, and peace-loving race, fond of music, and living chiefly on a diet of rice, vegetables, fruits, fish, and poultry. Pure and mixed, they number altogether perhaps some 1,500,000.

LÂO-TSZE, or **LAOU-TSZE**, the designation of the author of the celebrated treatise called *Tâo Teh King*, and the reputed founder of the religion called *Tâoism*. The Chinese characters composing the designation may mean either "the Old Son," which commonly assumes with foreigners the form of "the Old Boy," or "the Old Philosopher." The latter significance is attached to them by the Rev. Dr. Chalmers in his translation of the treatise published in 1868 under the title of *The Speculations on Metaphysics, Polity, and Morality of the "Old Philosopher," Lâo-tsze.* The former is derived from a fabulous account of Lâo-tsze which appeared in the *Shăn Hsien Chwan*, "The Account of Spirits and Immortals," of Ko Hung, in our 4th century. According to this, his mother, after a supernatural conception, carried him in her womb sixty-two years (or seventy-two, or eighty-one—ten years more or fewer are of little importance in such a case), so that when he was born at last, his hair was white as with age, and people might well call him "the old boy." The other meaning of the designation rests on better authority. We find it in the *Kiâ Yü*, or "Narratives of the Confucian School," compiled in our 3d century from documents said to have been preserved among the descendants of Confucius, and also in the brief history of Lâo-tsze given in the historical records of Sze-ma Ch'ien (about 100 B.C.). In the latter instance the designation is used by Confucius, and possibly it originated with him. It should be regarded more as an epithet of respect than of years, and is equivalent to "the Venerable Philosopher."

All that Ch'ien tells us about Lâo-tsze goes into small compass. His surname was Lî, and his name Urh. He was a native of the state of Ch'û, and was born in a hamlet, which we must place not far from the present prefectural city of Kwei-teh in Ho-nan province. What is of more importance, he was one of the recorders or historiographers at the court of Châu, his special department being the charge of the whole or a portion of the royal library. He must thus have been able to make himself acquainted with all the history of his country, and of the men who had played the most distinguished part in its affairs. Ch'ien does not mention the year of his birth, which is often said, though on what Chinese authority does not appear, to have taken place in the third year of King Phing, corresponding to 604 B.C. That date cannot be far from the truth. That he was contemporary with Confucius is established by the concurrent testimony of the *Lî Kî* and the *Kiâ Yü* on the Confucian side, and of Chwang-tsze and Sze-ma Ch'ien on the Tâoist. The two men whose influence has been so great on all the subsequent generations of the Chinese people, and whose views are now more attentively studied by thinking men of other nations than ever they were before—Khung-tsze and Lâo-tsze—had at least one interview, in 517 B.C., when the former was in his thirty-fifth year. The conversation between them was interesting. Lâo was in a mocking mood; Khung appears to the greater advantage.

If it be true that Confucius, when he was fifty-one years old, visited Lâo-tsze, as Chwang-tsze says (in the *Thien Yun*, the fourteenth of his treatises), to ask about the *Tâo*, they must have had more than one interview. Dr. Chalmers, however, has pointed out that both Chwang-tsze and Lieh-tsze (a still earlier Tâoist writer) produce Confucius in their writings, as the lords of the Philistines did the captive Samson on their festive occasions, "to make sport for them." Their testimony is valueless as to any matter of fact. There may have been several meetings between the two in 517 B.C., but we have no evidence that they were together in the same place after that time. Ch'ien adds: "Lâo-tsze cultivated the *Tâo* and virtue, his chief aim in his studies being how to keep himself concealed and unknown. He resided (at the capital of) Châu; but after a long time, seeing the decay of the dynasty, he left it, and went away to the Gate (leading from the royal domain into the regions beyond,—at the entrance of the pass of Han-kû, in the northwest of Ho-nan). Yin Hsî, the warden of the gate, said to him, 'You are about to withdraw yourself out of sight; I pray you to compose for me a book (before you go).' On this Lâo-tsze made a writing, setting forth his views on the *tâo* and virtue, in two sections, containing more than 5000 characters. He then went away, and it is not known where he died." The historian then mentions the names of two other men whom some regarded as the true Lâo-tsze. One of them was a Lâo Lâi, a contemporary of Confucius, who wrote fifteen treatises (or sections) on the practices of the school of *Tâo*. Subjoined to the notice of him is the remark that Lâo-tsze was more than one hundred and sixty years old, or, as some say, more than two hundred, because by the cultivation of the *Tâo* he nourished his longevity. The other was "a grand historiographer" of Châu, called Tan, one hundred and twenty-nine (? one hundred and nineteen) years after the death of Confucius. The introduction of these disjointed notices detracts from the verisimilitude of the whole narrative in which they occur.

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[1] Dr. Harmand, *Tour du Monde*, July 5, 1879.

Finally, Ch'ien makes the remark that "Lâo-tsze was a superior man, who liked to keep in obscurity," traces the line of his posterity down to the 2d century B.C., and concludes with this important statement:—"Those who attach themselves to the doctrine of Lâo-tsze condemn that of the literati, and the literati on their part condemn Lâo-tsze, thus verifying the saying, 'Parties whose principles are different cannot take counsel together.' Lî Urh taught that transformation follows, as a matter of course, the doing nothing (to bring it about), and rectification ensues in the same way from being pure and still."

Leaving these scanty historical notes, and accepting the *Tâo Teh King* as the veritable work of Lâo-tsze, we must now try to give the reader some idea of its contents. Consisting, it has been seen, of not more than between five and six thousand characters, it is but a short treatise,—not half the size of our Gospel of St. Mark. The nature of the subject, however, the want of any progress of thought or of logical connection between its different parts, and the condensed style, with the mystic tendencies and poetical temperament, of the author, make its meaning extraordinarily obscure,—as native scholars and Sinologists have found to their cost. Divided at first into two parts, it has subsequently and conveniently been subdivided into chapters. One of the oldest, and the most common, of these arrangements makes the chapters eighty-two.

Some Roman Catholic missionaries, nearly two centuries ago, fancied that they found a wonderful harmony between many passages and the teaching of our sacred Scriptures. Montucci of Berlin, who had adopted their views, ventured to say in 1808:—"Many things about a Triune God are so clearly expressed that no one who has read this book can doubt that the mystery of the Holy Trinity was revealed to the Chinese five centuries before the coming of Jesus Christ." Even Remusat, the first occupant of a Chinese chair in Europe, published at Paris, in 1823, his *Mémoire sur la Vie et les Opinions de Lâo-tsze*, to vindicate the view that the Hebrew name Jehovah was phonetically represented in the fourteenth chapter by Chinese characters. These fancies were exploded by the late Stanislas Julien, when he issued, in 1842, his translation of the whole treatise as *Le Livre de la Voie et de la Vertu*.

The most important thing is to determine what we are to understand by the *Tâo*, for *Teh* is merely its outcome, especially in man, and is rightly translated by our word "virtue." Julien, we have just seen, translated *Tâo* by "la voie." Chalmers leaves it untranslated. "No English word," he says (p. xi.), "is its exact equivalent. Three terms suggest themselves—the way, reason, and the word; but they are all liable to objection. Were we guided by etymology, 'the way' would come nearest the original, and in one or two passages the idea of a way seems to be in the term; but this is too materialistic to serve the purpose of a translation. 'Reason,' again, seems to be more like a quality or attribute of some conscious being than *Tâo* is. I would translate it by 'the Word,' in the sense of the Logos, but this would be like settling the question which I wish to leave open, viz., what resemblance there is between the Logos of the New Testament and this Chinese Tâo." Latterly some Sinologues in China have employed "nature" as our best analogue of the term. Thus Watters (*Lâo-tsze, A Study in Chinese Philosophy*, p. 45) says:—"In the *Tâo Teh King* the originator of the universe is referred to under the names Non-Existence, Existence, Nature (*Tâo*), and various designations,—all which, however, represent one idea in various manifestations. It is in all cases Nature (*Tâo*) which is meant." This view has been skilfully worked out; but it only hides from us the scope of "the Venerable Philosopher." "Nature" cannot be accepted as a translation of *Tâo*. That character was, primarily, the symbol of a way, road, or path; and then, figuratively, it was used, as we also use *way*, in the senses of means and method,—the *course* that we pursue in passing from one thing or concept to another as its end or result. It is the name of a quality. Professor Douglas has well said (*Confucianism and Tâoism*, p. 189):—"If we were compelled to adopt a single word to represent the *Tâo* of Lâo-tsze, we should prefer the sense in which it is used by Confucius, 'the way,' that is, *μέθοδος*."

What then was the quality which Lâo-tsze had in view, and which he thought of as the *Tâo*,—there in the library of Châu, at the pass of the valley of Han, and where he met the end of his life beyond the limits of the civilized state? It was the simplicity of spontaneity, action (which might be called non-action) without motive, free from all selfish purpose, resting in nothing but its own accomplishment. This is found in the phenomena of the material world. "All things spring up without a word spoken, and grow without a claim for their production. They go through their processes without any display of pride in them; and the results are realized without any assumption of ownership. It is owing to the absence of such assumption that the results and their processes do not disappear" (chap. ii.). It only needs the same quality in the arrangements and measures of government to make society beautiful and happy. "A government conducted by sages would free the hearts of the people from inordinate desires, fill their bellies, keep their ambitions feeble, and strengthen their bones. They would constantly keep the people without knowledge and free from desires; and, where there were those who had knowledge, they would have them so that they would not dare to put it in practice" (chap. iii.). A corresponding course observed by individual man in his government of himself, becoming again "as a little child" (chaps. x. and xxviii.), will have corresponding results. "His constant virtue will be complete, and he will return to the primitive simplicity" (chap. xxviii.).

Such is the subject-matter of the *Tâo Teh King*,—the operation of this method or *Tâo*, "without striving or crying," in nature, in society, and in the individual. Much that is very beautiful and practical is inculcated in connection with its working in the individual character. The writer seems to feel that he cannot say enough on the virtue of humility (chap. viii., etc.). There were three things which he prized and held fast,—gentle compassion, economy, and the not presuming to take precedence in the world (chap. lxvii.). His teaching rises to its highest point in chap. lxiii.:—"It is the way of *Tâo* not to act from any personal motive, to conduct affairs without feeling the trouble of them, to taste without being aware of the flavor, to account the great as small and the small as great, to recompense injury with kindness." This last and noblest characteristic of the *Tâo*, the requiting "good for evil," is not touched on again in the treatise; but we know that it excited general attention at the time, and was the subject of conversation between Confucius and his disciples (*Confucian Analects*, xiv. 36).

What is said in the *Tâo* on government is not, all of it, so satisfactory. The writer shows, indeed, the benevolence of his heart. He seems to condemn the infliction of capital punishment (chaps. lxxiii. and lxxiv.), and he deplores the practice of war (chap. lxix.); but he had no sympathy with the progress of society or with the culture and arts of life. He says (chap. lxv.):—"Those who anciently were skilful in practising the *Tâo* did not use it to enlighten the people; their object rather was to keep them simple. The difficulty in governing the people arises from their having too much knowledge, and therefore he who tries to govern a state by wisdom is a scourge to it, while he who does not try to govern thereby is a blessing." The last chapter but one is the following:—"In a small state with a few inhabitants I would so order it that the people, though supplied with all kinds of implements, would not (care to) use them; I would give them cause to look on death as a most grievous thing, while yet they would not go away to a distance to escape from it. Though they had boats and carriages, they should have no occasion to ride in them. Though they had buff coats and sharp weapons, they should not don or use them. I would make them return to the use of knotted cords (instead of written characters). They should think their coarse food sweet, their plain clothing beautiful, their poor houses places of rest, and their common simple ways sources of enjoyment. There should be a neighboring state within sight, and the sound of the fowls and dogs should be heard from it to us without interruption, but I would make the people to old age, even to death, have no intercourse with it."

On reading these sentiments, we must judge of Lâo-tsze that, with all his power of thought, he was only a dreamer. But thus far there is no difficulty arising from his language in regard to the *Tâo*. It is simply a quality, descriptive of the style of character and action, which the individual should seek to attain in himself, and the ruler to impress on his administration. The language about the *Tâo* in nature is by no means so clear. While Professor Douglas says that "the way" would be the best translation of *Tâo*, he immediately adds:—"But *Tâo* is more than the way. It is the way and the way-goer. It is an eternal road; along it all beings and things walk; but no being made it, for it is being itself; it is everything, and nothing, and the cause and effect of all. All things originate from *Tâo*, conform to *Tâo*, and to *Tâo* at last they return."

Some of these representations require modification; but no thoughtful reader of the treatise can fail to be often puzzled by what is said on the point in hand. Julien, indeed, says with truth (p. xiii.) that "it is impossible to take *Tâo* for the primordial Reason, for the sublime Intelligence, which has created and governs the world;" but the fact is that many of Lâo-tsze's statements are unthinkable if there be not behind the *Tâo* the unexpressed recognition of a personal creator and ruler. Granted that he does not affirm positively the existence of such a Being, yet certainly he does not deny it, and his language even implies it. It has been said, indeed, that he denies it, and we are referred in proof to the fourth chapter:—"*Tâo* is like the emptiness of a vessel; and the use of it, we may say, must be free from all self-sufficiency. How deep and mysterious it is, as if it were the author of all things! We should make our sharpness blunt, and unravel the complications of things; we should attemper our brightness, and assimilate ourselves to the obscurity caused by dust. How still and clear is *Tâo*, a phantasm with the semblance of permanence! I do not know whose son it is. It might appear to have been before God (*Tî*)."

The reader will not overlook the cautious and dubious manner in which the predicates of *Tâo* are stated in this remarkable passage. The author does not say that it was before God, but that "it might appear" to have been so. Nowhere else in his treatise does the nature of *Tâo* as a method or style of action come out more clearly. It has no positive existence of itself; it is but like the emptiness of a vessel, and the manifestation of it by men requires that they endeavor to free themselves from all self-sufficiency. Whence came it? It does not shock Lâo-tsze to suppose that it had a father, but he cannot tell whose son it is. And, as the feeling of its mysteriousness grows on him, he ventures to say that "it might appear to have been before God."

There is here no denial but express recognition of the existence of God, so far as it is implied in the name *Tî*, which is the personal name for the concept of heaven as the ruling power, by means of which the fathers of the Chinese people rose in prehistoric time to the idea of God. Again and again Lâo-tsze speaks of heaven just as "we do when we mean thereby the Deity who presides over heaven and earth." These last words are taken from Watters (p. 81); and, though he adds, "we must not forget that this heaven is inferior and subsequent to the mysterious *Tâo*, and was in fact produced by it," it has been shown how rash and unwarranted is the ascription of such a sentiment to "the Venerable Philosopher." He makes the *Tâo* prior to heaven and earth, which is a phrase denoting what we often call "nature," but he does not make it prior to heaven in the higher and immaterial usage of that name. The last sentence of this treatise is:—"It is the *Tâo*—the way—of Heaven to benefit and not injure; it is the *Tâo*—the way—of the sage to do and not strive."

It is impossible to go in the present article into an exposition of the *Tâo Teh King* at greater length. Since Julien laid it fairly open to Western readers in 1842, there has been, it appears to the writer, a tendency to overestimate rather than to underestimate its value as a scheme of thought and a discipline for the individual and society. There are in it, indeed, lessons of unsurpassed value, such as the inculcation of simplicity, humility, and self-abnegation, and especially the brief enunciation of the divine duty of returning good for ill; but there are on the other hand the regretful representations of a primitive society when men were ignorant of the rudiments of culture, and the longings for its return.

When it was thought that the treatise made known the doctrine of the Trinity, and even gave a phonetic representation of the Hebrew name Jehovah, it was natural, even necessary, to believe that its author had had communication with more western parts of Asia, and there was no end of speculation about visits to India and Judæa, and even to Greece. The necessity for assuming such travels has passed away, and they have ceased to be thought of If we can receive Sze-mâ Ch'ien's histories as reliable, Lâo-tsze might have heard, in the states of Châu and among the wild tribes adjacent to them, views about society and government very like his own. Ch'ien relates how an envoy came in 624 B.C.—twenty years, that is, before the date assigned to the birth of Lâo-tsze—to the court of Duke Mû of Ch'in, sent by the king of some rude hordes on the west. The duke told him of the histories, poems, codes of rites, music, and laws which they had in the middle states, while yet rebellion and disorder were of frequent occurrence, and asked how good order was secured at all among the wild people, who had none of those appliances. The envoy smiled, and replied that the troubles of China were occasioned by those very things of which the duke vaunted, and that there had been a gradual degeneration in the condition of its states, as their professed civilization had increased ever since the days of the ancient age, Hwang Tî, whereas in the land he came from, where there was nothing but the primitive simplicity, their princes showed a pure virtue in their treatment of the people, who responded to them with loyalty and good faith. "The government of a state," said he in conclusion, "is like a man's ruling his own single person. He rules it, and does not know how he does so; and this was indeed the method of the sages." Lâo-tsze did not need to go further afield to find all that he has said about government.

We have confined ourselves to the Tâoism of the *Tâo Teh*

King without touching on the religion Tâoism now existing in China, but which did not take shape until more than five hundred years after the death of Lâo-tsze, though he now occupies the second place in its trinity of "The three Pure or Holy Ones." There is hardly a word in his treatise that savors either of superstition or religion. In the works of Lieh-tsze and Chwang-tsze, his earliest followers of note, we find abundance of grotesque superstitions; but their beliefs (if indeed we can say that they had beliefs) had not become embodied in any religious institutions. When we come to the Ch'ien dynasty (221-206 B.C.), we meet with a Tâoism in the shape of a search for the fairy islands of the eastern sea, where the herb of immortality might be gathered. In our first century a magician, called Chang Tâo-ling, comes before us as the chief professor and controller of this Tâoism, preparing in retirement "the pill" which renewed his youth, supreme over all spirits, and destroying millions of demons by a stroke of his pencil. He left his books, talismans, and charms, with his sword and seal, to his descendants, and one of them, professing to be animated by his soul, dwells at this day on the Lung-hû mountain in Keang-se, the acknowledged head or pope of Tâoism. But even then the system was not yet a religion, with temples or monasteries, liturgies, and forms of public worship. It borrowed all these from Buddhism, which first obtained public recognition in China between 65 and 70 A.D., though at least a couple of centuries passed before it could be said to have free course in the country.

Even still, with the form of a religion, Tâoism is in reality a conglomeration of base and dangerous superstitions. Alchemy, geomancy, and spiritualism have dwelt and dwell under its shadow. Each of its "three Holy Ones" has the title of *Thien Tsun*, "the Heavenly and Honored" taken from Buddhism, and also of *Shang Tî* or God, taken from the old religion of the country. The most popular deity, however, is not one of them, but has the title of *Yü Wang Shang Tî*, "God, the Perfect King." But it would take long to tell of all its "celestial gods," "great gods," "divine rulers," and others. It has been doubted, we have said, whether Lâo-tsze acknowledged the existence of a God at all, but the Tâoism of the present day is a system of the wildest polytheism. The science and religion of the West will meet from it a most determined opposition. The "Venerable Philosopher" himself would not have welcomed them. The shrieking of our steam-engines, the bustle of our commerce, and the onward march of our various enterprises would have nearly driven him mad; but he ought not to bear the obloquy of being the founder of the Tâoist religion. (J. LE.)

LA PAZ, officially since 1825 LA PAZ DE AYACUCHO, in memory of the battle of Bolivian independence, is the capital of Bolivia, at the head of a department of its own name. It lies in 16° 30′ S. lat. and 68° W. long., at the height of 11,970 feet above the sea, in the valley of the Chuquiapo or Rio de la Paz, at the base of the Cordillera Real, which rises with imposing cliffs another thousand feet above it. About 40 miles to the east of Lake Titicaca, La Paz has regular coach and steamer communication with Puno, and so with Mollendo on the Pacific. Commercially the town is of very considerable importance as the centre of the Bolivian trade in cuca and cinchona. Among the public buildings are the cathedral founded by Pope Paul V. in 1605, and ranking as one of the finest in South America, the church of San Francisco erected by the Jesuits, the university (San Andres), and the president's palace. The population, which consists largely of Aymaras, is estimated at between 70,000 and 80,000. The city dates from 1548, and the name Pueblo Nuevo de N. Señora de la Paz was given by its founder, Alonzo de Mendozo, in honor of the reconciliation between Pizarro and Almagro. In 1605 it was made a bishopric.

LA PÉROUSE, JEAN-FRANÇOIS GALAUP DE (1741–c. 1788), a French navigator, was born near Albi, August 22, 1741. His family name was Galaup, and La Pérouse or La Péyrouse was an addition adopted by himself from a small family estate. As a lad of eighteen, he was wounded and made prisoner on board the "Formidable" when it was captured by Admiral Hawke in 1759; and during the war with England between 1778 and 1783 he served with distinction in various parts of the world, more particularly on the eastern coasts of Canada. His celebrity, however, is rather due to the expedition fitted out by the French Government in 1785 for the discovery of the Northwest Passage, and the verification of various matters left doubtful by previous circumnavigators. La Pérouse was placed in command of the "Boussole." and his chief assistant De Langle in command of the "Astrolabe." They sailed from Brest, August 1, 1785, and reached Mount St. Elias, on the coast of Alaska, June 23, 1786. From the search for the Northwest Passage they were deterred by the same storms which had proved too much for earlier adventurers; and, though they visited the Sandwich Islands, Macao, and the Philippines, it was not till they reached the coasts of Northwestern Asia that they really broke new ground. There the discovery of Sangar Strait and La Pérouse Strait showed that Saghalien and Yezo were each an independent island. The explorers were well received by the Russian authorities in Kamchatka, and M. Lesseps was sent home overland with the records of the expedition. In December, 1787, De Langle, Lamonon the naturalist, and ten of the crew of the "Astrolabe" were massacred on one of the Navigator Islands; and, after reaching Botany Bay in safety, the rest of the expedition was not again heard of. It was not till 1825 that Captain Dillon found the wreckage of what must have been the "Boussole" and the "Astrolabe" on the reefs of Varikoro, an island to the north of the New Hebrides.

See Milet Mureau, *Voyage de la Pérouse autour du Monde*, Paris, 1797, 4 vols.; Peter Dillon, *Narrative . . . . of a Voyage in the South Seas*, London, 1829.

LAPIDARY (*lapidarius*, from *lapis*, a stone), one who cuts, grinds, polishes, and engraves small pieces of stone, especially gems. The prehistoric stone implements found in cave deposits, peat-mosses, river-gravels, etc., may be regarded as the earliest examples of the chipping and grinding of stone. Small cylinders of serpentine and other soft stones, on which figures and inscriptions were engraved, were fabricated in very early times by the Assyrians. Similar cylinders were afterwards made in rock-crystals, chalcedony, hæmatite, etc., and these harder substances were engraved by means of drills charged with the powder of still harder minerals. The use of such drills is said to date as far back as the year 730 B.C. These cylinders were perforated by round holes, and were strung as necklaces. The stone scarabei and other amulets of the Egyptians were carved or chiselled, and, according to King (*Handbook of Engraved Gems*, 1866), these people do not appear to have followed the Ninevites and Babylonians in the use of the drill. This tool was, however, largely employed by the Etruscan lapidaries, who also used a diamond point in finishing their work. Signets were used by the Greeks as early as 600 B.C., and in the time of Alexander gems of all kinds were cut and engraved, with the exception of the diamond. The art of cutting diamonds was probably known to the Hindus and the Chinese in very early times, but it was unknown in Europe until nearly the close of the 15th century, the diamond cut and polished for Charles the Bold, duke of Burgundy, in 1475 being the first recorded example. The diamond point was extensively used in engraving the gems of the 16th, 17th, and early part of the 18th centuries, when skilful imitations of the antique gems were fabricated, and the employment of this tool is already spoken of by Pliny

FIG. 1.

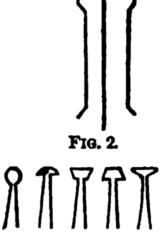

FIG. 2.

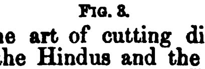

FIG. 3.

(*H. N.* xxxviii. 15) and Solinus, c. 52. The drills used by the ancients were worked either by hand or with a bow. Holes are now drilled in stone by means of an iron or copper tube, fed with diamond dust and oil (fig. 1).

The small tools used for engraving stones are set in a horizontal position, and are worked by vertical driving gear (fig. 2). They are of various forms, some of which are shown in fig. 3, and are made of soft iron and charged with diamond dust and oil. Any substance finely pulverized, and of greater hardness than the material operated upon, may be used for cutting and grinding stone, but diamond dust is preferred as it can be used sparingly by the employment of very thin slitting disks, into the edges of which it is imbedded by the application of an agate or glass roller, the dust being previously worked into a paste with oil. Oil of brick or soft soap is used freely as a lubricant during the process of cutting. The diamond powder is procured by finely pulverizing imperfect stones, usually the coarse variety termed *bort* or carbonado, in a steel mortar; or it is ground between flat iron slabs with oil or brick.

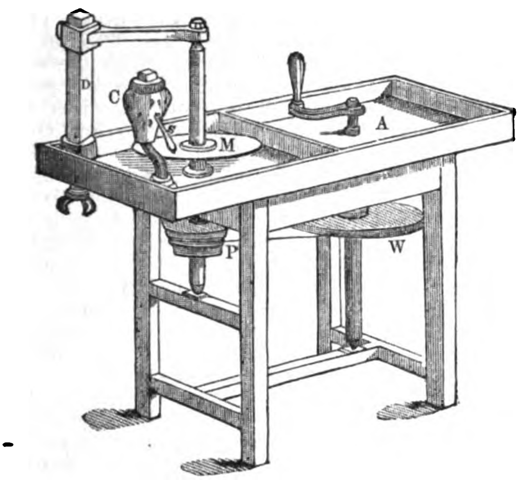

Fig. 4.—Lapidary's Mill.

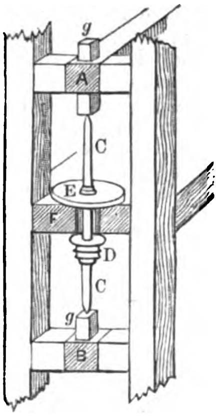

Fig. 5.—Part of Lapidary's Mill. A, upper summer (cut through); B, lower summer (cut through); C, spindle; D, pulley; E, lap; F, table (cut through); *g*, *g*, wooden blocks, adjusted by means of wedges.

The iron slicing disk in common use is 8 or 9 inches in diameter and about $\frac{1}{16}$ inch in thickness. Such disks with their driving gear are termed *slitting-mills*. When leaden laps charged with emery mud are substituted the arrangement is called a *roughing-mill*, and when leaden or pewter laps charged with rotten-stone are used it is known as a *polishing-mill*. The mills are sometimes worked by steam power, sometimes by hand. In the ordinary pattern of a lapidary's bench the handle turns in a horizontal plane, as shown in fig. 4, where W is the driving-wheel, turned by the handle A, and working the pulley P by means of a strap. The pulley is fixed on a vertical spindle which carries M, the disk, for slitting or the leaden lap for roughing or polishing. The upper end of this spindle is conical, and rotates in a socket drilled in a horizontal arm of iron which projects from a vertical wooden rod D. A block of wood C fits on to the end of an iron support termed the *gim-peg* or *germ-peg*. This support is used to steady the operator's arm when grinding the edges of small stones, and the wooden block, which is fixed by a wedge, is employed for cutting facets at any desired angle, the stone being cemented to the end of a stick S, which is fixed at the requisite angle in one of the holes or notches made in the sides of the socket C. In slicing stones it is necessary not to bring any sharp edge of the stone against the disk, but to commence upon a moderately flat or smooth surface, otherwise the charge of diamond dust or *seasoning*, which should last for several hours, will be stripped off during the first revolution.

Another form of lapidary's mill consists of a strong framework of oak, 8 or 9 feet long by 6 or 7 feet in height, and with a breadth of about 2 feet. It is formed of four square uprights, mortised into a couple of sole-bars, and braced together by eight cross-bars at top and bottom, which, like all the other parts of the frame, are mortised and strongly bolted together. Half way up the frame a strong board or table is fixed, and above and below this table stout wooden bars or *summers* run the length of the frame. In each of these summers are two square holes through which slide short oaken rods having square sections and bored out conically at the ends to receive the upper and lower extremities of the iron spindles which carry the laps or slicers (fig. 5). The remainder of the working parts are very similar to those already described, except that the driving-wheels are very large and the lower extremities of their axletrees, which are conical, rest upon sockets fixed to the floor, while their upper ends revolve in holes in a beam. The driving-wheels drop over pegs which project from the upper sides of collets, immediately beneath which the axle has a crank. The crank is connected with an arm composed of three flat iron bars, which are fixed together at suitable lengths by square rings. The other end of the crank bar is provided with a stud by which it is attached to a pivoted wooden arm carrying two upright pegs, which serve as handles for the operator, who imparts a backward and forward motion to the arm.

A very important substitute for the gim-peg socket, already described, is the *dial*, by means of which facets can be cut with great precision. One of the improved forms of the lapidary's dial consists of two jaws *a*, *a* (fig. 6), in each of which a hemispherical cavity is ground, and within this cavity a brass ball *b* is contained by the jaws when they are clamped together. A brass tube is attached to this ball, and carries a circular dial *d* at its upper end. Into the lower end of the tube is tightly inserted the cement-rod, which is fixed by a set screw carrying at its lower end *e* the stone to be cut. At its upper end, which is squared, and projects above the dial, a small index *f* is fitted. Upon the side of one of the jaws is a divided quadrant *g*, with the centre of which the centre of the brass ball coincides. The tube bearing the dial can therefore be inclined at any angle corresponding with the divisions on the exposed face of the quadrant, while, by turning the cement-stick and its index, the stone can be easily set, so that a range of facets may be cut with great accuracy.

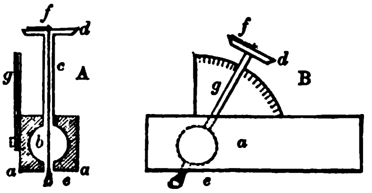

Fig. 6.—Lapidary's Dial. A, section; B, side elevation; *a*, *a*, jaws; *b*, ball; *c*, tube; *d*, dial; *e*, cement-rod; *f*, index; *g*, quadrant.

Where practicable, the lapidary avails himself of the natural cleavages in the mineral upon which he is going to operate, and these are constant in direction in any one species, but are more easily available in certain minerals than they are in others. When no satisfactory cleavage planes exist, the mineral may be sawn into slices by a thin wire charged with diamond dust. The diamond is cut and polished upon a lap of cast-iron fed with diamond dust and olive oil. Gems having a hardness of 8 and 9 (Mosh's scale) are cut on copper disks, similarly primed, and are afterwards polished with tripoli and water. Stones of inferior hardness are ground upon a leaden lap with emery and water, and are polished on tin disks with tripoli, or on zinc disks, with putty-powder and water. In grinding very fragile or soft stones, disks of hard wood are employed. Precious stones are cut in forms known as *brilliants* and *roses*, and the several parts are designated as shown in fig. 7 (side elevations). Turquoise, opal, cat's eye, carbuncle, asteria, and a few other stones are cut en cabochon.

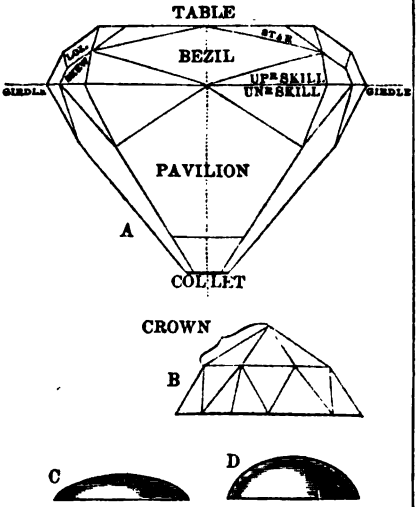

FIG. 7.—Cut Gems. A, brilliant; B, rose; C, goute de suif; D, en cabochon.

Prior to engraving on a stone, the polish is removed with emery from the surface to be engraved, and the device marked on it with a brass point; the outline is then sharply incised, and the work continued by means of small drills, the diamond point, etc.

Within the last few years a great advance has been made in our knowledge of the minute structure and mineral constitution of rocks by cutting and grinding small slices of them so thin that they readily transmit light, and can then be examined under the microscope, and the optical properties of their constituent minerals conveniently studied. Sections suitable for this purpose may be prepared by grinding thin flakes or splinters of a rock or mineral upon a cast-iron plate smeared with emery powder and water. The emery employed for the first grinding should not be very fine, that of medium grain being best suited for the purpose. The fragment is pressed by the fingers against the slab, and ground uniformly over all parts of the plate with a circular motion. When a flat surface is obtained, the fragment should be carefully washed from all traces of the emery mud, and a finer face should be imparted to it by a second grinding with the finest flour-emery and water, smeared upon a slab of plate-glass or a smoothly-planed brass slab. When thoroughly cleaned, the smooth face of the chip is warmed and cemented to a small piece of plate-glass with Canada balsam (fig. 8). The older and drier the balsam the better it answers this purpose. A little should be placed on the piece of glass and warmed until it liquefies (it must not boil). The smooth surface of the stone is then laid upon the balsam and pressed tightly against the glass; when the balsam has hardened, the grinding process is renewed, the piece of glass serving as a handle, and the flour-emery should generally be employed as soon as the fragment is thin enough to transmit light. When finished, the glass and section are cleaned, the glass is warmed, and the section is pushed off with a blunt needle or wire into a saucer of turpentine, which should be gently warmed, and all traces of dirt should be removed with a camel's hair brush. The section is then lifted from its bath by means of a needle and allowed to subside gently upon a drop of fluid Canada balsam placed on a clean glass slip which has been previously warmed. A thin covering-glass is then slightly warmed and placed over the preparation, care being taken not to include any air-bubbles. The process of grinding sections by hand is necessarily a rather slow one, and, although in the finishing it cannot well be superseded by other methods, still the rough grinding may be much more expeditiously done by means of various machines which have been devised for this purpose. Some of these are worked by hand. others by a treadle. Among the latter, the apparatus devised by Mr. J. B. Jordan, and manufactured by Messrs. Cotton & Johnstone of Grafton Street, Soho,[1] and that made by Fuess of Berlin are those in most general use. These machines are provided with slitting disks for cutting thin slices with diamond dust. This saves much grinding, but presents some difficulties to the novice. The grinding laps with which the machines are supplied are generally cast in lead or pewter, while occasionally prepared corundum disks are employed, and disks of hard wood are now and then used for imparting a final polish. (F. R.)

FIG. 8.

LAPIS LAZULI, a mineral possessing usually a fine blue color, whence it is much prized for decorative purposes. From the large number of Egyptian ornaments in this material, which have been preserved from the time of the Pharaohs, it is evident that it was a favorite stone with the ancient Egyptians. A few Assyrian seal-cylinders in lapis lazuli are also known. It appears to have been the Greek sapphire, thus, Theophrastus describes the σάπφειρος as sprinkled with gold-dust, a description which is utterly inappropriate to any variety of our modern sapphire, which applies with much force to the lapis lazuli, inasmuch as this stone frequently contains disseminated particles of iron pyrites, which by their color and lustre may readily be mistaken for such a metal. In like manner, Pliny refers to one variety of the *sapphirus* as being spotted with gold. An allusion to the same quality is perhaps found in Job. xxviii. 6.

It is but rarely that the lapis lazuli exhibits anything approaching to distinct crystallization. Usually it occurs in compact masses, which break with an uneven fracture; but occasionally it presents an imperfect cleavage parallel to the faces of a rhombic dodecahedron, and still more rarely offers distinct faces of this form. Its specific gravity is about 2.5, and its degree of hardness between 5 and 6; it therefore scratches glass, and is capable of receiving a fair polish. Although the color is generally a fine azure, or rich Berlin blue, some varieties exhibit violet, green, or even red tints, or are altogether colorless. The mineral is always opaque, with only slight translucency at the edges. Microscopic sections reveal a want of homogeneity in the constitution of the substance, bluish particles being disseminated through a white matrix.

The lapis lazuli is a silicate of aluminium, calcium, and sodium; but the published analyses are rather discordant. All agree, however, in recording the presence of sulphur, and it is generally supposed that this element exists as a sulphide of iron and sodium, and that it is upon the presence of such a compound that the blue color depends. The following is an analysis of the South American variety:—silica, 45.7; alumina, 25.34; soda, 10.55; potash, 1.35; lime, 7.48; ferric oxide, 1.30; sulphur, 3.96; and sulphuric acid, 4.32. By the action of hydrochloric acid the mineral is decomposed, with separation of gelatinous silica and evolution of sulphuretted hydrogen. Before the blowpipe it fuses readily, with loss of color.

The lapis lazuli is usually found in crystalline limestone or in gneissose rocks, but its occurrence is confined to very limited localities. It is found in Persia, Tartary, Tibet, and China, and in the neighborhood of Lake Baikal in Siberia. Fine masses occur in the Andes of Chili and Peru. In Europe it has been found at Ditro in Transylvania, and in the ejected blocks of Monte Somma.

In addition to its use as an ornamental stone, the lapis lazuli was formerly employed, to a large extent, in the preparation of the beautiful blue pigment called *ultramarine*. For this purpose the mineral was ground, calcined, and carefully levigated in water. Of late years, however, artificial ultramarine has been prepared which claims to be of equal beauty and permanency with the natural pigment. Artists, however, still regard the natural color as superior.

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[1] Described and figured in *The Study of Rocks* (Longman's Text-Books of Science).

LAPITHÆ, a mythic race whose contest with the Centaurs is one of the most famous events in Greek mythology and one of the most favorite subjects of Greek art. The home of the legend is the district round Mount Pelion in Thessaly; it is not found in the other places where the Centaur legend has its home—Pholoe in Arcadia, and the river Evenus in Ætolia. It is impossible to write of the Lapithæ without including also their adversaries the Centaurs and the great battle at the marriage of Pirithous and Deidamia. The outlines of the legend have already been given under CENTAUR; here we shall merely attempt to distinguish between earlier and later elements in the myth, and thus trace its growth. By the Greek sculptors of the school of Phidias the battle of Lapithæ with Centaurs was conceived as a struggle between mankind and mischievous monsters, and symbolical of the great conflict between Greeks and Persians. There can be no doubt that such a moralized view is of later growth, and inconsistent with the original character of mythology; though the battle is conceived under this form from an early time, and universally throughout the historical period. But on the other hand the genealogies given of the Lapithæ make them a brother race with the Centaurs. Pirithous, king of the Lapithæ, was son of Ixion; so were the Centaurs. Various other accounts lead to the same result. Ultimately, then, the battle of Lapithæ with Centaurs is a contest of the physical powers of nature; and the excellent discussion of Professor S. Colvin (*Journ. Hell. Stud.*, i. p. 164) leaves little room for doubt that the Centaurs represent the power—dangerous, yet sometimes beneficent—of mountain floods, and that the battle is the mythic expression of the terrible effects of swollen waters. No satisfactory derivation of the word *Lapithes* has yet been found, but some of the names of individual Lapithæ, such as Dryas, Charaxus, Caineus son of Elate, etc., refer us to the trees and ravines of the mountains.

Beside the article of Professor Colvin, and the numerous works on Greek mythology, see Welcker, *Kl. Schr.*, vol. ii.

LAPLACE, PIERRE SIMON, MARQUIS DE (1749–1827), one of the greatest mathematicians and physical astronomers who ever lived, was born at Beaumont-en-Auge in Normandy, March 28, 1749. His early years have remained in the obscurity with which poverty and some ignoble shame of poverty combined to cover them. It is known, however, that his father was a small farmer, and that he owed his education to the interest excited by his lively parts in some persons of position. His first distinctions are said, singularly enough, to have been gained in theological controversy, but at an early age he became mathematical teacher in the military school of Beaumont, the classes of which he had attended as an extern. He was not more than eighteen when, armed with letters of recommendation, he approached D'Alembert, then at the height of his fame and influence, in the hope of finding a career in Paris. The letters remained unnoticed; but Laplace was not a man to be crushed by the first rebuff of fortune. He wrote to the great geometer a letter on the principles of mechanics, which evoked an immediate and enthusiastic response. "You," said D'Alembert to him, "needed no introduction; you have recommended yourself; my support is your due." He accordingly obtained for him an appointment as professor of mathematics in the École Militaire of Paris, and continued to forward his interests with zeal and constancy.

The future of the young mathematician was now assured, and his scientific vocation finally determined. He had not yet completed his twenty-fourth year when he entered upon the course of discovery which has earned him the title of "the Newton of France." Having, in his first published paper,[1] shown his mastery of analysis, he immediately proceeded to apply the powerful instrument at his command to the great outstanding problems in the application of the law of gravitation to the celestial motions. Of these the most conspicuous was offered by the opposite inequalities of Jupiter and Saturn, which the emulous efforts of Euler and Lagrange had failed to bring within the bounds of theory. The discordance of their results incited Laplace to a searching examination of the whole subject of planetary perturbations, and his maiden effort was rewarded with a discovery which constituted, when developed and completely demonstrated by his own further labors and those of his illustrious rival Lagrange, the most important advance made in physical astronomy since the time of Newton. In a paper read before the Academy of Sciences, February 10, 1773 (*Mém. présentés par divers Savans*, tom. vii. 1776), Laplace announced his celebrated conclusion of the invariability of planetary mean motions, carrying the proof as far as the cubes of the eccentricities and inclinations. This was the first and most important step in the establishment of the stability of the solar system. It was followed up by a series of profound investigations, in which Lagrange and Laplace alternately surpassed and supplemented each other in assigning limits of variation to the several elements of the planetary orbits. The analytical tournament closed with the communication to the Academy by Laplace, in 1787, of an entire group of remarkable discoveries. It would be difficult, in the whole range of scientific literature, to point to a memoir of equal brilliancy with that published (divided into three parts) in the volumes of the Academy for 1784, 1785, and 1786. The long-sought cause of the "great inequality" of Jupiter and Saturn was found in the near approach to commensurability of their mean motions; it was demonstrated in two elegant theorems (see ASTRONOMY, vol. ii. p. 683), independently of any except the most general considerations as to mass, that the mutual action of the planets could never largely affect the eccentricities and inclinations of their orbits; and the singular peculiarities detected by him in the Jovian system were expressed in the so-called "laws of Laplace" (ASTRONOMY, p. 708). He completed the theory of these bodies in a treatise contained amongst the Paris *Memoirs* for 1788 and 1789; and the tables computed by Delambre from the data there supplied served, by their striking superiority to those hitherto available, to mark the profit derived from the investigation by practical astronomy.[2] The year 1787 was rendered further memorable by Laplace's announcement, November 19 (*Memoirs*, 1786), of the dependence of lunar acceleration upon the secular changes in the eccentricity of the earth's orbit. The last apparent anomaly, and the last threat of instability, thus disappeared from the solar system.

With these brilliant performances the first period of Laplace's scientific career may be said to have closed. If he made no more striking discoveries in celestial mechanics, it was rather their subject-matter than his powers that failed. The general working of the great machine was now laid bare, and it needed a further advance of knowledge to render a fresh set of problems accessible to investigation. The time had come when the results obtained in the development and application of the law of gravitation by three generations of illustrious mathematicians might be collected in a single work, and presented from a single point of view. It was to this task that the second period of Laplace's activity was devoted. As a monument of mathematical genius applied to the celestial revolutions the *Mécanique Céleste* ranks second only to the *Principia* of Newton.

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[1] "Recherches sur le calcul intégral," *Mélanges de la Soc. Roy. de Turin*, 1766–69.

[2] Grant, *History of Physical Astronomy*, p. 96.

The declared aim of the author[1] was to offer a complete solution of the great mechanical problem presented by the solar system, and to bring theory to coincide so closely with observation that empirical equations should no longer find a place in astronomical tables. His success in both respects fell but little short of his lofty ideal. The first part of the work (2 vols. 4to, Paris, 1799) contains methods for calculating the movements of translation and rotation of the heavenly bodies, for determining their figures, and resolving tidal problems; the second, especially dedicated to the improvement of tables, exhibits in the third and fourth volumes (1802 and 1805) the application of these formulæ; while a fifth volume, published in three instalments, 1823–25, comprises the results of Laplace's latest researches, together with a valuable history of progress in each separate branch of his subject. In the delicate task of apportioning his own large share of merit, he certainly does not err on the side of modesty; but it would perhaps be as difficult to produce an instance of injustice as of generosity in his estimate of others. Far more serious blame attaches to his all but total suppression in the body of the work—and the fault pervades the whole of his writings—of the names of his predecessors and contemporaries. Theorems and formulæ are appropriated wholesale without acknowledgment, and a production which may be described as the organized result of a century of patient toil presents itself to the world as the offspring of a single brain. The *Mécanique Céleste* is, even to those most conversant with analytical methods, by no means easy reading. The late M. Biot, who had the privilege of assisting in the correction of its proof sheets, remarks that it would have extended, had the demonstrations been fully developed, to eight or ten instead of five volumes; and he saw at times the author himself obliged to devote an hour's labor to recovering the dropped links in the chain of reasoning covered by the recurring formula, "Il est aisé à voir."[2]

The *Exposition du Système du Monde* (Paris, 1796) has been styled by Arago "the *Mécanique Céleste* disembarrassed of its analytical paraphernalia." Not only the conclusions reached by geometers are stated, but the methods followed by them are indicated. The integuments, so to speak, of a popular dissertation clothe and conceal the skeleton of an analytical treatise. The style is lucid and masterly, and the summary of astronomical history with which it terminates has been reckoned amongst the masterpieces of the language. To this linguistic excellence the writer owed the place accorded to him in 1816 amongst the "forty" of the French Academy, of which institution he became president in the following year. The famous "nebular hypothesis" of Laplace makes its appearance in the *Système du Monde.* Although relegated to a note (vii.), and propounded "Avec la défiance que doit inspirer tout ce qui n'est point un résultat de l'observation ou du calcul," it is plain, from the complacency with which he recurs to it,[3] at the lapse of above a quarter of a century, that he regarded the speculation with considerable interest. That it formed the starting-point, and has remained the model, of thought on the subject of planetary origin is due to the simplicity of its assumptions, and the clearness of the mechanical principles involved, rather than to any cogent evidence of its truth. It is curious that Laplace, while bestowing more attention than they deserved on the crude conjectures of Buffon, seems to have been unaware that he had been, to some extent, anticipated by Kant, who had put forward in 1755, in his *Allgemeine Naturgeschichte*, a true nebular cosmogony, though one in which the primitive reign of chaos was little likely to terminate.

The career of Laplace was one of scarcely interrupted prosperity. Admitted to the Academy of Sciences as an associate in 1773, he became a member in 1785, having, about a year previously, succeeded Bezout as examiner to the royal artillery. During a temporary access of revolutionary suspicion, he was removed from the commission of weights and measures; but the slight was quickly effaced by new honors. He was one of the first members, and became president, of the Bureau of Longitudes, took a prominent place at the Institute (founded in 1796), professed analysis at the École Normale, and aided in the organization of the decimal system. The publication of the *Mécanique Céleste* gained him world-wide celebrity, and his name appeared on the lists of all the principal scientific associations of Europe, including the Royal Society. But merely scientific distinctions by no means satisfied his ambition. He aspired to the rôle of a politician, and has left a memorable example of genius degraded to servility for the sake of a riband and a title. The ardor of his republican principles gave place, after the 18th Brumaire, to devotion towards the first consul, a sentiment promptly rewarded with the post of minister of the interior. His incapacity for affairs was, however, so flagrant that it became necessary to supersede him at the end of six weeks, when Lucien Bonaparte became his successor. "He brought into the administration," according to the dictum of the future emperor, "the spirit of the infinitesimals." His failure was consoled by elevation to the senate, of which body he became chancellor in September, 1803. He was at the same time named grand officer of the Legion of Honor, and obtained in 1813 the same rank in the new order of Reunion. The title of count he had previously acquired on the creation of the empire. Nevertheless he cheerfully gave his voice in 1814 for the dethronement of his patron, and his "suppleness" merited a seat in the chamber of peers, and, in 1817, the dignity of a marquisate. The memory of these tergiversations is perpetuated in his writings. The first edition of the *Système du Monde* was inscribed to the Council of Five Hundred; to the third volume of the *Mécanique Céleste* (1802) was prefixed the declaration that, of all the truths contained in the work, that most precious to the author was the expression of his gratitude and devotion towards the "pacificator of Europe;" upon which noteworthy protestation the suppression, in the editions of the *Théorie des Probabilités* subsequent to the restoration, of the original dedication to the emperor formed a fitting commentary.

During the later years of his life, Laplace lived much at Arcueil, where he had a country-place adjoining that of his friend Berthollet. With his co-operation the Société d'Arcueil was formed, and he occasionally contributed to its *Memoirs.* In this peaceful retirement he pursued his studies with unabated ardor, and received with uniform courtesy distinguished visitors from all parts of the world. Here, too, he died, attended to the last by his physician Dr. Majendie, and his mathematical coadjutor Bouvard, March 5, 1827, having nearly completed his seventy-eighth year. His last words were: "Ce que nous connaissons est peu de chose, ce que nous ignorons est immense."

Although commonly believed to have held atheistical opinions, Laplace refrained from giving any direct expression to them in his writings. His character, notwithstanding the vanity and egotism by which it was disfigured, had an amiable and engaging side. Young men of science found in him an active benefactor. His relations with these "adopted children of his thought" possessed a singular charm of affectionate simplicity; their intellectual progress and material interests were objects of equal solicitude to him, and he demanded in return only diligence in the pursuit of knowledge. M. Biot relates that, when he himself was beginning his career, Laplace introduced him at the Institute for the purpose of explaining his supposed discovery of equations of mixed differences, and afterwards showed him, under a strict pledge of secrecy, the papers, then yellow with age, in which he had long before obtained the same results, but which he had laid aside with a view to future development. This instance of abnegation is the more worthy of record that it formed a marked exception to Laplace's usual course. Between him and Legendre there was a feeling of "more than coldness," owing to his appropriation, with scant acknowledgment, of the fruits of the other's labors; and our celebrated countryman, Dr. Thomas Young, counted himself, rightly or wrongly, amongst the number of those similarly aggrieved by him. With Lagrange, on the other hand, he always remained on the best of terms.

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[1] "Plan de l'Ouvrage," *Œuvres*, tom. i. p. 1.

[2] *Journal des Savants*, 1850.

[3] *Méc. Cél.*, tom. v. p. 346.

The extreme abstemiousness of his life, joined to a naturally good constitution, preserved Laplace from most of the infirmities incidental to old age. He was indeed obliged to use his eyes with precaution; but his powerful memory remained unimpaired, and it was not until within two years of his death that his health began to suffer from his severe application. He married a beautiful and amiable woman, and left a son, born in 1789, who succeeded to his title, and rose to the rank of general in the artillery.

It might be said that Laplace was a great mathematician by the original structure of his mind, and became a great discoverer through the sentiment which animated it. The regulated and persistent enthusiasm with which he regarded the system of nature was with him from first to last. It can be traced in his earliest essay, and it dictated the ravings of his final illness. By it his extraordinary analytical powers became strictly subordinated to physical investigations. To this lofty quality of mind he added a rare sagacity in perceiving analogies, and in detecting the new truths that lay concealed in his formulæ, and a tenacity of mental grip, by which problems, once seized, were held fast, year after year, until they yielded up their solutions. In every branch of physical astronomy, accordingly, deep traces of his work are visible. "He would have completed the science of the skies," Fourier remarks, "had the science been capable of completion."

For a fuller account of the results achieved by him, the article ASTRONOMY, vol. ii. p. 665, may be consulted; it need only be added that he first examined the conditions of stability of the system formed by Saturn's rings, pointed out the necessity for their rotation, and fixed for it a period ($10^{\mathrm{h}}\ 33^{\mathrm{m}}$) differing by little more than a minute from that established by the observations of Herschel; that he detected the existence in the solar system of an invariable plane, such that the sum of the products of the planetary masses by the projections upon it of the areas described by their radii vectores in a given time is always a maximum, made notable advances in the theory of astronomical refraction (*Méc. Cél.*, tom. iv. p. 258), and constructed formulæ, agreeing remarkably with observation, for the barometrical determination of heights (*Méc. Cél.*, tom. iv. p. 324). His removal of the considerable discrepancy between the actual and Newtonian velocities of sound,[1] by taking into account the increase of elasticity due to the heat of compression, would alone have sufficed to illustrate a lesser name. Molecular physics also engaged a large share of his attention, and he announced in 1824 his purpose of treating the subject in a separate work. With Lavoisier he made an important series of experiments on specific heat (1782-84), in the course of which the "ice calorimeter" was discovered; and they contributed jointly to the *Memoirs* of the Academy (1781) a paper on the development of electricity by evaporation. Laplace was, moreover, the first to offer a complete analysis of capillary action based upon a definite hypothesis—that of forces "sensible only at insensible distances;" and he made strenuous but unsuccessful efforts to explain the phenomena of light on an identical principle. It was a favorite idea of his that chemical affinity and capillary attraction would eventually be included under the same law, and it was perhaps as much because it threatened an inroad on a cherished generalization as because it seemed to him little capable of mathematical treatment that the undulatory theory of light was distasteful to him.

The investigation of the figure of equilibrium of a rotating fluid mass engaged the attention of Laplace during the greater part of his long life. His first memoir was communicated to the Academy in 1773, when he was only twenty-four years of age, his last in 1817, when he was sixty-eight. The results of his many papers on this subject—characterized by him as "un des points les plus intéressans du système du monde"—are embodied in the *Mécanique Céleste*, and furnish one of the most remarkable proofs of his analytical genius. Maclaurin, Legendre, and D'Alembert had furnished partial solutions of the problem, confining their attention to the possible figures which would satisfy the conditions of equilibrium. Laplace treated the subject from the point of view of the gradual aggregation and cooling of a mass of matter, and demonstrated that the form which such a mass would ultimately assume must be an ellipsoid of revolution whose equator was determined by the primitive plane of maximum areas.

The honor of having brought almost to perfection the closely related problem of the attraction of spheroids must also be accorded to him. All the powers of analysis in the hands of its greatest masters replaced the old geometrical methods, and their superiority was soon evidenced by a succession of remarkable discoveries. Legendre, in 1783, extended Maclaurin's theorem concerning ellipsoids of revolution to the case of any spheroid of revolution where the attracted point, instead of being limited to the axis or equator, occupied any position in space; and Laplace, in his treatise *Théorie du Mouvement et de la Figure Elliptique des Planètes* (published in 1784), effected a still further generalization by proving, what had been suspected by Legendre, that the theorem was equally true for any confocal ellipsoids. Finally, in a celebrated memoir, *Théorie des Attractions des Sphéroides et de la Figure des Planètes*, published in 1785, among the Paris *Memoirs* for the year 1782, written, however, after the treatise of 1784, Laplace treated exhaustively the general problem of the attraction of any spheroid upon a particle situated outside or upon its surface.

The researches of Laplace and Legendre on the subject of attractions derive additional interest and importance from having introduced two powerful engines of analysis for the treatment of physical problems, Laplace's Coefficients and the Potential Function. The expressions for the attraction of an ellipsoid involved integrations which presented insuperable difficulties; it was therefore with pardonable exultation that Laplace announced his discovery that the attracting force in any direction could be obtained by the direct process of differentiating a single function. He thereby translated the forces of nature into the language of analysis, and laid the foundations of the mathematical sciences of heat, electricity, and magnetism. This function, V, which received the name of potential from Green in 1828, and independently from Gauss in 1840, is defined as the sum of the masses of the molecules of the attracting body divided by their respective distances from the attracted point; or, in mathematical language—

$$V=\iiint\frac{\rho\,dx\,dy\,dz}{\left\{(x-a)^2+(y-\beta)^2+(z-\gamma^2)\right\}^{\frac{1}{2}}},$$

ρ being the density of the body at the point x, y, z; a, β, γ, the coordinates of the attracted point; and the limits of integration being determined by the form of the attracting mass. V is thus a function of a, β, γ, that is to say, depends for its value on the position of the point, and its several differentials with respect to these coordinates furnish the components of the attractive force. The integrations, however, could not in general be effected so as to express V in finite terms; but Laplace showed that V satisfied the partial differential equation

$$\frac{d^2V}{da^2}+\frac{d^2V}{d\beta^2}+\frac{d^2V}{d\gamma^2}=0,$$

which is still known as Laplace's equation. It is worthy of remark that it was not in this symmetrical form that the equation was discovered, but in the complicated shape which it assumes when expressed in polar coordinates:

$$\frac{d\left\{(1-\mu^2)\frac{dV}{d\mu}\right\}}{d\mu}+\frac{1}{1-\mu^2}\cdot\frac{d^2V}{d\omega^2}+r\frac{d^2(rV)}{dr^2}=0,$$

where μ is substituted for $\cos\theta$. This differential equation forms the basis of all Laplace's researches in attractions, and makes its appearance in every branch of physical science.

The expressions which are known as Laplace's coefficients, a name first given to them by Dr. Whewell,[2] occupy a distinguished place in modern analysis. They were first introduced in their generality by Laplace in the memoir on attractions, 1785, above referred to, which is, to a great extent, reprinted in the third book of the *Mécanique Céleste*, but Legendre, in a celebrated paper entitled *Recherches sur l'attraction des Sphéroides homogènes*, printed in the tenth volume of the *Divers Savans*, 1783, had previously made use of them, and proved some of their properties, in the simplified form which they assume with one instead of two variables. They may be defined as follows. If two points in space are determined by their polar coordinates, r, θ, ω, and r', θ', ω', T the reciprocal of the distance between them is expressed in terms of those coordinates by

$$\left[r^2-2rr'\left\{\mu\mu'+\sqrt{1-\mu^2}\sqrt{1-\mu'^2}\cos(\omega-\omega')\right\}+r'^2\right]^{-\frac{1}{2}},$$

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[1] *Annales de Chimie et de Physique*, 1816, tom. iii. p. 288.

[2] See *Monthly Notices of the Astronomical Society*, xxvii. p. 211. They are also included in the more general expression "Spherical harmonics" ("Fonctions spheriques," "Kugelfunctionen").

where μ and μ' are written for cos θ and cos θ' respectively. This expression may be expanded in a series of the form

$$\frac{1}{r'}\left[P_0+P_1\frac{r}{r'}+P_2\frac{r^2}{r'^2}+\ \dots\ P_i\frac{r^i}{r'^i}+\ \dots\ \right],$$

where $P_0, P_1 \dots P_i$ are Laplace's coefficients of the orders $0, 1 \dots i$. They are rational integral functions of μ, $\sqrt{1-\mu^2}\cos\omega$, and $\sqrt{1-\mu^2}\sin\omega$, and are precisely the same functions of μ' $\sqrt{1-\mu'^2}\cos\omega'$ and $\sqrt{1-\mu'^2}\sin\omega_,$; or, in other words, of the rectangular coordinates of the two points divided by their distances from the origin. The general coefficient P_i is of i dimensions in these quantities, and its maximum value can be shown to be unity, so that the above written series will be convergent if r' is greater than r. It can be easily proved that T satisfies Laplace's differential equation—

$$\frac{d\left\{(1-\mu^2)\frac{dT}{d\mu}\right\}}{d\mu}+\frac{1}{1-\mu^2}\cdot\frac{d^2T}{d\omega^2}+r\frac{d^2(rT)}{dr^2}=0;$$

and if for T we substitute the expanded form, we obtain the general differential equation of which Laplace's coefficients are particular integrals:—

$$\frac{d\left\{(1-\mu^2)\frac{dP_i}{d\mu}\right\}}{d\mu}+\frac{1}{1-\mu^2}\cdot\frac{d^2P_i}{d\omega^2_,}+i(i+1)P_i=0,$$

Expressions which satisfy this equation[1] are referred to as Laplace's functions; they include as a particular case the coefficients, which are, as we have seen, certain definite functions of the spherical surface coordinates of the two points. If

$$x=\mu\mu'+\sqrt{1-\mu^2}\sqrt{1-\mu'^2}\cos(\omega-\omega'),$$

the coefficients become functions of x alone, and it was in this form that Legendre first introduced them. One of the fundamental properties of Laplace's functions, known as Laplace's theorem, is that, if Y_i and Z_i' be two such functions, i and i' being whole numbers and not identical, then

$$\int_{-1}^{1}\int_{0}^{2\pi}Y_iZ_i'\,d\mu\,d\omega=0.$$

Again, if Y_i' is the same function of μ' and ω', that Y_i is of μ and ω, we have the important relation

$$Y_i'=\frac{2i+1}{4\pi}\int_{-1}^{1}\int_{0}^{2\pi}Y_iP_i\,d\mu\,d\omega.$$

But the property on which their utility in physical researches chiefly depends is that every function of the coordinates of a point on a sphere can be expanded in a series of Laplace's functions.[2]

In the figure of the earth, the theory of attractions, and the sciences of electricity and magnetism, this powerful calculus occupies a prominent place. Gauss in particular has employed it in the calculation of the magnetic potential of the earth, and it has recently received new light from Professor Clerk Maxwell's interpretation of harmonics with reference to poles on the sphere.

Laplace, always profound rather than elegant, nowhere displays the massiveness of his genius so conspicuously as in the theory of probabilities. The science which Pascal and Fermat had initiated he brought very nearly to perfection; but the demonstrations are so involved, and the omissions in the chain of reasoning so frequent, that the *Théorie Analytique* is to the best mathematicians a work requiring the most arduous study. The theory of probabilities, which Laplace describes as common sense expressed in mathematical language, first attracted his attention from its importance in physics and astronomy; and he applied his theory, not only to the ordinary problems of chances, but also to the inquiry into the causes of phenomena, vital statistics, and future events.

The device known as the method of least squares, for reducing numerous equations of condition to the number of unknown quantities to be determined, had been adopted as a practically convenient rule by Gauss and Legendre; but Laplace first treated it as a problem in probabilities, and proved by an intricate and difficult course of reasoning that it was also the most advantageous, the mean of the probabilities of error in the determination of the elements being thereby reduced to a minimum.

The method of generating functions, the foundation of his theory of probabilities, Laplace published in 1779; and the first part of his *Théorie Analytique* is devoted to the exposition of its principles, which in their simplest form consist in treating the successive values of any function as the coefficients in the expansion of another function with reference to a different variable. The latter is therefore called the generating function of the former. A *direct* and an *inverse* calculus is thus created, the object of the former being to determine the coefficients from the generating function, of the latter to discover the generating function from the coefficients. The one is a problem of interpolation, the other a step towards the solution of an equation in finite differences. The method, however, is now obsolete from the more extended facilities afforded by the calculus of operations.

The first formal proof of Lagrange's theorem for the development in a series of an implicit function was furnished by Laplace, who gave to it an extended generality. He also showed that every equation of an even degree must have at least one real quadratic factor, reduced the solution of linear differential equations to definite integrals, and furnished an elegant method by which the linear partial differential equation of the second order might be solved. He was also the first to consider the difficult problems involved in equations of mixed differences, and to prove that an equation in finite differences of the first degree and the second order might always be converted into a continued fraction.

In 1842, the works of Laplace being nearly out of print, his widow was about to sell a farm in order to procure funds for a new impression, when the Government of Louis Philippe took the matter in hand. A grant of 40,000 francs having been obtained from the Chamber, a national edition was issued in seven 4to vols., bearing the title *Œuvres de Laplace*, 1843–47. The *Mécanique Céleste* with its four supplements occupies the first 5 vols., the 6th contains the *Système du Monde*, and the 7th the *Th. des Probabilités*, to which the more popular *Essai Philosophique* forms an introduction. Of the four supplements added by the author, 1816–25, he tells us that the problems in the last were contributed by his son. An enumeration of Laplace's memoirs and papers (about one hundred in number) is rendered superfluous by their embodiment in his principal works. The *Th. des Prob.* was first published in 1812, the *Essai* in 1814; and both works as well as the *Système du Monde* went through repeated editions. Laplace's first separate work, *Théorie du Mouvement et de la Figure Elliptique des Planètes*, 1784, was published at the expense of President Bochard de Saron. The *Précis de l'Histoire de l'Astronomie*, 1821, formed the fifth book of the 5th edition of the *Système du Monde*. An English translation, with copious elucidatory notes, of the first 4 vols. of the *Mécanique Céleste*, by Dr. Bowditch, was published at Boston, U. S., 1829–39, in 4 vols. 4to; a compendium of certain portions of the same work by Mrs. Somerville appeared in 1831, and a German version of the first 2 vols. by Burckhardt at Berlin in 1801. English translations of the *Système du Monde* by Mr. Pond and Mr. Harte were published, the first in 1809, the second in 1830. An edition entitled *Les Œuvres Complètes de Laplace*, 1878, etc., which is to include the whole of his memoirs, is now in course of publication under the auspices of the Academy of Sciences. The four 4to vols. which have already appeared comprise the first ten books of the *Mécanique Céleste*.

Scanty notices of Laplace's life will be found in Fourier's *Éloge*, June 15, 1829, in the funeral oration of Poisson, and Arago's *Report*, 1842, translated amongst his *Biographies* by Admiral Smyth and Mr. Grant. His astronomical work is treated of in Gautier's *Problème des trois Corps* and Grant's *Hist. of Astronomy*. For Laplace's Functions see Dr. E. Heine, *Handbuch der Kugelfunctionen*, Berlin, 1861; John H. Pratt, *A Treatise on Attractions*, 1865; Todhunter's *Elementary Treatise on Laplace's Functions*, 1875, and *History of the Mathematical Theories of Attraction*, 1873; N. M. Ferrers's *Elementary Treatise on Spherical Harmonics*, 1877; and L. Schläfli, *Die zwei Heine'schen Kugelfunctionem*, 1881. Consult also Thompson and Tait, *Treatise on Natural Philosophy*, 1879, p. 141; Clerk Maxwell, *Treatise on Electricity*, chap. ix; Professor Niven in *Phil. Trans.*, 1879, p. 379; Dirichlet in *Crelle*, xvi. p. 35; and Jacobi, vol. ii. p. 223, xxvii. p. 82. Some of Laplace's results in the theory of probabilities are simplified in Lacroix's *Traité élémentaire du Calcul des Probabilités* and De Morgan's *Essay*, published in Lardner's Cabinet Cyclopædia. For the history of the subject see *A History of the Mathematical Theory of Probability*, by Isaac Todhunter, 1865. (A. M. C.)

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[1] This equation was first integrated by Mr. Hargreave, *Philosophical Transactions*, 1841, p. 75, and it has since been successfully treated by Professor Boole, *Camb. and Dub. Math. Journ.*, vol. i. p. 10, and Professor Donkin, *Phil. Trans.*, 1857, p. 43. See Boole's *Differential Equations*, 3d ed., p. 433.

[2] The proof of this theorem in its full generality has given rise to much controversy; where, however, the form of the function is rational and integral—the only case of practical importance—no difficulty is experienced. The reader is referred to two papers by Ivory in the *Phil. Trans.*, 1812 and 1822; Poisson, *Théorie Mathématique de la Chaleur;* L. Dirichlet, in *Crelle's Journal* vol. xvii.; and O. Bonnet, in *Liouville's Journal*, vol. xvii.

LAPLAND, or **LAPPLAND**, is the northwest portion of the continent of Europe, bounded W., N., and E. by the North Atlantic, the Arctic Ocean, and the White Sea, and S. partly by the White Sea, but mainly by a conventional line. It includes the northern parts of Norway, Sweden, and Finland, and the western part of the Russian Government of Archangel. A line drawn from the mouth of the Salten Fjord on the Norwegian coast to the mouth of the Ponoi on the White Sea, practically identical with the 61st parallel of north latitude, measures 700 miles. Of Russian Lapland only a very small portion lies outside of the Arctic circle; but in Swedish Lapland the southern confines descend as low as 64°. According to Frijs (in Petermann's *Mitth.*, 1870), the total area of Lapland may be estimated at 153,200 square miles, of which 16,073 miles belong to Norway, 48,898 to Sweden, 26,575 to Finland, and 61,654 to Russia.

Lapland is merely the land of the Lapps or Laps, and does not constitute a geographical unity. The Scandinavian portion presents the usual characteristics of the mountain plateau of that peninsula,—on one side the bold headlands, fjords, deep-grooved valleys, and glaciers of Norway, on the other the long mountain lakes and lake-fed rivers of Sweden. On the Swedish side the Lapp borders only come down to within from 30 to 40 miles of the coast, where the rivers begin to lose the character of mountain streams. With the exception of Torne Lappmark, which is really part of Scandinavia, Finnish and Russian Lapland may be generally described as comparatively low country, broken by detached hills and ridges, one of which, the Umbdek Dunder, attains an elevation of 2500 feet. Rivers and lakes abound. In the north of the Finnish region lies the great Enare or Inara (formerly Upper Imandra) Lake, with an area of 1147 square miles; and the south is traversed by the countless head-waters of the Kemi, which falls into the Gulf of Bothnia to the east of the Swedish frontier. The largest of the rivers of Russian Lapland—or, as it is often called, the Kola peninsula—is the Tulom, which falls into the Arctic Ocean; and others of importance are the Pasvig, the Ponoi, and the Varsuga. Lake Imandra, or Inandra (in Lappish Aver), is about 65 miles long by 8 or 9 broad; Lake Nuoljaure is 35 miles by 7; and Guollejaure, Umbozero, Kontojarvi, and Pääjarvi are all of considerable extent. An opinion was long prevalent that there was a natural boundary of the most striking kind between the Arctic coast of Norwegian and that of Russian Lapland,—that to the east of Jacob's river the harbors or fjords were ice-bound for six months of the year, while the influence of the Gulf Stream never allowed those to the west to be frozen. This, however, is not the case. The principal harbors on the Murman coast eastward to the mouth of the White Sea remain open like those of Norway.

Though Lapland contains vast stretches of desolate tundra and dreary swamps, the country as a whole has a certain quiet beauty, and in the wilder districts the scenery is wonderfully various in color and form. "It is hardly possible," says Lieutenant Temple in *Proc. Roy. Geog. Soc.*, 1880, "to conceive a greater contrast to the ice-bound regions which lie between the same parallels in the western hemisphere." And, though it gives little scope for husbandry, Lapland is richly furnished with much that is serviceable to man. Not to mention the iron and copper mines, it still possesses great store of timber, pine and spruce and birch; though fruit trees yield no fruit, there is abundance of edible berries; the rivers and lakes abound with salmon, trout, perch, and pike; myriads of water-fowl, ptarmigan, partridges, and capercailzie breed within its borders; and the cod, herring, halibut, and Greenland sharks of its seas give occupation to thousands of fishermen.

The chief characteristic of Lapland is its Arctic climate and the distribution of daylight and darkness. In the northern parts the longest day and the longest night last for three months each, and through the greater part of the country the sun does not set at midsummer or rise at midwinter.

The following calendar of the climate after Læstadius relates more particularly to the northern districts of Swedish Lapland, but is more or less applicable to a large part of the country;—*January:* cold and clear; no daylight; about 4 o'clock the "rose of dawn;" mean temperature, 0.50° Fahr. *February:* cold; snow and wind; daylight from 6–7 A.M. to 5–6 P.M.; mean temperature, —1.4°. *March:* heat of the sun begins to modify the cold; steady snow-fall; swans begin to appear; mean temperature, 11.5°. *April:* weather variable; snow and wind; birds of passage, crows, and snow sparrows appear; snows melt from the branches; mean temperature, 26.6°. *May:* the finest month in the year; spring flowers in blossom; bird life abundant; sowing season; temperature often reaches 68° during the day; seed is often "brairded" eight days after it is sown; mean temperature, 36.5°. *June:* ice breaks up on lakes and rivers; woods rush into leaf; about the 20th continual day; mean temperature, 49° to 50°. *July:* quite warm; mountain floods; grain shoots into ear; fishing and hunting; mosquitoes; cloudberries ripe; mean temperature, 59°. *August:* much rain; harvest; by the 10th strong frosts at night; mean temperature, 56°. *September:* short days; rain, wind, sleet; raspberries, strawberries, bilberries, etc., ripe; fall of the leaf; mean temperature, 41°. *October:* "golden pudding time;" slaughter of reindeer, and laying up of meat store for winter; mean temperature, 27.50°. *November:* full winter; lakes frozen over; fishing still prosecuted with ice-nets; mean temperature, 12.24°. *December:* much like January; hunting of bears, wolves, etc., mean temperature, 1°.

The population of Lapland has been considerably recruited in modern times by immigrants from the south; but the country is still very sparsely peopled, and the Lapps still predominate. There are no towns, and the villages are not only few and insignificant, but often hardly less nomadic than the people, being shifted according to exigencies of fodder or fuel. Hammerfest, the "most northern town of the European continent," has only 2100 inhabitants, and Kola (formerly Malmis), the principal settlement in Russian Lapland, does not now exceed 500.

The Lapps.—The Lapps (Swed., *Lappar;* Russian, *Lopari;* Norw., *Finner*) call their country *Sabme* or *Same*, and themselves *Samelats*—names almost identical with those employed by the Finns for their country and race, and probably connected with a root signifying "dark" (see Donner, *Verg. Wört. der Finn.-Ugr. Sprachen*, Hels., 1876). Lapp is almost certainly a nickname imposed by foreigners, although some of the Lapps apply it contemptuously to those of their countrymen whom they think to be less civilized than themselves.[1]

In Sweden and Finland the Lapps are usually divided into fisher, mountain, and forest Lapps. In Sweden the first class includes many impoverished mountain Lapps. As described by Læstadius (1827–32), their condition was a very miserable one; but since his time matters have much improved. The principal colony has its summer quarters on the Stuor-Lule Lake, possesses good boats and nets, and, besides catching and drying fish, makes money by the shooting of wild fowl and the gathering of eggs. When he has acquired a little means, it is not unusual for the fisher to settle down and reclaim a bit of land. The mountain and forest Lapps are the true representatives of the race. In the wandering life of the mountain Lapp his autumn residence, on the borders of the forest district, may be considered as the central point; it is there he erects his *njalla*, a small wooden storehouse raised high above the ground by one or more piles. At the beginning of November, a little sooner or later, he begins to wander south or east into the forest land, and in the course of the winter he may visit, not only such places as Jokkmokk and Arjepluog, but even Gefle, Upsala, or Stockholm. About the beginning of May he is back at his njalla, but as soon as the weather grows warm he pushes up to the mountains, and there throughout the summer pastures his herds and prepares his store of cheese. By autumn or October he is busy at his njalla killing the surplus reindeer bulls and curing meat for the winter. From the mountain Lapp the forest (or, as he used to be called, the spruce-fir) Lapp is mainly distinguished by the narrower limits within which he pursues his nomadic life. He never wanders outside of a certain district, in which he possesses hereditary rights, and maintains a series of camping grounds which he visits in regular rotation. In May or April he lets his reindeer loose, to wander as they please; but immediately after midsummer, when the mosquitoes become troublesome, he goes to collect them. Catching a single deer and "belling" it, he drives it through the wood; the other deer, whose instinct leads them to gather into herds for mutual protection against the mosquitoes, are attracted by the sound. Should the summer be very cool and the mosquitoes few, the Lapp finds it next to impossible to bring the creatures together. About the end of August they are again let loose, but they are once more collected in October, the forest Lapp during winter pursuing the same course of life as the mountain Lapp.

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[1] The most probable etymology is the Finnish *lappu*, and in this case the meaning would be the "land's-end folk."

In Norway there are three classes—the sea Lapps, the river Lapps, and the mountain Lapps; the first two are settled, the third nomadic. The mountain Lapps have, on the whole, a rather ruder and harder life than the same class in Sweden. About Christmas those of Kautokeino and Karasjokk are usually settled in the neighborhood of the churches; in summer they visit the coast, and in autumn they return inland. Previous to 1852, when they were forbidden by imperial decree, they were wont in winter to move south across the Russian frontiers. It is seldom possible for them to remain more than three or four days in one spot. Flesh is their favorite, in winter almost their only, food, though they also use reindeer milk, cheese, and rye or barley cakes. The sea Lapps are in some respects hardly to be distinguished from the other coast dwellers of Finmark. Their food consists mainly of cooked fish. The river Lapps, many of whom, however, are descendants of Quains or Finns proper, breed cattle, attempt a little tillage, and intrust their reindeer to the care of the mountain Lapps.

In Finland there are comparatively few Laplanders, and the great bulk of them belong to the fisher class. Many of them are settled in the neighborhood of the Enare Lake. In the spring they go down to the Norwegian coast and take part in the sea fisheries, returning to the lake about midsummer. Formerly they found the capture of wild reindeer a profitable occupation, using for this purpose a palisaded avenue gradually narrowing towards a pitfall.

The Russian Lapps are also for the most part fishers, as is natural in a district with such an extent of coast and such a number of lakes, not to mention the advantage which the fisher has over the reindeer keeper in connection with the many fasts of the Greek Church. They maintain a half nomadic kind of life, very few of them having become regular settlers in the Russian villages. It is usual to distinguish them according to the district of the coast which they frequent, as Murman (Murmanski) and Terian (Terski) Lapps. A separate tribe, the Filmans, *i.e.*, Finnmanns, nomadize about the Pazyets, Motoff, and Petchenga tundras, and retain the peculiar dialect and the Lutheran creed which they owe to a former connection with Sweden. They were formerly known as the "twice and thrice tributary" Lapps, because they paid to two or even three states—Russia, Denmark, and Sweden.

The ethnographical position of the Lapps has not been clearly determined, though it is evident they can no longer be classified with the Finns. They are, as has been seen, far from a numerous people, and within the historical period they have considerably recruited themselves from neighboring races. Shortness of stature[1] is their most obvious characteristic, though in regard to this much exaggeration has prevailed. Düben (p. 167) found an average of 4.9 feet for males and a little less for females; Mantegazza, who made a number of anthropological observations in Norway in 1879, gives 5 feet and 4.75 feet respectively (*Archivio per l'antrop.*, 1880). Individuals much above or much below the average are rare. The body is usually of fair proportions, but the legs are rather short, and in many cases somewhat bandy. Dark, swarthy, yellow, copper-colored are all adjectives employed by competent observers to describe their complexion,—the truth being that their habits of life do not conduce either to the preservation or display of their natural color of skin, and that some of them are really fair, and others, perhaps the majority, really dark. The color of the hair, too, ranges from blonde and reddish to a bluish or grayish black; and the eyes are black, hazel, blue, or gray. The shape of the skull is the most striking peculiarity of the Lapp. He is the most brachycephalous type of man in Europe, perhaps in the world.[2] According to Virchow, the women in width of face are more Mongolian-like than the men, but neither in men nor women does the opening of the eye show any true obliquity. In children the eye is large, open, and round. The nose is always low and broad, more markedly retroussé among the females than the males. Wrinkled and puckered by exposure to the weather, the faces even of the younger Lapps assume an appearance of old age. The muscular system is usually well developed, but there is a deficiency of fatty tissue, which affects the features (particularly by giving relative prominence to the eyes) and the general character of the skin. The thinness of the skin, indeed, can but rarely be paralleled among other Europeans. Among the Lapps, as among other lower races, the index is shorter than the ring finger.[3]

The Lapps are a quiet, inoffensive people. Crimes of violence are almost unknown among them, and the only common breach of law is the killing of tame reindeer belonging to other owners. In Russia, however, they have a bad reputation for lying and general untrustworthiness, and drunkenness is wellnigh a universal vice. In Scandinavia laws have been directed against the importation of intoxicating liquors into the Lapp country since 1723.

Superficially at least the great bulk of the Lapps have been Christianized,—those of the Scandinavian countries being Protestants, those of Russia members of the Greek Church. In education the Scandinavian Lapps are far ahead of their Russian brethren, to whom reading and writing are arts as unfamiliar as they were to their pagan ancestors. The general manner of life is patriarchal. The father of the family has complete authority over all its affairs; and on his death this authority passes to the eldest son. Parents are free to disinherit their children; and if a son separates from the family without his father's permission, he receives no share of the property except a gun and his wife's dowry.[4]

By the very circumstances of their position the Lapps are of necessity conservative in most of their habits, many of which can hardly have altered since the first taming of the reindeer. But the strong current of mercantile enterprise has carried a few important products of southern civilization into their huts. The lines in which Thomson describes their simple life—

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[1] Hence they have been supposed by many to be the originals of the "little folk" of Scandinavian legend.

[2] Bertillon found in one instance a cephalic index of 94. The average obtained by Pruner Bey was 84.7, by Virchow, 82.5.

[3] See Retzius, *Finska Kranier* (Stockholm, 1878); Virchow, in *Arch. für Anthrop.*, tom. iv., 1870; papers by Virchow (1874), Hagenbeck and Europeus (1875), and Van der Horck (1876), in *Zeitschrift für Ethnologie*; and by Guérault (1868) and Pruner Bey (1864), in *Mémoires de la Soc. d'Anthrop.* Bertillon, in Broca's *Revue d'Anthrop.*, has given a comparison of the craniology of the Lapps with that of Parisians, Kaffres, and New Caledonians.

[4] A valuable paper by Ephimenko, on "The Legal Customs of the Lapps, especially in Russian Lapland," appears in vol. viii. of the *Mem. of Russ. Geog. Soc.*, Ethnog. Section, 1878.

The reindeer form their riches: these their tents,
Their robes, their beds, and all their homely wealth
Supply; their wholesome fare and cheerful cups—

are still applicable in the main to the mountain Lapps; but even they have learned to use coffee as an ordinary beverage, and to wear stout Norwegian cloth (*vadmal*).

Linguistically the Lapps belong to the great Uralo-Altaic family; the similarity of their speech to Finnish is evident on the surface. It is broken up into very distinct and even mutually unintelligible dialects, the origin of several of which is, however, easily found in the political and social dismemberment of the people. Düben distinguishes four leading dialects; but a much greater number are recognizable. In Russian Lapland alone there are three, due to the influence of Norwegian, Karelian, and Russian (Lönnrot, *Acta Soc. Sci. Fennicæ*, vol. iv.). "The Lapps," says Castren, "have had the misfortune to come into close contact with foreign races while their language was yet in its tenderest infancy, and consequently it has not only adopted an endless number of foreign words, but in many grammatical aspects fashioned itself after foreign models." That it began at a very early period to enrich itself with Scandinavian words is shown by the use it still makes of forms belonging to a linguistic stage older even than that of Icelandic. Düben has subjected the vocabulary to a very interesting analysis for the purpose of discovering what stage of culture the people had reached before their contact with the Norse. Agricultural terms, the names of metals, and the word for smith are all of Scandinavian origin, and the words for "taming" and "milk" would suggest that the southern strangers taught the Lapps how to turn the reindeer to full account. The important place, however, which this creature must have always held in their estimation is evident from the existence of more than three hundred native reindeer words.

The Lapp tongue was long ago reduced to writing by the missionaries; but very little has been printed in it except school-books and religious works. A number of popular tales and songs, indeed, have been taken down from the lips of the people by Fjellner, Grönland, and others; J. A. Frijs, professor of Lapp in the university of Christiania, has published *Lappiske Sprogprover: en samling lapp. eventyr, ordsprog, og gåder*, Christiania, 1856; and *Lappisk mythologi eventyr og folkesagn*, Christiania, 1871. See also G. Donner, *Lieder der Lappen*, Helsingfors, 1876. The songs are extremely similar to those of the Finns, and a process of mutual borrowing seems to have gone on. In one of the saga-like pieces—Pishan-Peshan's son—there seems to be a distinct mention of the Baikal Lake, and possibly also of the Altai Mountains. The story of Njavvisena, daughter of the Sun, is full of quaint folklore about the taming of the reindeer. Giants, as well as a blind or one-eyed monster, are frequently introduced, and the Æsopic fable is not without its representatives. Grammars of the Lapp tongue have been published by Fjellström (1738), Leem (1748), Rask (1832), Stockfleth (1840); lexicons by Fjellström (1730), Leem (1768–1781), Lindahl (1780), Stockfleth (1852). Many of the Lapps are able to speak one or even two of the neighboring tongues.

The reputation of the Laplanders for skill in magic and divination is of very early date, and in Finland is not yet extinct. When Erik Blood-axe, son of Harold Haarfager, visited Bjarmaland in 922, he found Gunhild, daughter of Asur Tote, living among the Lapps, to whom she had been sent by her father for the purpose of being trained in witchcraft; and Ivan the Terrible of Russia sent for magicians from Lapland to explain the cause of the appearance of a comet. One of the powers with which they were formerly credited was that of raising winds. "They tye three knottes," says old Richard Eden, "on a strynge hangyng at a whyp. When they lose one of these they rayse tollerable wyndsꞏ When they lose an other the wynde is more vehement; but by losing the thyrd they rayse playne tempestes as in old tyme they were accustomed to rayse thunder and lyghtnyng." (*Hist. of Trauayle*, 1577, p. 284.) Though we are familiar in English with allusions to "Lapland witches," it appears that the art, according to native custom, was in the hands of the men. During his divination the wizard fell into a state of trance or ecstasy, his soul being held to run about at large to pursue its inquiries. Great use was made of a curious divining-drum, oval in shape, and made of wood, 1 to 4 feet in length. Over the upper surface was stretched a white-dressed reindeer skin, and at the corners (so to speak) hung a variety of charms—tufts of wool, bones, teeth, claws, etc. The area was divided into several spaces, often into three, one for the celestial gods, one for the terrestrial, and one for man. A variety of figures and conventional signs were drawn in the several compartments: the sun, for instance, is frequently represented by a square and a stroke from each corner, Thor by two hammers placed crosswise; and in the more modern specimens symbols for Christ, the Virgin, and the Holy Ghost are introduced. An *arpa* or divining-rod was laid on a definite spot, the drum beaten by a hammer, and conclusions drawn from the position taken up by the arpa. Any Lapp who had attained to manhood could in ordinary circumstances consult the drum for himself, but in matters of unusual moment the professional wizard (nåid, noide, or noaide) had to be called in.

The Lapps have a dim tradition that their ancestors lived in a far eastern land, and they tell rude stories of their own conflicts with Norsemen and Karelians. But no answer can be obtained from them to the questions naturally put by the historian in regard to their early distribution and movements. By many it has been maintained that they were formerly spread over the whole of the Scandinavian peninsula, and they have even been considered by some as the remnants of that primeval race of cave-dwellers which hunted the reindeer over the snow-fields of Central and Western Europe. But much of the evidence adduced for these theories is highly questionable. The contents of the so-called Lapps' graves found in various parts of Scandinavia are often sufficient in themselves to show that the appellation must be a misnomer, and the syllable Lap or Lapp found in many names of places can often be proved to have no connection with the Lapps. Nothing more can be affirmed with certainty than that the area occupied or visited by the Lapps once extended farther south (in Russia as far, it would appear, as Lake Ladoga), and that they already occupied their present territory at the time when they are first mentioned in history. According to Düben the name first occurs in the 13th century—in the *Fundinn Noregr*, composed about 1200, in Saxo Grammaticus, and in a papal bull of date 1230; but the people are probably to be identified with those Finns of Tacitus whom he describes as wild hunters with skins for clothing and rude huts as only means of shelter, and certainly with the Skrithiphinoi of Procopius (*Goth.*, ii. 15), the Scritobini of Paulus Warnefridus, and the Scridifinni of the geographer of Ravenna. Some of the details given by Procopius, in regard for instance to the treatment of infants, show that his informant was acquainted with certain characteristic customs of the Lapps.

In the 9th century the Norsemen from Norway began to treat their feeble northern neighbors as a subject race. The wealth of Ottar,—"northmost of the northmen,"—whose narrative has been preserved by King Alfred, consisted mainly of six hundred of those "deer they call hrenas" and in tribute paid by the natives; and the Eigils saga tells how Brynjulf Bjargulfson had his right to collect contributions from the Finns (*i. e.*, the Lapps) recognized by Harold Haarfager. So much value was attached to this source of wealth that as early as 1050 strangers were excluded from the fur trade of Finmark, and a kind of coast-guard prevented their intrusion. Meantime the Karelians were pressing on the eastern Lapps, and in the course of the 11th century the rulers of Novgorod began to treat them as the Norsemen had treated their western brethren. The ground-swell of the Tartar invasion drove the Karelians westward in the 13th century, and for many years even Finmark was so unsettled that the Norsemen received no tribute from the Lapps. At length in 1326 a treaty was concluded between Norway and Russia by which the supremacy of the Norwegians over the Lapps was recognized as far east as Voljo beyond Kandalax on the White Sea, and the supremacy of the Russians over the Karelians as far as Lyngen and Målself. The relations of the Lapps to their more powerful neighbors were complicated by the rivalry of the different Scandinavian kingdoms. After the disruption of the Calmar Union (1523), Sweden began to assert its rights with vigor, and in 1595 the treaty of Teusina between Sweden and Russia decreed "that the Lapps who dwell in the woods between Eastern Bothnia and Varanger shall pay their dues to the king of Sweden." It was in vain that Christian IV. of Denmark visited Kola and exacted homage in 1599, and every year sent messengers to protest against the collection of his tribute by the Swedes (a custom which continued down to 1806). Charles of Sweden took the title of "king of the Kajans and Lapps," and left no means untried to establish his power over all Scandinavian Lapland. By the peace of Knäröd (1613) Gustavus Adolphus gave up the Swedish claim to Finmark; and in 1751 mutual renunciations brought the relations of Swedish and Norwegian (Danish) Lapland to their present position. Meanwhile Russian influence had been spreading westward; and in 1809, when Alexander I. finally obtained the cession of Finland, he also added to his dominions the whole of Finnish Lapland to the east of the Muonio and the Köngäma.

The Lapps have had the ordinary fate of a subject and defenceless people; they have been utilized with little regard to their own interests or inclinations. The example set by the early Norwegians was followed by the Swedes: a peculiar class of adventurers known as the Birkarlians (from *Bjark* or *Birk*, "trade") began in the 13th century to farm the Lapps, and, receiving very extensive privileges from the kings, grew to great wealth and influence. In 1606 there were twenty-two Birkarlians in Tornio, seventeen in Lule, sixteen in Pite, and sixty-six in Ume Lappmark. They are regularly spoken of as having or owning Lapps, whom they hire out, and dispose of as any other piece of property. In Russian Lapland matters followed much the same course. The very institution of the Solovets monastery, intended by St. Tryphon for the benefit of the poor neglected pagans, turned out the occasion of much injustice towards them. By a charter of Ivan Vasilivitch (November, 1556), the monks are declared masters of the Lapps of the Motoff and Petchenga districts, and they soon sought to extend their control over those not legally assigned to them (Ephimenko). Other monasteries in distant parts of the empire were gifted with similar proprietary rights; and the supplication of the patriarch Nikon to Alexis Mikhaelovitch, for example, shows only too clearly the oppression to which the Lapps were subjected.

It is long, however, since these abuses were abolished; and in Scandinavia more especially the Lapps of the present day enjoy the advantages resulting from a large amount of philanthropic legislation on the part of their rulers. There seems to be no fear of their becoming extinct, except it may be by gradual amalgamation with their more powerful neighbors. The aggregate number in all Lapland is estimated at 27,000. According to official statistics the Swedish Lapps increased from 5617 in 1830 to 6702 in 1870. In Norway there were 14,464 in 1845, 17,178 in 1865. For Russian and Finnish Lapland the numbers were given in 1859 as 1200 and 2183, and according to Kelsieff the whole number in Russia is not now more than 3000. The number of reindeer possessed by the whole people is estimated at 363,000.

Gustav von Düben's *Om Lappland och Lapparne* (Stockh., 1873) is the fullest and most systematic work on its subject. It gives a list of more than two hundred authorities. See also Scheffer, *Lapponia* (Frankf., 1673; English version, Oxford 1674), for long the standard book; Regnard, *Voyage de Laponie* (1681, often reprinted; English in Pinkerton, vol. i.); Högström, *Beskrifn. öfver de till Sveriges Krona lydande Lappmarker*, Stockh., 1746; Leem, *Beskrivelse over Finmarkens Lapper*, Copenh., 1767, extremely important, in Danish and Latin; Acerbi, *Reise durch Schweden*, Berlin, 1803; Læstadius, *Journal*, etc., Stockh., 1831; Leopold von Buch, *Reise durch Norwegen und Lappland*, Berlin, 1840; Bayard Taylor, *Northern Travel*, London, 1858; Castren, *Nordiska Resor* (Hels., 1852–58; Germ. transl., St. Petersburg); Stockfleth, *Dagbog over mine Missions-Reiser*, Christ., 1860, of great value; Friis, *En sommer* (1867) *i Finmarken*, etc., Christ., 1871; Aubel, *Reise nach Lappland*, Leipsic, 1874; Nemirovitch-Dantchenko, *Laplandiya i Laplandtzui*, St. Petersburg, 1874; *Reports* by Kelsieff, etc., for the Anthropological Exhibition at Moscow, 1877, Moscow, 1878; Ecker, *Lappland*, etc., Freiburg, 1878; Du Chaillu, *Land of the Midnight Sun*, London, 1881; Edward Rae, *The White Sea Peninsula*, London, 1882. (H. A. W.)

LAPORTE, chief city of Laporte county, Indiana, U. S., is situated at the intersection of three railways, 12 miles south of Lake Michigan, and about 60 miles southeast of Chicago. Surrounded by a fertile agricultural region, it carries on a considerable trade, and has manufactories of agricultural implements, foundries, and various mills. The vicinity has become a favorite summer residence, on account of its beautiful lakes, which in winter supply large quantities of clear ice for the Chicago and southern markets. The population in 1880 was 6195.

LAPPENBERG, JOHANN MARTIN (1794–1865), a German historical writer, was born July 30, 1794, at Hamburg, where his father held a good official position; early in life he began to study medicine, and afterwards history, at Edinburgh. The latter pursuit he continued in London and at the universities of Berlin and Göttingen, graduating as doctor of laws of Göttingen in 1816. He was forthwith sent by the Hamburg senate as resident minister to the Prussian court, where he remained till 1823, when he became keeper of the Hamburg archives, an office in which he had the amplest opportunities for the cultivation and exercise of those habits of laborious and critical research on which his highly respectable reputation as an historian rests. He continued to hold this post until 1863, when a serious affection of the eyes compelled him to resign. In 1850 he had the honor of representing Hamburg at the Frankfort conference. His death took place on November 28, 1865.

Lappenberg's most important contribution to literature, and that by which he is best known outside of Germany, was his *Geschichte von England* (2 vols., Hamburg, 1834–37), which was translated by Thorpe (1845–57) and continued by Pauli (from 1160). His other works include a continuation of the *Geschichte des Ursprungs der deutschen Hansa* of Sartorius, 1830; *Hamburgisches Urkundenbuch*, 1842; *Hamburger Rechtsalterthümer*, 1845; *Chroniken der Stadt Hamburg im niederdeutscher Sprache*, 1852–61; *Quellen zur Geschichte des Erzbisthums u. der Stadt Bremen*, 1841; editions of Thietmar of Merseburg, Adam of Bremen, Helmold, and Arnold of Lübeck in the *Monumenta* of Pertz, and an edition of Th. Murner's *Till Eulenspiegel*, 1853.

LAPWING, Anglo-Saxon *Hleápewince* (="one who turns about in running or flight," see Skeat's *Etymol. Dictionary*, p. 321),[1] a bird, the *Tringa vanellus* of Linnæus and the *Vanellus vulgaris* or *V. cristatus* of modern ornithologists. In the temperate parts of the Old World this species is perhaps the most abundant of the Plovers, *Charadriidæ*, breeding in greater or fewer numbers in almost every suitable place from Ireland to Japan,—the majority migrating towards winter to southern countries, as the Punjab, Egypt, and Barbary,—though in the British Islands some are always found at that season, chiefly about estuaries. As a straggler it has occurred within the Arctic Circle (as on the Varanger Fjord in Norway), as well as in Iceland and even Greenland; while it not unfrequently appears in Madeira and the Azores. Conspicuous as the strongly contrasted colors of its plumage and its very peculiar flight make it, one may well wonder at its success in maintaining its ground when so many of its allies have been almost exterminated, for the lapwing is the object perhaps of greater persecution than any other European bird that is not a plunderer. Its eggs—the well known "Plovers' Eggs" of commerce[2]—are taken by the thousand or ten thousand; and, worse than this,' the bird, wary and wild at other times of the year, in the breeding-season becomes easily approachable, and is (or used to be) shot down in enormous numbers to be sold in the markets for "Golden Plover." Its growing scarcity as a species was consequently in Great Britain very perceptible until an Act of Parliament (35 & 36 Vict. cap. 78) frightened people into letting it alone,[3] and its numbers have since then as perceptibly increased, to the manifest advantage of many classes of the community—those who would eat its eggs, those who would eat its flesh (at the right time of year), as well as the agriculturists whose lands it frequented, for it is admitted on all hands that no bird is more completely the farmer's friend. What seems to be the secret of the Lapwing holding its position in spite of slaughter and rapine is the adaptability of its nature to various kinds of localities. It will find sustenance for itself and its progeny equally on the driest soils as on the fattest pastures; upland and fen, arable and moorland, are alike to it, provided only the ground be open enough. The wailing cry[4] and the frantic gestures of

[1] Caxton in 1481 has "lapwynches" (*Reynard the Fox*, cap. 27).

[2] There is a prevalent belief that many of the eggs sold as "Plovers'" are those of Rooks, but no notion can be more absurd, since the appearance of the two is wholly unlike. Those of the Redshank, of the Golden Plover (to a small extent), and enormous numbers of those of the Black-headed Gull, and in certain places of some of the Terns, are, however, undoubtedly sold as Lapwings', having a certain similarity of shell to the latter, and a difference of flavor only to be detected by a fine palate. It is estimated that 800,000 Lapwings' eggs are yearly sent to England from the one province of Friesland in Holland (see *Ornith. Centralblatt*, 1877, p. 108).

[3] This measure was really insufficient to afford it, or any other bird, proper protection, but the British public seldom read Acts of Parliament critically, and, hearing that one had been passed for the Preservation of Wild Birds, in which the Lapwing was specially named, most persons desisted from persecuting this species, not in the least knowing that the utmost penalty they could incur by killing it in the close-season would be but trifling.

[4] This sounds like *pee-weet*, with some variety of intonation. Hence the names Peewit, Peaseweep, and Teuchit, commonly

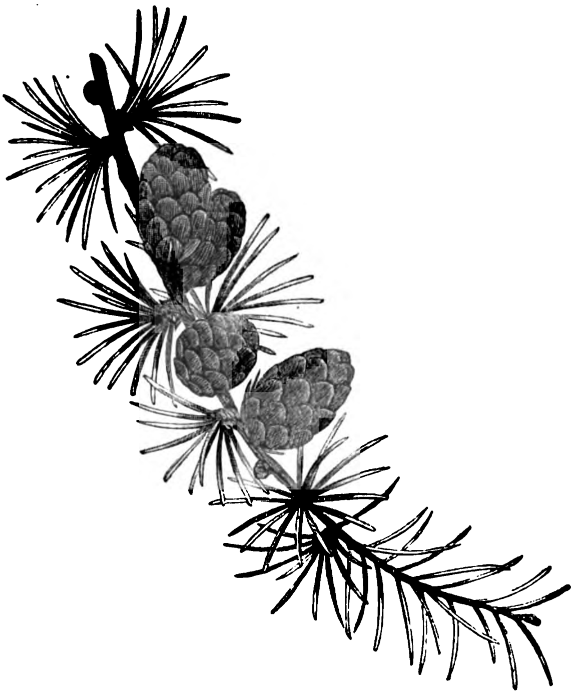
the cock-bird in the breeding season will tell any passer-by that a nest or brood is near; but, unless he knows how to look for it, nothing save mere chance will enable him to find it. Yet by practice those who are acquainted with the bird's habits will accurately mark the spot whence the hen silently rises from her treasure, and, disregarding the behavior of the cock, which is intended to delude the intruder, will walk straight to one nest after another as though they knew beforehand the exact position of each. The nest is a slight hollow in the ground, wonderfully inconspicuous even when deepened, as is usually the case, by incubation, and the black-spotted olive eggs (four in number) are almost invisible to the careless or untrained eye unless it should happen to glance directly upon them. The young when first hatched are clothed with mottled down so as closely to resemble a stone and to be overlooked as they squat motionless on the approach of danger. At a distance the plumage of the adult appears to be white and black in about equal proportions, the latter predominating above; but on closer examination nearly all the seeming black is found to be a bottle-green gleaming with purple and copper; and the tail-coverts, both above and below, are seen to be of a bright bay color that is seldom visible in flight. The crest consists of six or eight narrow and elongated feathers, turned slightly upwards at the end, and is usually carried in a horizontal position, extending in the cock beyond the middle of the back; but it is capable of being erected so as to become nearly vertical. Frequenting (as has been said) parts of the open country so very divergent in character, and as remarkable for the peculiarity of its flight as for that of its cry, the Lapwing is far more often observed in nearly all parts of the British Islands than any other of the group, *Limicolæ*, to which it belongs. The peculiarity of its flight seems due to the wide and rounded wings it possesses, the steady and ordinarily somewhat slow flapping of which impels the body at each stroke with a manifest though easy jerk. Yet on occasion, as when performing its migrations, or even its almost daily transits from one feeding-ground to another, and still more when being pursued by a Falcon, the speed with which it moves through the air is very considerable; and the passage of a flock of Lapwings, twinkling aloft or in the distance, as the dark and light surfaces of the plumage are alternately presented, is always an agreeable spectacle to those who love a landscape enlivened by its wild creatures. On the ground this bird runs nimbly, and is nearly always engaged in searching for its food, which is wholly animal.

Allied to the Lapwing are several forms that have been placed by ornithologists in the genera *Hoplopterus*, *Chettusia*, *Lobivanellus*, *Sarciophorus*, and so forth; but the respective degree of affinity they bear to one another is not rightly understood, and space would prohibit any attempt at here expressing it. In some of them the hind toe, which has already ceased to have any function in the Lapwing, is wholly wanting. In others the wings are armed with a tubercle or even a sharp spur on the carpus. Few have any occipital crest, but several have the face ornamented by the outgrowth of a fleshy lobe or lobes. With the exception of North America, they are found in most parts of the world, but perhaps the greater number in Africa. Europe has three species—*Hoplopterus spinosus*, the Spur-winged Plover, and *Chettusia gregaria* and *C. leucura*; but the first and last are only stragglers from Africa and Asia. (A. N.)

LÁR, a city of Persia, capital of Láristán, in 27° 30′ N. lat., 53° 58′ E. long., 174 miles from Shíráz, and 127 from the coast at Mogu Bay. Lár stands at the foot of a mountain range in an extensive plain covered with palm trees. The crest of a hill immediately behind the town is crowned by the ruins of a castle formerly deemed impregnable. Lár was once a flourishing place, but a large portion is now in ruins, and the population is reduced to about 12,000. There are still some good buildings, of which the most prominent is the bazaar, said to be the finest in Persia, and resembling that of Shíráz, but considerably larger. The governor's residence stands in the centre of the town, and is surrounded by strong walls flanked with towers. There is also an outer moat filled by a canal of recent structure, which also serves to supply the numerous cisterns when the rain-water fails. Lár is noted for its manufacture of muskets and cloth.

LARCENY. See THEFT.

LARCH (from the German *Lerche;* Latin, *larix*), a name applied to a small group of coniferous trees, of which the common larch of Europe is taken as the type. The members of the genus *Larix* are distinguished from the firs, with which they were formerly placed, by their deciduous leaves, scattered singly, as in *Abies*, on the young shoots of the season, but on all older branchlets growing in whorl-like tufts, each surrounding the extremity of a rudimentary or abortive branch; from cedars (*Cedrus*) they differ, not only in the deciduous leaves, but in the cones, the scales of which are thinner towards the apex, and are persistent, remaining attached long after the seeds are discharged. The trees of the genus are closely allied in botanic features, as well as in general appearance, so that it is sometimes difficult to assign to them determinate specific characters, and the limit between species and variety is not always very accurately defined. Nearly all are natives of Europe, or the northern plains and mountain ranges of Asia and North America, though



Branchlet of Larch (*Larix europæa*).

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applied in some parts of Britain to this bird,—though the first is that by which one of the smaller Gulls, *Larus ridibundus* (see GULL, vol. xi. p. 243), is known in the districts it frequents. In Sweden *Vipa*, in Germany *Kiebitz*, in Holland *Kiewiet*, and in France *Dixhuit*, are names of the Lapwing, given to it from its usual cry. Other English names are Green Plover and Hornpie—the latter from its long hornlike crest and pied plumage. The Lapwing's conspicuous crest seems to have been the cause of a common blunder among our writers of the Middle Ages, who translated the Latin word *Upupa*, properly HOOPOE (*q. v.*), by Lapwing, as being the crested bird with which they were best acquainted. In like manner other writers of the same or an earlier period Latinized Lapwing by *Egrettides* (plural), and rendered that again into English as Egrets—the tuft of feathers misleading them also. The word *Vanellus* is from *vannus*, the fan used for winnowing corn, and refers to the audible beating of the bird's wings.

one occurs only on the Himalayas; a somewhat aberrant form, usually placed in a separate sub-genus, is peculiar to North China and Japan.

The common larch (*L. europæa*) is, when grown in perfection, a stately tree with tall erect trunk, gradually tapering from root to summit, and horizontal branches springing at irregular intervals from the stem, and in old trees often becoming more or less drooping, but rising again towards the extremities; the branchlets or side shoots, very slender and pendulous, are pretty thickly studded with the whorls of narrow linear leaves, of a peculiar bright light green when they first appear in the spring, but becoming of a deeper hue when mature. The yellow stamen-bearing flowers are in sessile, nearly spherical catkins; the fertile ones vary in color, from red or purple to greenish-white, in different varieties; the erect cones, which remain long on the branches, are above an inch in length and oblong-ovate in shape, with reddish-brown scales somewhat waved on the edges, the lower bracts usually rather longer than the scales. The tree flowers in April or May, and the winged seeds are shed the following autumn. When standing in an open space, uncrowded by neighboring trees, the larch grows of a nearly conical shape, with the lower branches almost reaching the ground, while those above gradually diminish in length towards the top of the trunk, presenting a very symmetrical form; but in dense woods the lower parts become bare of foliage, as with the firs under similar circumstances. When springing up among rocks or on ledges, the stem sometimes becomes much curved, and, with its spreading boughs and pendent branchlets, often forms a striking and picturesque object in the Alpine passes and steep ravines in which the tree delights to grow. In the prevalent European varieties the bark is reddish-gray, and rather rough and scarred in old trees, which are often much lichen-covered. The trunk attains a height of from 80 to 140 feet, with a diameter of from 3 to 5 feet near the ground, but in close woods is comparatively slender in proportion to its altitude. The larch abounds on the Alps of Switzerland, on which it flourishes at an elevation of 5000 feet, and also on those of Tyrol and Savoy, on the Carpathians, and in most of the hill regions of Central Europe; it is likewise found on parts of the Apennine chain, but is not indigenous to the Pyrenées, and in the wild state is unknown in the Spanish peninsula. It forms extensive woods in Russia, but does not extend its range to the Scandinavian countries, where its absence is somewhat remarkable, as the tree grows freely in Norway and Sweden where planted, and even multiplies itself by self-sown seed, according to Schübeler, in the neighborhood of Trondhjem. In the northeastern parts of Russia, in the country towards the Petchora river, and on the Ural, a peculiar variety prevails, regarded by some as a distinct species (*L. sibirica*); this form is abundant nearly throughout Siberia, extending to the Pacific coast of Kamchatka and the hills of Dahuria. The Siberian larch has smooth gray bark and smaller cones, approaching in shape somewhat to those of the American hackmatack; it seems even hardier than the Alpine tree, growing up to latitude 68°, but, as the inclement climate of the polar shores is neared, dwindling down to the form of a dwarf and even trailing bush; on the Altai, however, Pallas states that it flourishes only at medium elevations.

The larch, from its lofty straight trunk and the high quality of its wood, must be regarded as one of the most important of coniferous trees; its growth is extremely rapid, the stem attaining a large size in from sixty to eighty years, while the tree yields good useful timber at forty or fifty; it forms firm heartwood at an early age, and the sapwood is less perishable than that of the firs, rendering it more valuable in the young state.

The wood of large trees is close and compact in texture, in the best varieties of a deep reddish color varying to brownish-yellow, but apt to be lighter in tint, and less hard in grain, when grown in rich soils or in low sheltered situations. It is remarkably tough, resisting a rending strain better than any of the fir or pine woods in common use, though not as elastic as some; properly seasoned, it is as little liable to shrink as to split; the boughs being small compared to the trunk, the timber is more free from large knots, and the small knots remain firm and undecayed. The only drawback to these good qualities is a certain liability to warp and bend, unless very carefully seasoned; for this purpose it is recommended to be left floating in water for a year after felling, and then allowed some months to dry slowly and completely before sawing up the logs; barking the trunk in winter while the tree is standing, and leaving it in that state till the next year, has been often adviced with the larch as with other timber, but the practical inconveniences of the plan have prevented its adoption on any large scale. When well prepared for use, larch is one of the most durable of coniferous woods. Its strength and toughness render it valuable for naval purposes, to which it is largely applied; its freedom from any tendency to split adapts it for clinker-built boats, for the construction of which a high authority, Matthew, pronounces it the best of all woods. It is much employed for house building in all countries where it grows in abundance; most of the picturesque log-houses in Vand and the adjacent cantons are built of squared larch trunks, and derive their fine brown tint from the hardened resin that slowly exudes from the wood after long exposure to the summer sun; the wooden shingles that in Switzerland supply the place of tiles are also frequently of larch. In Germany it is much used by the cooper as well as the carpenter, durable staves for casks being made of this valuable wood, while the form of the trunk admirably adapts it for all purposes for which long straight timber is needed. It is one of the most durable of woods in wet ground or under water, and answers well for fence-posts and river piles; many of the foundations of old Venice rest upon larch, the lasting qualities of which were well known and appreciated, not only in mediæval times, but in the far-off days of Vitruvius and Pliny. The harder and darker varieties are valuable to the cabinetmaker in the construction of cheap solid furniture, being fine in grain and taking polish better than many more costly woods. A peculiarity of larch wood is the difficulty with which it is ignited, although so resinous, a quality that gives it still higher value to the builder; for, though not quite so incombustible as the Romans deemed it, large pieces do not as easily take fire as the ordinary kinds of deal timber; and, coated with a thin layer of plaster, beams and pillars of larch might probably be found to justify Cæsar's epithet "igni impenetrabile lignum;" even the small branches are not easily kept alight, and a larch fire in the open needs considerable care. Yet the forests of larch in Siberia often suffer from conflagration. When these fires occur while the trees are full of sap, a curious mucilaginous matter is exuded from the half-burnt stems; when dry it is of a pale reddish color, like some of the coarser kinds of gum-arabic, and is soluble in water, the solution resembling gum-water, in place of which it is sometimes used; considerable quantities are collected and sold as "Orenburg gum;" in Siberia and Russia it is occasionally employed as a semi-medicinal food, being esteemed an antiscorbutic. For burning in close stoves and furnaces, larch makes tolerably good fuel, its value being estimated by Hartig as only one-fifth less than that of beech; the charcoal is compact, and is in demand for iron-smelting and other metallurgic uses in some parts of Europe.

In the trunk of the larch, especially when growing in climates where the sun is powerful in summer, a fine clear turpentine exists in great abundance; on the declivities of the Alps of Savoy and the south of Switzerland, it is collected by the peasants for sale, though not in such quantity as formerly, when, being taken to Venice for shipment, it was known in commerce as "Venice turpentine." Old trees are selected, from the bark of which it is observed to ooze in the early summer; holes are bored in the trunk, somewhat inclined upward towards the centre of the stem, in which, between the layers of wood, the turpentine is said to collect in small lacunæ; wooden gutters placed in these holes convey the viscous fluid into little wooden pails hung on the end of each gutter; the secretion flows slowly all through the summer months, and the little tubs are emptied and replaced as they fill; a tree in the proper condition yields from 6 to 8℔ a year, and will continue to give an annual supply for thirty or forty years, being, however, rendered quite useless for timber by subjection to this exhausting process. In Tyrol, whence a supply is also obtained, a single hole is made near the root of the tree in the spring; this is stopped with a plug, and the turpentine is removed by a scoop in the autumn; but each tree yields only from a few ounces to ½℔ by this process. Real larch turpentine is a thick, tenacious fluid, of a deep yellow color, and nearly transparent; it does not harden by time; it contains 15 per cent. of the essential oil of turpentine, also resin, succinic, pinic, and sylvic acids, and a bitter extractive matter. According to Pereira, much sold under the name of Venice turpentine is a mixture of common resin and oil of turpentine, and probably little of the real article now reaches England. On the French Alps a sweet exudation is found on the small branches of young larches in June and July, resembling manna in taste and laxative properties, and known as *Manna de Briançon* or *Manna Brigantina;* it occurs in small whitish irregular granular masses, which are removed in the morning before they are too much dried by the sun; this manna seems to differ little in composition from the sap of the tree, which also contains *mannite;* its cathartic powers are weaker than those of the manna of the manna ash (*Ornus*), but it is employed in France for the same purposes. The bark of the larch is largely used in some countries for tanning; it is taken from the trunk only, being stripped from the trees when felled; its value is about equal to that of birch bark; but, according to the experience of British tanners, it is scarcely half as strong as that of the oak. The soft inner bark is occasionally used in the wilds of Siberia as a ferment, by hunters and others, being boiled and mixed with rye-meal, and buried in the snow for a short time, when it is employed as a substitute for other leaven, and in making the sour liquor called "quass." In Germany a fungus (*Polyporus laricis*) grows on the roots and stems of decaying larches, which was formerly in esteem in England as a drastic purgative, but has given place to safer drugs, though it is still occasionally used by the Continental pharmacist. The young shoots of the larch are sometimes given in Switzerland as fodder to cattle.

The larch, though mentioned by Parkinson in 1629 as "nursed up" by a few "lovers of variety" as a rare exotic, does not seem to have been much grown in England till early in the last century. In Scotland the date of its introduction is a disputed point, but it seems to have been planted at Dunkeld by the duke of Athole in 1727, and about thirteen or fourteen years later considerable plantations were made at that place, the commencement of one of the largest planting experiments on record: it is estimated that 14 million larches were planted on the Athole estates between that date and 1826. The cultivation of the tree rapidly spread, and the larch has long become a conspicuous feature of the scenery in many parts of Scotland. It grows as rapidly and attains as large a size in British habitats suited to it as in its home on the Alps, and often produces equally good timber, but has sometimes been planted under circumstances little adapted to its successful growth. The larch of Europe is essentially a mountain tree, and requires, not only free air above, but a certain moderate amount of moisture in the soil beneath, with, at the same time, perfect drainage, to bring the timber to perfection,—conditions often occurring on the mountain slope and rocky glen that form its natural habitats, but not always so readily provided in artificial culture. Complete freedom from stagnant water in the ground, and abundant room for the spread of its branches to light and air, are the most necessary requirements for the successful growth of larch,—the contrary conditions being the most frequent causes of failure in the cultivation of this valuable tree. Where these important needs are complied with, it will flourish in a great variety of soils, stiff clays, wet or mossy peat, and moist alluvium being the chief exceptions; in its native localities it seems partial to the debris of primitive and metamorphic rocks, but is occasionally found growing luxuriantly on calcareous subsoils; in Switzerland it attains the largest size and forms the best timber, on the northern declivities of the mountains; but in Scotland a southern aspect appears most favorable. The best variety for culture in Britain is that with red female flowers; the light-flowered kinds are said to produce inferior wood, and the Siberian larch does not grow in Scotland nearly as fast as the Alpine tree. The larch is raised from seed in immense numbers in British nurseries; that obtained from Germany is preferred, being more perfectly ripened than the cones of home growth usually are. The seeds are sown in April, on rich ground, which should not be too highly manured; the young larches are planted out when two years old, or sometimes transferred to a nursery bed to attain a larger size; but, like all conifers, they succeed best when planted young; on the mountains, the seedlings are usually put into a mere slit made in the ground by a spade with a triangular blade, the place being first cleared of any heath, bracken, or tall herbage that might smother the young tree; the plants should be from 3 to 4 feet apart, or even more, according to the growth intended before thinning, which should be commenced as soon as the boughs begin to overspread much; little or no pruning is needed beyond the careful removal of dead branches. The larch is said not to succeed on arable land, especially where corn has been grown, but recent experience does not seem to support this prejudice; that against the previous occupation of the ground by Scotch fir or Norway spruce is probably better founded, and, where timber is the object, it should not be planted with other conifers. On the Grampians and neighboring hills the larch will flourish at a greater elevation than the pine, and will grow up to an altitude of 1700 or even 1800 feet; but it attains its full size on lower slopes. In very dry and bleak localities, the Scotch fir will probably be more successful up to 900 feet above the sea, the limit of the luxuriant growth of that hardy conifer in Britain; and in moist valleys or on imperfectly drained acclivities Norway spruce is more suitable. The growth of the larch while young is exceedingly rapid; in the south of England it will often attain a height of 25 feet in the first ten years, while in favorable localities it will grow upwards of 80 feet in half a century or less; one at Dunkeld felled sixty years after planting was 110 feet high; but usually the tree does not increase so rapidly after the first thirty or forty years. Larches now exist in Scotland that rival in size the most gigantic specimens standing in their native woods, a tree at Dalwick, Peeblesshire (said to have been planted in 1725), is 5 feet in diameter; one at Glenarbuck, near the Clyde, is above 140 feet high, with a circumference of 13 feet. The annual increase in girth is often considerable even in large trees; the fine larch near the abbey of Dunkeld figured by Strutt in his *Sylva Britannica* increased 2½ feet between 1796 and 1825, its measurement at the latter date being 13 feet, with a height of 97½ feet.

In the south of England, the larch is much planted for the supply of hop-poles, and is considered one of the best woods for that purpose, the stems being straight and easily trimmed into poles, while they are extremely durable, though in parts of Kent and Sussex those formed of the Spanish chestnut are regarded as still more lasting. In plantations made with this object, the seedlings are placed very close (from 1½ to 2 feet apart), and either cut down all at once, when the required height is attained, or thinned out, leaving the remainder to gain a greater length; the land is always well trenched before planting; the best season for larch planting, whether for poles or timber, is the month of November; the operation is sometimes performed in the spring, but the practice cannot be commended as the sap flows early, and, if a dry period follows, the growth is sure to be checked. The thinnings of the larch woods in the Highlands are in demand for railway sleepers, scaffold poles, and mining timber, and are applied to a variety of agricultural purposes. The tree generally succeeds on the Welsh hills, and might with advantage be planted on many of the drier mountains of Ireland, now mere barren moorland or poor unremunerative pasture.

The European larch has long been introduced into the United States, where, in suitable localities, it flourishes as luxuriantly as in Britain. Of late years some plantations have been made in America with an economic view, the tree growing much faster, and producing good timber at an earlier age, than the native hackmatack, while the wood is less ponderous, and therefore more generally applicable.

The larch in Britain is occasionally subject to destructive casualties. The young seedlings are sometimes nibbled by the hare and rabbit; and on parts of the Highland hills both bark and shoots are eaten in the winter by the roe-deer, which is a great enemy to young plantations; larch woods should always be fenced in to keep out the hill-cattle, which will browse upon the shoots in spring. The "woolly aphis," "American blight," or "larch blight" (*Eriosoma laricis*) often attacks the trees in close valleys, but rarely spreads much unless other unhealthy conditions are present. A far more formidable enemy is the disease known as the "heart-rot;" it occurs in all the more advanced stages of growth, occasionally attacking young larches only ten years old or less, but is more common at a later period, when the trees have acquired a considerable size, sometimes spreading in a short time through a whole plantation. The trees for a considerable period show little sign of unhealthiness, but eventually the lower part of the stem near the root begins to swell somewhat, and the whole tree gradually goes off as the disease advances; when cut down, the trunk is found to be decayed at the centre, the "rot" usually commencing near the ground and gradually extending upwards. Trees of good size are thus rendered nearly worthless, often showing little sign of unhealthiness till felled. Great difference of opinion exists among foresters as to the cause of this destructive malady; the manner in which it spreads would seem to indicate a fungoid origin, and the previous growth of pine on the ground is one of the most usual explanations offered. That some fungoid mycelium may be the remote cause of the disease seems not improbable; but there is little doubt that any circumstance that tends to weaken the tree acts as a predisposing cause of the attack, and the best safeguards are probably perfect drainage, and early and sufficient thinning. On exposed hill-sides, and other well-drained breezy localities, the larch is little liable to failure from "rot" or any other cause. On arid subsoils, however, the tree will sometimes be injured in very dry seasons; and such situations, though suitable for Scotch fir, are therefore badly adapted for larch.

Considerable quantities of larch timber are imported into Britain for use in the dockyards, in addition to the large home supply. The quality varies much, as well as the color and density; an Italian sample in the museum at Kew (of a very dark red tint) weighs about 24½ lb to the cubic foot, while a Polish specimen, of equally deep hue, is 44 lb 1 oz. to the same measurement.

For the purposes of the landscape gardener, whose chief aim is the picturesque, the larch is a valuable aid in the formation of park and pleasure ground. On steep hill-sides, the lofty aspiring stem and drooping branchlets add a pleasing feature to the prospect; the light airy aspect of the tree adapts it as a contrast to the heavier masses of the pines and firs; the bright light-green foliage in the spring affords an agreeable variety, and nature presents few more refreshing objects to the sight than a larch plantation bursting into young leaf; in the late autumn, the pale yellow of the changing foliage stands out in strong relief to the sombre tones of the evergreen conifers, or the deep red-brown of the beech; but in park or plantation the larch is never seen to such advantage as when hanging over some tumbling burn or rocky pass among the mountains. A variety with very pendent boughs, known as the "drooping" larch, is occasionally met with in gardens.

The bark of the larch has lately been introduced into pharmacy, being given, generally in the form of an alcoholic tincture, in chronic bronchitic affections and internal hæmorrhages. It contains, in addition to tannin, a peculiar principle called *larixin*, which may be obtained in a pure state by distillation from a concentrated infusion of the bark; it is a colorless substance in long crystals, with a bitter and astringent taste and a faint acid reaction; hence some term it *larixinic acid*

The genus is represented in the eastern parts of North America by the hackmatack (*L. americana*), of which there are several varieties, two so well marked that they are by some botanists considered specifically distinct. In one (*L. microcarpa*) the cones are very small, rarely exceeding ½ inch in length, of a roundish oblong shape; the scales are very few in number, crimson in the young state, reddish-brown when ripe; the tree much resembles the European larch in general appearance, but is of more slender growth; its trunk is seldom more than 2 feet in diameter, and rarely above 80 feet high; this form is the red larch, the *épinette rouge* of the French Canadians. The black larch (*L. pendula*) has rather larger cones, of an oblong shape, about ¾ inch long, purplish or green in the immature state, and dark brown when ripe, the scales somewhat more numerous, the bracts all shorter than the scales. The bark is dark bluish-gray, smoother than in the red larch, on the trunk and lower boughs often glossy; the branches are more or less pendulous and very slender. The red larch grows usually on higher and drier ground, ranging from the Virginia mountains to the shores of Hudson's Bay; the black larch is found on moist land, and even in swamps. The hackmatack is one of the most valuable timber trees of America; it is in great demand in the ports of the St. Lawrence for shipbuilding, the best vessels built in British America having their frames wholly or partially constructed of this fine wood. It is far more durable than any of the oaks of that region, is heavy and close-grained, and much stronger, as well as more lasting, than that of the pines and firs of Canada. In many parts all the finer trees have been cut down, but large woods of it still exist in the less accessible districts; it abounds especially near Lake St. John, and in Newfoundland is the prevalent tree in some of the forest tracts; it is likewise common in Maine and Vermont. In the timber and building yards the "red" hackmatack is the kind preferred, the produce, probably, of *L. microcarpa*; the "gray" is less esteemed; but the varieties from which these woods are obtained cannot always be traced with certainty. Several fine specimens of the red larch exist in English parks, but its growth is much slower than that of *L. europæa*, and it has never been planted on a large scale; the more pendulous forms of *L. pendula* are elegant trees for the garden. The hackmatacks might perhaps be grown with advantage in places too wet for the common larch.

In Western America a larch occurs more nearly resembling *L. europæa*, the western larch (*L. occidentalis*) of Nuttall, who speaks of it as found by him in "the coves of the Rocky Mountains on the western slope towards the Oregon." The leaves are short, thicker and more rigid than in any of the other larches; the cones are much larger than those of the hackmatacks, egg-shaped or oval in outline; the scales are of a fine red in the immature state, the bracts green and extending far beyond the scales in a rigid leaflike point. The bark of the trunk has the same reddish tint as that of the common larch of Europe. This is probably the tree described by Fremont as the European larch, and found by him in great abundance on the Blue Mountains, near the valley called the Grand Rond. He alludes to the large size of the trunk, some of the trees being 200 feet high and one 10 feet in circumference; the stems were often clear of branches for 100 feet from the ground. Little is known of the quality of the timber, but specimens of the wood seem to be firm and close in grain; the color is a pale reddish tint throughout. From its great size the tree would appear worthy of the attention of American planters.

The other species of the genus *Larix* present few features of interest except to the botanist. (C. P. J.)

LARD is the melted and strained fat of the common hog. The bulk of the lard of commerce is obtained from the abdominal fat of the animal; but in the preparation of inferior qualities fatty scraps of all kinds which result from the preparation of pork are melted up, and occasionally entire flanks of pigs are treated for the fat they yield. Ordinary lard is a pure white fat of the consistency of butter, having a faint characteristic taste, and scarcely any odor. It melts at between 78° to 88° Fahr., has a specific gravity of 0.915, and consists of 62 per cent. of fluid fat (olein or lard oil), and 38 per cent. of the hard fats palmitin and stearin. If perfectly pure it has no tendency to become rancid; but there is generally sufficient impurity present to develop a change in the olein, which gradually exhibits itself by a yellow color and a rancid odor and taste. Lard is an article of considerable importance in commerce; it is calculated that the annual produce of the substance in the United States of America alone is not less than 5,000,000 cwts. Its preparation is conducted in connection with the great pork-curing and packing establishments, mostly centred in Chicago, Cincinnati, St. Louis, Milwaukee, Louisville, and Indianapolis,—Chicago alone now monopolizing about one-half of the American trade. In these establishments the fat is "rendered" in large vats heated by coils or worms of steam pipes, each charge being completely melted in from ten to twelve hours. The greaves or cracklings which remain are used for making "dog biscuits," etc. The finest lard is prepared from the "leaf" fat of the abdominal cavity, and passes into commerce as "prime steam lard." The intestinal fat, trimmings, and refuse yield No. 2 lard, which is mostly sent to the European market. The summer-killed pigs yield on an average 34 ℔ of lard, while the winter-killed animals produce about 37 ℔, but in the case of selected animals these figures may rise to 45 ℔ and 54 ℔ respectively. The uses of lard are numerous: it is largely employed by biscuit and pastry bakers and in domestic cookery; it is used in the dressing and currying of leather; it is an important article in pharmacy for ointments, plasters, and suppositories; it forms a principal ingredient in many pomades and preparations for the toilet; and it is the source of the important lard oil and "solar stearin" noted below. Lard is occasionally adulterated with water up even to 20 per cent., with starch, chalk, plaster of Paris, baryta, etc. Such falsifications, owing to the nature of the substance, are easily detected:—the water by bringing the substance gently to the melting-point when it separates; starch by the characteristic reaction with iodine; and mineral substance by the ash remaining after the burning of the fat. The imports into the United Kingdom in 1880 amounted to 927,512 cwts., value £1,852,160,—the very large proportion of 873,100 cwts. coming from the United States, and 46,618 from British North America. A large amount of native lard is also consumed in the United Kingdom, this being usually put up in bladders for sale. That prepared in Wiltshire is the most highly prized, and is the quality generally used in domestic cookery.

Lard oil is the limpid, clear, colorless oil expressed by pressure and gentle heat from lard, leaving a solid, glistening, and crystalline residue, known in commerce as "solar stearin," which is useful in candle making, but is also used to adulterate spermaceti. Lard oil has now an important function in industry, being principally employed for the oiling of wool and in lubrication. It is also a good deal consumed in the falsification of more valuable oils, for which its neutral properties well adapt it; and it in turn is adulterated with cotton seed oil, etc.

LARDNER, Dionysius (1793–1859), a prolific scientific writer, was born at Dublin, April 3, 1793. His father was a solicitor, and intended his son to follow the same calling. After some years of uncongenial desk work, Lardner, determining on a university career, entered Trinity College, Dublin, and graduated B.A. in 1817. In 1828 he became professor of natural philosophy and astronomy at University College, London, a position which he held till 1840, when he eloped with a married lady and had to leave the country. After a most successful lecturing tour through the principal cities of the United States, which realized 200,000 dollars, he returned to Europe in 1845. He settled at Paris, and continued to reside there till within a few months of his death, which took place at Naples, April 29, 1859.

Though lacking in real originality or brilliancy, Lardner showed himself to be a successful popularizer of science. He was the author of numerous mathematical and physical treatises on such subjects as algebraic geometry (1823), the differential and integral calculus (1825), the steam engine (1828), besides hand-books on various departments of natural philosophy (1854–56); but it is as the editor of *Lardner's Cyclopædia* (1830–44) that he will be best remembered. To this scientific library of 134 volumes many of the ablest savants of the day contributed, Lardner himself being the author of the treatises on arithmetic, geometry, heat, hydrostatics and pneumatics, mechanics (in conjunction with Kater), and electricity (in conjunction with Walker). The *Cabinet Library* (12 vols., 1830–32), and the *Museum of Science and Art* (12 vols., 1854–56) are his other chief undertakings. A few original papers appear in the Royal Irish Academy's *Transactions* (1824), in the Royal Society's *Proceedings* (1831–36), and in the Astronomical Society's *Monthly Notices* (1852–53); and two *Reports* to the British Association on railway constants (1838, 1841) are from his pen

LARDNER, Nathaniel (1684–1768), author of *The Credibility of the Gospel History*, was born at Hawkhurst, Kent, in 1684. After having studied for the Presbyterian ministry in London, and also at Utrecht and Leyden, he in 1709 took license as a preacher; but, failing to gain acceptance in the pulpit, he in 1713 entered the family of a lady of rank as tutor and domestic chaplain, and in this position he remained until 1721. In 1724 he was appointed to deliver the Tuesday evening lecture in the Presbyterian chapel, Old Jewry, London, and in 1729 he became assistant minister to the Presbyterian congregation in Crutched Friars. He died at Hawkhurst on July 24, 1768.

An anonymous volume of *Memoirs* appeared in 1769; and a life by Kippis is prefixed to the edition of the *Works* of Lardner, published in 11 vols. 8vo in 1788, in 4 vols. 4to in 1817, and 10 vols. 8vo in 1827. The full title of his principal work—a work which, though now quite out of date, gives its author a permanent place of some respectability in the history of Christian apologetics—is *The Credibility of the Gospel History; or the Principal Facts of the New Testament confirmed by Passages of Ancient Authors, who were contemporary with our Saviour or his Apostles, or lived near their time.* Part i., in 2 vols. 8vo, appeared in 1727; the publication of part ii., in 12 vols. 8vo, began in 1733 and ended in 1755. In 1730 there was a second edition of part i., and the *Additions and Alterations* were also published separately. A *Supplement*, otherwise entitled *A History of the Apostles and Evangelists, Writers of the New Testament*, was added in three vols. (1756–57), and reprinted in 1760. Other works by Lardner are *A large Collection of Ancient Jewish and Heathen Testimonies to the Truth of the Christian Revelation, with Notes and Observations*, 4 vols. 4to, 1764–67; *The History of the Heretics of the first two Centuries after Christ*, published posthumously in 1780; a considerable number of occasional sermons; and *A Letter concerning the question whether the Logos supplied the place of the Human Soul in the Person of Jesus Christ.* In this tract, written in 1730 and published in 1759, Lardner indicated his preference for the Unitarian view.

LARES were Roman deities, whose character and worship share in the obscurity that envelops all antique Roman religion. They belonged to the cultus of the dead, from which so much of Roman and Greek religion was derived; they were the deified ancestors still living in their graves in the house, and worshipped by the family as their guardians and protectors. But the dead were powerful also to do harm, unless they were duly propitiated with all the proper rites; they were spirits of terror as well as of good; in this fearful sense the names *Lemures* and still more *Larvæ* were appropriated to them. The name Lar has been thought to be an Etruscan word, meaning "lord;" it is a common personal name or title in Etruria. We find certainly, from a very early time, a distinction between *Lares privati* and *Lares publici*. The former were worshipped in the house by the family alone, and the *Lar familiaris* was conceived as the head of the family and of the family cultus. The *Lares publici* belonged to the state religion; and their worship, after having fallen into neglect, was restored by Augustus and to some extent remodelled. It is therefore difficult to distinguish how far the known rites of the cultus are ancient; but it seems certain that the *genius* of Augustus, as refounder of the state, was added, and that the original *Lares præstites* were two in number. Schwegler and others have maintained that this pair are the twin brothers so frequent in early religions, the Romulus and Remus of the Roman foundation-legend; that the tale of the twins is in most of its elements derived from the religion of the two Lares; that Acca Larentia, the fostermother of the twins, is the same as Lara, Larunda, Mania, or Muta, the mother of the Lares; and that the Larentalia, celebrated on December 23, was a feast of the Lares. But the two sets of legends must be strictly distinguished: the difference in the quantity of the opening syllable shows that Larentia has no connection with Larunda and the Lares; the Larentalia was a festival of Jupiter and Acca Larentia, in which the Lares had no place; and Mommsen argues that Remus was a late addition to the foundation legend, in which originally Romulus alone was known. As restored by Augustus, the *Lares præstites* were the guardians of the state and protectors of its unity; and, in lesser circles, every division of the city had likewise its *Lares compitales*, now three in number, who had their own ædicula at the cross-roads and their special festival, *Compitalia*. The temple of the city Lares (*sacellum Larum*) was near the top of the Via Sacra.

The worship of the private Lares, who had their home either on the hearth of the *atrium* or in their own little shrine, *lararium*, persisted throughout the pagan period, but in later time changed its character to a great extent. The emperor Alexander Severus had images of Abraham, Christ, and Alexander the Great among his household Lares. These domestic Lares were worshipped daily, but with special rites on the kalends, nones, and ides of every month; they shared with the family in every festival; when the young bride entered the house for the first time she offered a sacrifice to them; when the boy assumed the *toga virilis* he dedicated his childish *bulla* to the *Lar familiaris*. Marquardt maintains that there was only one *Lar* in each household, and that the two *Lares compitales* were the guardians of the two roads that intersected at the *compita*. The Lemures as distinguished from the Lares were propitiated at the festival of the *Lemuralia*, on the 9th, 11th, and 13th of May. In it the dead were propitiated, and the strange, unexplained ceremony of throwing the *arges* into the river was performed. A legend of the birth of the Lares makes them children of the god Mercury, and a female figure, Larunda, Lara, or Lala. The fact that the dog was sacred to them, and that a stone figure of a dog stood in the Sacellum Larum, deserves notice in illustration of this legend, for the dog is connected with the Greek god Hermes. Probably this may have arisen under Greek influence. Other classes of Lares mentioned as early as the republican period are the *Lares rurales, viales, permarini*. To the last-named Aurelius dedicated a temple in commemoration of the naval victory over Antiochus, 190 B.C. The generally accepted view is that the Lares are represented as young men crowned with laurel, dressed in short high girt tunics, holding horns and cups in their hands; but Marquardt, in accordance with his view that there was only one *Lar*, considers that these two figures are penates, and on a coin of the gens Cæsia the Lares are represented as two young men with chlamys and spear, seated, with a dog between them. Jordan remarks that in the *cinctus Gabinus* the end of the toga was thrown over the head, whereas the Lares always wear only a tunic, and have never veiled heads. The *Compitalia* was, during the Republican time, a *feria conceptiva*, set by the prætor at some time soon after the Saturnalia, December 17–19. Under the empire it was fixed for January 3–5.

See Schömann, *De Diis Manibus;* Hertzberg, *De Diis Roman patr.;* Hartung, *Relig. der Römer;* Schwegler, *Röm. Gesch.*, vol. ii.; Preller, *Röm. Mythol.;* Jordan, "Vesta und die Laren," and "De Larum Imag.," in *Annali*, 1862; Reifferscheid, "De Lar. pict. Pomp.," in *Annali*, 1863; Marquardt, *Röm. Staatsverw.*, iii. 120, 197, 244; Mommsen, "Acca Larentia," in *Röm. Forsch.*, ii., and "Remus Legend," in *Hermes*, 1881.

LARGILLIÈRE, Nicolas (1656–1746), perhaps the most distinguished portrait painter of the age of Louis XIV., was born at Paris, October 20, 1656. His father, who was a merchant, took him to Antwerp at the age of three, and when nine years old he accompanied a friend of the family to London, where he remained nearly two years. The attempt to turn his attention to business having failed, he entered, some time after his return to Antwerp, the studio of Goubeau, quitting this at the age of eighteen to seek his fortune in England, where he was befriended by Lely, who employed him for four years at Windsor. His skill attracted the notice of Charles II., who wished to retain him in his service, but the fury aroused against Catholics by the Rye House Plot alarmed Largillière for his own safety, and he left England for Paris, where he was well received by Le Brun and Van der Meulen. In spite of his Flemish training the reputation of Largillière, especially as a portrait painter, was soon established; his brilliant color and lively touch attracted all the celebrities of the day,—actresses, public men, and popular preachers flocking to his studio. Huet, bishop of Avranches, Cardinal de Noailles, the Duclos, and President Lambert, with his beautiful wife and daughter, are amongst some of his most noted subjects. It is said that James II. recalled Largillière to England on his accession to the throne in 1685, that he declined to accept the office of keeper of the royal collections, but that, although he could not be induced to remain in London permanently, he made a short visit, during which he painted portraits of the king, the queen, and the prince of Wales. This last is impossible, as the birth of the prince did not take place till 1688; the three portraits, therefore, painted by Largillière of the Pretender in his youth must all have been executed in Paris, to which city he returned some time before March, 1686, when he was received by the Academy as a member, and presented as his diploma picture the fine portrait of Le Brun, now in the Louvre. He was received as an historical painter; but, although he occasionally produced works of that class (Crucifixion, engraved by Roettiers), and also treated subjects of still life, it was in his historical portraits that he excelled. Horace Walpole tells us that he left in London those of Pierre van der Meulen and of Sybrecht. His works are rare in the local museums, but several are at Versailles. The church of St. Étienne du Mont at Paris contains the finest example of Largillière's work when dealing with large groups of figures; it is an *ex voto* offered by the city to St. Geneviève, painted in 1694, and containing portraits of all the leading officers of the municipality. Largillière passed through every post of honor in the Academy, until in 1743 he was made chancellor. He died on the 20th March, 1746. Oudry was the most distinguished of his pupils. Largillière's work found skilful interpreters in Van Schuppen, Edelinck, Desplaces, Drevet, Pitou, and other engravers.

LARISSA (in Turkish *Yeni Shehr*), the most important town of Thessaly, is situated in a rich agricultural district on the right bank of the Salambria (Peneius), about 35 miles northwest of Volo. Up till 1881 it was the seat of a pasha in the vilayet of Janina; it now ranks as the chief town of the new Greek province. Its long subjection to Turkey has left little trace of a nobler antiquity, and the most striking features in the general view are the mosques and Mohammedan burying grounds. It was the seat of a strong Turkish garrison, and the great mass of the people were of Turkish blood. In the outskirts is a village of Africans from the Sudan—a curious remnant of the forces collected by Ali Pasha. The manufactures include Turkish leather, cotton, silk, and tobacco, but the general state of trade and industry is far from being prosperous. Fevers and agues are rendered prevalent by the badness of the drainage and the overflowing of the river; and the death-rate is higher than the birth-rate. The population is estimated at 25,000 or 30,000.

Larissa, written Larisa on ancient coins and inscriptions, is near the site of the Homeric Argissa. It appears in early times as a powerful city under the rule of the Aleuadæ, whose authority extended over the whole plain of the Pelasgiotis. The inhabitants sided with Athens during the Peloponnesian War, and during the Roman invasion their city was a point of considerable importance. In the 5th century it was made the seat of an archbishop, who has now fifteen suffragans. During the war of Greek independence Larissa was the headquarters of Ali Pasha. Notices of the few ancient inscriptions recently found at Larissa are given by Miller in *Mélanges philologiques*, Paris, 1880. The name Larissa is a common one, and the city has more particularly to be distinguished from Larissa Cremaste on Mount Othrys.

LÁRISTÁN, a province of Persia, bounded by Farsistán on the W. and N. W., by Kirmán on the E. and N. E., by the Persian Gulf on the S. It lies between 26° 30′ and 28° 25′ N. lat., 52° 30′ and 55° 30′ E. long., and has an extreme length and breadth of 210 and 120 miles respectively, with an area of 20,000 square miles. Láristán is one of the least productive provinces in Persia, consisting mainly of mountain ranges in the north and east, and of arid plains varied rith rocky hills and salt or sandy valleys stretching hence to the coast. In the highlands there are some ertile upland tracts producing corn, dates, and other ruits; and the climate is genial. But elsewhere it is xtremely sultry, and on some low-lying coast lands ubject to malaria. Good water is everywhere so carce that but for the rain preserved in cisterns the ountry would be mostly uninhabitable. The coast is hiefly occupied by Arab tribes under their own chiefs, who are virtually independent, paying merely a nomial tribute to the shah's Government. They reside in mall towns and mud forts scattered along the coast, nd were till recently addicted to piracy. The people f the interior are mostly of the old Iranian stock, intermediate between the Tajiks and Kurds, and speaking an archaic form of Persian. Here the chief tribes re the Mezaijan, about 1600, with numerous flocks nd herds; the Bekoi. 2500; and the Tahuni, 200. Aristán was subdued eight hundred years ago by Turki khan, and remained an independent state till ts last ruler was deposed and put to death by Shah Abbás the Great. Population about 90,000.

LARK, Anglo-Saxon *Láwerce*, German *Lerche*, Danish *Lærke*, Dutch *Leeuwerik*, a bird's name (perhaps always, but now certainly) used in a rather genral sense, the specific meaning being signified by a prefix, as Skylark, Titlark, Woodlark, and so forth. It seems to be nearly conterminous with the Latin *Alauda* as used by older authors; and, though this was to some extent limited by Linnæus, several of the pecies included by him under the genus he so designated have long since been referred elsewhere. By Englishmen the word Lark, used without qualification, lmost invariably means the **SKYLARK**, *Alauda arvensis*, which, as the best known and most widelypread species throughout Europe, has been invariably considered the type of the genus. It scarcely needs description. Of all birds it holds unquestionably the foremost place in our literature, and there is hardly a poet or poetaster who has not made it his theme, to say nothing of the many writers of prose who have celebrated its qualities in passages that will be remembered so long as our language lasts. It is also one of the most favorite cage birds, as it will live for many years in captivity, and, except in he season of moult, will pour forth its thrilling song many times in an hour for weeks or months together, while its affection for its owner is generally of the most marked kind. Difficult as it is o estimate the comparative abundance of different species of birds, there would probably be no error in accounting the Skylark the most plentiful of the Class in Western Europe. Not only does it frequent almost all unwooded districts in this quarter of the globe, making known its presence throughout spring and summer, everywhere that it occurs, by its gladsome and heart-lifting notes, but, unlike most birds, its numbers increase with he spread of agricultural improvement, and since he beginning of the century the extended breadth of arable land in Great Britain must have multiplied manifold the Lark-population of the country. Nesting chiefly in the growing corn, its eggs and young are protected in a great measure from all molestation; and as each pair of birds will rear several broods in the season, their produce on the average may be set down as at least quadrupling the original stock —the eggs in each nest varying from five to three. The majority of young Larks seem to leave their birthplace as soon as they can shift for themselves, but what immediately becomes of them is one of the many mysteries of bird-life that has not yet been penetrated. When the stubbles are cleared, old and young congregate in flocks; but the young then seen appear to be hose only of the later broods. In the course of the autumn they give place to others coming from more northerly districts, and then as winter succeeds in great part vanish, leaving but a tithe of the numbers previously present. On the approach of severe weather, in one part of the country or another, flocks arrive, undoubtedly from the Continent, which in magnitude cast into insignificance all those that have hitherto inhabited the district. On the east coast of both Scotland and England this immigration has been several times noticed as occurring in a constant stream for as many as three days in succession. Further inland the birds are observed "in numbers simply incalculable," and "in countless hundreds." On such occasions the bird-catchers are busily at work with their nets or snares, so that 20,000 or 30,000 Larks are often sent together to the London market, and at the lowest estimate £2000 worth are annually sold there. During the winter of 1867–68, 1,255,500 Larks, valued at £2260, were taken into the town of Dieppe.[1] The same thing happens in various places almost every year, and many persons are apt to believe that thereby the species is threatened with extinction. When, however, it is considered that, if these birds were left to continue their wanderings, a large proportion would die of hunger before reaching a place that would supply them with food, and that of the remainder an enormous proportion would perish at sea in their vain attempt to find a settlement, it must be acknowledged that man by his wholesale massacres, which at first seem so brutal, is but anticipating the act of Nature, and on the whole probably the fate of the Larks at his hands is not worse than that which they would encounter did not his nets intervene.

The Skylark's range extends across the Old World from the Faroe to the Kurile Islands. In winter it occurs in North China, Nepaul, the Punjab, Persia, Palestine, Lower Egypt, and Barbary. It sometimes strays to Madeira, and has been killed in Bermuda, though its unassisted appearance there is doubtful. It has been successfully introduced on Long Island in the State of New York, and into New Zealand—in which latter it is likely to become as troublesome a denizen as are other subjects upon which Acclimatization Societies have exercised their meddlesome activity. Allied to the Skylark a considerable number of species have been described, of which perhaps a dozen may be deemed valid, besides a supposed local race, *Alauda agrestis;* the difference between which and the normal bird is shown in the annexed woodcut (fig. 1), kindly lent to this work by Mr. Dresser, in whose *Birds of Europe* it is described at length. These are found in various parts of Africa and Asia.

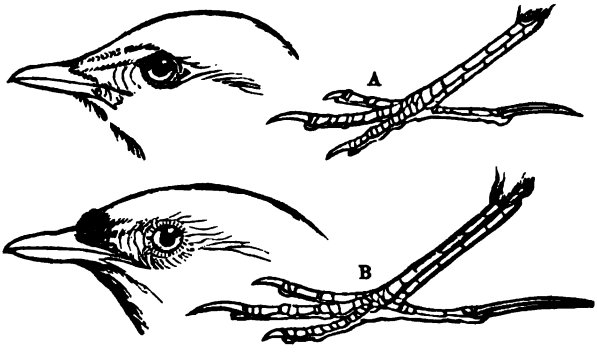

FIG. 1.—A, *Alauda agrestis;* B, *Alauda arvensis.*

The **WOODLARK**, *Alauda arborea*, is the only other clearly-established European species of the genus, as now limited by some recent authorities. It is a much more local and therefore a far less numerous bird than the Skylark, from which it may be easily distinguished by its finer bill, shorter tail, more spotted breast, and light superciliary stripe. Though not actually inhabiting woods, as its common name might imply, it is seldom found far from trees. Its song wants the variety and power of the Skylark's, but has a resonant sweetness peculiarly its own. The bird, however, requires much care in captivity, and is far less often caged than its congener. It has by no means so wide a range as the Skylark, and perhaps the most eastern locality recorded for it is Erzeroum, while its appearance in Egypt and even in Algeria must be accounted rare.

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[1] See Yarrell (*Hist. Br. Birds*, ed. 4, i. pp. 618–621), where particular references to the above statements, and some others, are given.

Not far removed from the foregoing is a group of Larks characterized by a larger crest, a stronger and more curved bill, a rufous lining to the wings, and some other minor features. This group has generally been termed *Galerita*,[1] and has for its type the Crested Lark, the *Alauda cristata* of Linnæus, a bird common enough in parts of France and some other countries of the European Continent, and said to have been obtained several times in the British Islands. Many of the birds of this group frequent the borders if not the interior of deserts, and such as do so exhibit a more or less pale coloration, whereby they are assimilated in hue to that of their haunts. The same characteristic may be observed in several other groups—especially those known as belonging to the Genera *Calandrella*, *Ammomanes*, and *Certhilauda*, some species of which are of a light sandy or cream color. The genus last named is of very peculiar appearance, presenting in some respects an extraordinary resemblance to the Hoopoes, so much so that the first specimen described was referred to the genus *Upupa*, and named *U. alaudipes*. The resemblance, however, is merely one of analogy. The HOOPOE (*q. v.*) belongs to a totally distinct Order of birds, widely differing anatomically and physiologically, and we can hardly yet assume that this resemblance is the effect of what is commonly called "mimicry," though that may ultimately prove to be the case.

There is, however, abundant evidence of the susceptibility of the Alaudine structure to modification from external circumstances,—in other words, of its plasticity; and perhaps no homogeneous group of *Passeres* could be found which better displays the working of "Natural Selection." This fact was recognized many years ago, and ere "Darwinism" was founded as a creed, by one whose knowledge of the *Alaudidæ* was based on the safe ground of extensive personal observation, and by one who cannot be suspected of any prejudice in favor of newfangled notions. The remarks made by Canon Tristram (*Ibis*, 1859, pp. 429–433) deserve all attention, going, as they do, to the root of the matter, and nothing but the exigencies of space precludes their reproduction here. A monograph of the Family executed by a competent ornithologist from an evolutionary point of view could not fail to be a weapon of force in the hands of all evolutionists. Almost every character that among Passerine birds is accounted most sure is in the Larks found subject to modification. The form of the bill varies in an extraordinary degree. In the Woodlark (fig. 2, A), already noticed, it is almost as slender as a Warbler's; in *Ammomanes* it is short; in *Certhilauda* (fig. 2, B) it is elongated and curved; in *Pyrrhulauda* and *Melanocorypha* (fig. 3, A) it is stout and Finchlike; while in *Rhamphocorys* (fig. 3, B) it is exaggerated to an extent that surpasses almost any Fringilline form, exceeding in its development that found in some members of the perplexing genus *Paradoxornis*, and even presenting a resemblance to the same feature in the far distant *Anastomus*—the tomia of the maxilla not meeting those of the mandibula along their whole length, but leaving an open space between them. The hind claw, generally greatly elongated in Larks, is in *Calandrella* (fig. 4) and some other genera reduced to a very moderate size. The wings exhibit almost every modification, from the almost entire abortion of the first primary in the Skylark to its considerable development (fig. 5), and from tertials and scapulars of ordinary length to the extreme elongation found in the *Motacillidæ* and almost in certain *Limicolæ*. The most constant character indeed of the *Alaudidæ* would seem to be that afforded by the *podotheca* or covering of the tarsus, which is scutellate behind as well as in front, but a character easily overlooked.[2]

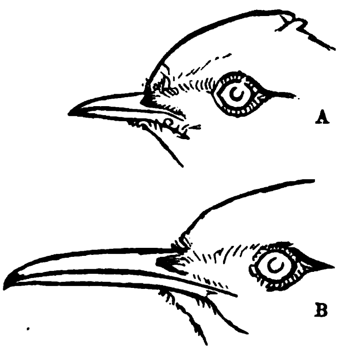

FIG. 2.—A, *Alauda arborea*; B, *Certhilauda*.

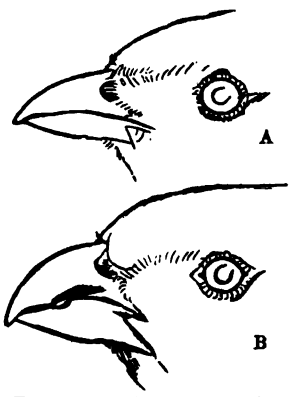

FIG. 3.—A, *Melanocorypha calandra*; B, *Rhamphocorys clot-bey*.

In the Old World Larks are found in most parts of the Palæarctic, Ethiopian, and Indian Regions; but only one genus, *Mirafra*, inhabits Australia, where it is represented by, so far as is ascertained, a single species, *M. horsfieldi*; and there is no true Lark indigenous to New Zealand. In the New World there is also only one genus, *Otocorys*,[3] where it is represented by two species, one of which, found over nearly the whole of

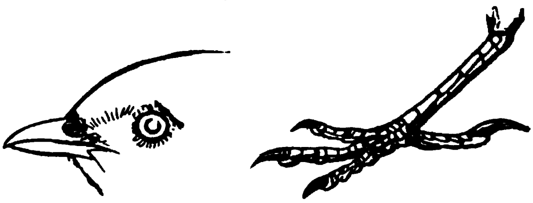

FIG. 4.—*Calandrella brachydactyla*.

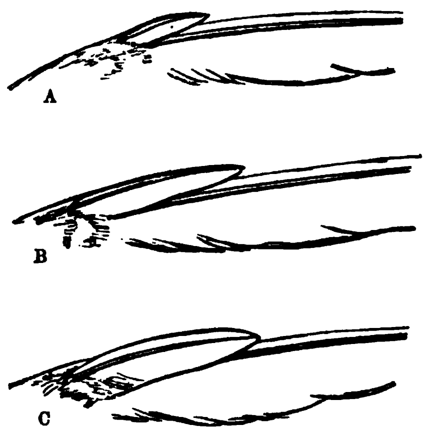

FIG. 5.—A, *Alauda arborea*; B, *Certhilauda*; C, *Melanocorypha calandra*.

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[1] The name, however, is inadmissible, owing to its prior use in tomology

[2] By assigning far too great an importance to this superficial character (in comparison with others), Sundevall (*Tentamen*, pp. 58-63) was induced to array the Larks, Hoopoes, and several other heterogeneous groups in one "Series," to which he applied the name of *Scutelliplantares*.

[3] By American writers it is usually called *Eremophila*, but that name seems to be preoccupied in natural history.

North America, is certainly not distinguishable from the Shore-Lark of Europe and Asia, *O. alpestris;* while the other, confined to the higher elevations of more southern latitudes, seems to be the relic of a former immigration (perhaps during a glacial period) of the northern form, which has through isolation come to be differentiated as *O. chrysolæma* (see BIRDS, vol. iii. p. 647). The Shore-Lark is in Europe a native of only the extreme north, but is very common near the shores of the Varanger Fjord, and likewise breeds on mountain-tops further southwest, though still well within the Arctic circle. The mellow tone of its call-note has obtained for it in Lapland a name signifying "Bell-bird," and the song of the cock is lively, though not very loud. The bird trustfully resorts to the neighborhood of houses, and even enters the villages of East Finmark in search of its food. It produces at least two broods in the season, and towards autumn migrates to lower latitudes in large flocks. Of late years these have been observed almost every winter on the east coast of Great Britain, and the species instead of being regarded, as it once was, in the light of an accidental visitor to the United Kingdom, must now be deemed an almost regular visitor, though in very varying numbers. The observations on its habits made by Audubon in Labrador have long been known, and often reprinted.[1] Other congeners of this bird are the *O. penicillata* of Southeastern Europe, Palestine, and Central Asia—to which are referred by Mr. Dresser (*B. Europe*, iv. p. 401) several other forms originally described as distinct; but the specific validity of one of them, *O. longirostris*, has since been reasserted by Dr. Scully (*Ibis*, 1881, p. 581)—as well as the *O. bilopha* of Arabia and Mauritania. All these birds, which have been termed Horned Larks, from the tuft of elongated black feathers growing on each side of the head, form a little group easily recognized by their peculiar coloration, which calls to mind some of the Ringed Plovers, *Ægialitis* (see KILLDEER, p. 78 of the present volume).

The name Lark is also frequently applied to many birds which do not belong to the *Alaudidæ* as now understood. The Mud-Lark, Rock-Lark, Titlark, and Tree-Lark are PIPITS (*q.v.*). The Grasshopper-Lark is one of the aquatic WARBLERS (*q.v.*), while the Meadow-Lark of America, as has been already said, is an ICTERUS (vol. xii. p. 736). Sand-Lark and Sea-Lark are likewise names often given to some of the smaller members of the *Limicolæ*. Of the true Larks, *Alaudidæ*, there may be perhaps about one hundred species, and it is believed to be a physiological character of the Family that they moult but once in the year, while the Pipits, which in general appearance so much resemble them, undergo a double moult, as do others of the *Motacillidæ*, to which they are most nearly allied. (A. N.)

LARNACA, or LARNICA. See CYPRUS.

LA ROCHEFOUCAULD, FRANÇOIS DE (1613–1680), the greatest maxim writer of France, one of her best memoir writers, and perhaps the most complete and accomplished representative of her ancient nobility, was born at Paris in the Rue des Petits Champs on the 15th of September, 1613. His family was one of the most ancient and noble in France, counting twenty-one descents in the direct male line from Foucauld, Seigneur de la Roche, in the province of Angoumois, who flourished early in the 11th century. The house of Rochefoucauld took the Protestant side for a time in the quarrels of the 16th century, but was faithful to Henry IV. in religion as in politics. La Rochefoucauld's father was a favorite of Louis XIII., and was created by him duke and peer in 1622, the possessions of the family in Angoumois and the neighboring provinces being very considerable. The author of the *Maxims*, who during the lifetime of his father and his own most stirring years bore the title of Prince de Marcillac, was somewhat neglected in the matter of education, at least of the scholastic kind; but he joined the army before he was sixteen, and almost immediately began to make a figure in public life. He had been nominally married a year before to Andrée de Vivonne, of whom little enough is known to satisfy even a Greek. She seems to have been an affectionate wife, and not a breath of scandal touches her,—two points in which La Rochefoucauld was perhaps more fortunate than he deserved. For some years Marcillac continued to take part in the annual campaigns, where he displayed the utmost bravery, though he never obtained credit for much military skill. Then he fell under the influence of Madame de Chevreuse, the first of three celebrated women who successively influenced his life. Through Madame de Chevreuse he became attached to the queen Anne of Austria, and in one of her quarrels with Richelieu and her husband a wild scheme seems to have been actually formed, according to which Marcillac was to carry her off to Brussels on a pillion. These caballings against Richelieu, however, had no more serious results than occasional exiles, that is to say, orders to retire to his father's estates. After the death of the great minister (1642), opportunity seemed to be favorable to the vague ambition which then animated half the nobility of France. Marcillac became one of the so-called *importants*, and took an active part in reconciling the queen and Condé in a league against Gaston of Orleans. But the growing credit of Mazarin came in his way, and the *liaison* in which about this time (1645) he became entangled with the beautiful duchess of Longueville made him irrevocably a Frondeur. He was a conspicuous figure in the siege of Paris, fought desperately in the desultory engagements which were constantly taking place, and was severely wounded. In the second Fronde Marcillac followed the fortunes of Condé, and the death of his father, which happened at the time (1650), gave rise to a characteristic incident. The nobility of the province gathered to the funeral, and the new duke de la Rochefoucauld took the opportunity of persuading them to follow him in an attempt on the royal garrison of Saumur, which, however, was not successful. We have no space to follow La Rochefoucauld through the tortuous cabals and negotiations of the latter Fronde; it is sufficient to say that he was always brave and generally unlucky. His run of bad fortune reached its climax in the battle of the Faubourg Saint Antoine (1652), where he was shot through the head, and it was thought that he would lose the sight of both eyes. It was nearly a year before he recovered, and then he found himself at his country seat of Verteuil, with no result of twenty years' fighting and intriguing except impaired health, a seriously embarrassed fortune, and some cause for bearing a grudge against almost every party and man of importance in the state. He spent some years in this retirement, and he was fortunate enough (thanks chiefly to the fidelity of Gourville, who had been in his service, and, passing into the service of Mazarin and of Condé, had acquired both wealth and influence) to be able to repair in some measure the breaches in his fortune. He did not, however, return to court life much before Mazarin's death. Louis XIV. was then in the full adolescence of his absolute power, and the turbulent aristocratic anarchy of the Fronde was a thing utterly of the past.

Somewhat earlier, La Rochefoucauld had taken his place in the salon of Madame de Sablé, a member of the old Rambouillet coterie, and the founder of a kind of successor to it. It was known that La Rochefoucauld, like almost all his more prominent contemporaries, had spent his solitude in writing memoirs, while the special literary employment of the Sablé salon was the fabrication of *Sentences* and *Maximes*. In 1662, however, more trouble than reputation, and not a little of both, was given to him by a surreptitious publication of his memoirs, or what purported to be his memoirs, by the Elzevirs. Many of his old friends were deeply wounded, and he hastened to deny flatly the authenticity of the publication, a denial which (as it seems, without any reason) was not very generally accepted. Three years later (1665) he published, though without his name, the still more famous *Maxims*, which at once established him high among the men of letters of the time. About the same date began the friendship with Madame de la Fayette, which lasted till the end of his life. The glimpses which we have of him henceforward are chiefly derived from the letters of Madame de Sévigné, and, though they show him suffering agonies from gout, are on the whole pleasant. He had a circle of devoted friends; he was recognized as a moralist and man of letters of the first rank; he might have entered the Academy for the asking; and in the altered measure of the times his son the Prince de Marcillac, to whom some time before his death he resigned his titles and honors, enjoyed a considerable position at court, Above all, La Rochefoucauld was generally recognized by his contemporaries from the king downward as a type of the older noblesse as it was before the sun of the great monarch dimmed its brilliant qualities. This position he has retained until the present day. He died at Paris on the 17th of March, 1680, of the disease which had so long tormented him.

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[1] The osteology of this bird is minutely described by Dr. Shufeldt (*Bull U. S. Geol. Survey*, vi. pp. 119–147).

La Rochefoucauld's character, if considered without the prejudice which a dislike to his ethical views has sometimes occasioned, is thoroughly respectable and even amiable. Like almost all his contemporaries, he saw in politics little more than a chessboard, where the people at large were but pawns, and the glory and profit were reserved to the nobility. The weight of testimony, however, inclines to the conclusion that he was unusually scrupulous in his conduct, and that his comparative ill success in the struggle arose more from this scrupulousness than from anything else. He has been charged with irresolution, and there is some ground for admitting the charge so far as to pronounce him one of those the keenness of whose intellect, together with their apprehension of both sides of a question, interferes with their capacity as men of action. But there is no ground whatever for the view which represents the *Maxims* as the mere outcome of the spite of a disappointed intriguer, disappointed through his own want of skill rather than of fortune.

Interesting, however, as he is when considered as a man and as a typical figure of a brilliant and historically important class, his importance as a social and historical figure is far inferior to his importance as a man of letters. His work in this respect consists of three parts—Letters, *Memoirs*, and the *Maxims*. The letters, collected by the diligence of his latest editor, exceed one hundred in number, and are biographically valuable, besides displaying not a few of his literary characteristics; but they need not further detain us. The *Memoirs*, when they are read in their proper form, yield, in literary merit, in interest, and in value to no memoirs of the time, not even to those of Retz, between whom and La Rochefoucauld there was a strange mixture of enmity and esteem, which resulted in a couple of most characteristic portraits. But their history is unique in its strangeness. It has been said that a pirated edition appeared in Holland, and this, despite the author's protest, continued to be reprinted for some thirty years. It has been now proved beyond doubt or question to be a mere cento of the work of half a dozen different men, scarcely a third of which is La Rochefoucauld's, and which could only have been possible at a time when it was the habit of persons who frequented literary society to copy pellmell in commonplace books the MS. compositions of their friends and others. Some years after La Rochefoucauld's death a new recension appeared, somewhat less incorrect than the former, but still largely adulterated, and this held its ground for more than a century. Only in 1817 did anything like a genuine edition (even then by no means perfect) appear. The *Maxims*, however, had no such fate. The author re-edited them frequently during his life, with alterations and additions; a few were added after his death, and it is usual now to print the whole of them, at whatever time they appeared, together. Thus taken, they amount to about seven hundred in number, in hardly any case exceeding half a page in length, and more frequently confined to two or three lines. The view of conduct which they illustrate is usually and not quite incorrectly summed up in the words "everything is reducible to the motive of self-interest." Though not absolutely incorrect, the phrase is misleading. The *Maxims* are in no respect mere deductions from or applications of any such general theory. They are on the contrary independent judgments on different relations of life, different affections of the human mind, and so forth, from which, taken together, the general view may be deduced or rather composed. Sentimental moralists have loudly protested against this view, yet it is easier to declaim against it in general than to find a flaw in the several parts of which it is made up. With a few exceptions La Rochefoucauld's maxims represent the matured result of the reflection of a man deeply versed in the business and pleasures of the world, and possessed of an extraordinarily fine and acute intellect, on the conduct and motives which have guided himself and his fellows. There is as little trace in them of personal spite as of *forfanterie de vice*. But the astonishing excellence of the literary medium in which they are conveyed is even more remarkable than the general soundness of their ethical import. In uniting the four qualities of brevity, clearness, fulness of meaning, and point, La Rochefoucauld has no rival. His *Maxims* are never mere epigrams; they are never platitudes; they are never dark sayings. He has packed them so full of meaning that it would be impossible to pack them closer, yet there is no undue compression; he has sharpened their point to the utmost, yet there is no loss of substance. The comparison which occurs most frequently, and which is perhaps on the whole the justest, is that of a bronze medallion, and it applies to the matter no less than to the form. Nothing is left unfinished, yet none of the workmanship is finical. The sentiment, far from being merely hard as the sentimentalists pretend, has a vein of melancholy poetry running through it, which calls to mind the traditions of La Rochefoucauld's devotion to the romances of chivalry. The maxims are never shallow; each is the text for a whole sermon of application and corollaries which any one of thought and experience can write. Add to all this that the language in which they are written is French, still at almost its greatest strength, and chastened but as yet not emasculated by the reforming influence of the 17th century, and it is not necessary to say more. To the literary critic no less than to the man of the world La Rochefoucauld ranks among the scanty number of pocket-books to be read and re-read with ever new admiration, instruction, and delight.

The editions of La Rochefoucauld's *Maxims* published in his lifetime[1] bear the dates 1665 (*editio princeps*), 1666, 1671, 1675, 1678. An important edition which appeared after his death in 1693 may rank almost with these. As long as the *Memoirs* remained in the state above described no edition of them need be mentioned, and none of the complete works was possible. There have been several editions more or less complete in the last seventy years, but they are all thrown into the shade by that of MM. Gilbert and Gourdault, 1868-81, in the series of *Grands Écrivans de la France*, 3 vols. This is complete as to the text, but a glossary and some other additional matters have yet to appear. The handsomest separate edition of the *Maxims* is the so-called *Édition des Bibliophiles*, 1870; but cheap and handy issues are plentiful. (G. SA.)

LA SALLE, an important city of La Salle county, Illinois, U. S., is situated on the right bank of the Illinois river, navigable up to this point, about 80 miles southwest of Chicago, with which it is connected by the

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[1] The full original title was *Réflexions ou Sentences et Maximes Morales.*

Illinois and Michigan Canal as well as by rail. La Salle is a rising commercial city, with manufactories of glass, sulphuric acid, and soda-ash, and some export of ice, as well as extensive zinc rolling mills—the only works of the kind in the United States. The supply of bituminous coal in the vicinity is large, the output of the mines being 1,000,000 tons annually. The population in 1880 was 7847.

LA SALLE, Robert Cavelier, Sieur de (1643–1687), a French explorer in North America, was born at Rouen in November, 1643. He became a settler in Canada, and about 1669, leaving his trading post at Lachine, above Montreal, he sought to reach China by way of the Ohio, supposing, from the reports of Indians, this river to flow into the Pacific. He made explorations of the country between the Ohio and the lakes, but, when Joliet and Marquette made it evident that the main river Mississippi emptied into the Gulf of Mexico, he conceived a vast project for extending the French power in the Lower Mississippi valley, and thence attacking Mexico. He obtained extensive grants from the French government, rebuilt Fort Frontenac, established a post above Niagara Falls, and built a small vessel, in which he sailed up the lakes to Green Bay. Thence, dispatching his vessel freighted with furs, he proceeded with the rest of the party, in boats and on foot, to the Illinois river, near the head of which he began a post called Fort Crêve Cœur, and a vessel in which to descend the Mississippi. Not hearing of his vessel on the lakes, he detached Hennepin, with one companion, to ascend the Mississippi from the mouth of the Illinois, and leaving Tonty, with five men, at Fort Crêve Cœur, he returned by land to Canada. Towards the close of 1681 La Salle, with a party in canoes, again reached the head of Lake Michigan, at the present site of Chicago, and making the long portage to the Illinois, descended it to the Mississippi, which he followed to its mouth, where he set up a cross and the arms of France, April 9, 1682. La Salle fell sick on his voyage up the river, and sent on intelligence of his success, which was carried to France by Father Membré, and was published in Hennepin's work in 1683. When La Salle reached France, projects were taken up by the Government for an expedition against the rich mining country of Northern Mexico. Plans were submitted by La Salle and by Peñalosa, a renegade Spaniard, who, while governor of New Mexico in 1662, had penetrated apparently to the Mississippi. La Salle was accordingly sent out in July, 1684, with four vessels and a small body of soldiers, ostensibly to found an establishment at the mouth of the Mississippi, but really to push on and secure a favorable base of operations, and gain the aid of the Indians against the Spaniards, while awaiting a more powerful force under Peñalosa. The design was so well masked, and subsequently misrepresented, that he is generally said to have been carried beyond the Mississippi by the treachery of Beaujeu, a naval officer commanding one of the vessels. After running along the coast, La Salle returned to Espiritu Santo Bay, Texas. There he landed his soldiers, but lost one vessel with valuable stores. He refused Beaujeu's offer to obtain aid for him from the West Indies, and when that officer, according to his orders, sailed back, La Salle put up a rude fort. Then for two years, from January, 1685, to January, 1687, he wasted the time in aimless excursions by land, never getting beyond the present limits of Texas, and making no attempt to explore the coast or reach the Mississippi with his remaining vessel. His colonists and soldiery dwindled away; no reinforcements or expedition under Peñalosa arrived; and in January, 1687, leaving part of his force at Fort St. Louis, he set out with the rest to obtain relief. Canada by way of the Mississippi to obtain relief. His harshness and arbitrary manner had provoked a bitter feeling among his followers, and he was assassinated on the 19th of March, near the Trinity river. Some of the survivors reached Tonty's post on the Arkansas, and returned to France by way of Canada. The party left at the fort were nearly all cut off by the Indians, a few survivors having been rescued by a Spanish force sent to root out the French.

For the various operations of La Salle, the chief works are Hennepin's *Description of Louisiana*, 1683; Le Clercq's *Establishment of the Faith*, 1691; Tonty's *Narrative* (1697), and Joutel's (1713); and the immense collection of documents published by Margry (3 vols. 8vo., Paris, 1875–78). Hennepin and Le Clercq's accounts were published partially in Shea's *Discovery of the Mississippi*, 1852, and recently entire. La Salle's early explorations have been discussed by Tailhan, Verreau, and Shea, historical scholars generally rejecting the claims set up by Margry. Parkman gives La Salle's whole career in his *Discovery of the Great West*, modified, however, greatly in his *La Salle*, Boston, 1879. (J. G. S.)

LASCAR, an Anglo-Persian term (from *lashkar*; an army) which formerly meant a non-combatant, or public follower of the ordnance department. Later on it came to mean any supernumeraries, and especially the native sailors engaged to supplement the crews of European vessels in the Eastern waters. The term is at present applied generally to the seafaring populations of the Indian seaboard manning British vessels sailing between England and the East. The Peninsular and Oriental and other large steamship companies now employ the lascars almost exclusively, preferring them to European crews on account of their greater docility, temperance, and obedience to orders. Nearly all are Mohammedans, and, besides their several native tongues, speak among themselves a sort of lingua franca based on Hindustani, with a considerable admixture of English, Arabic, and other elements. The word lascar is still applied somewhat in its former sense to tent-pitchers, inferior artillerymen, coolies, or sutlers.

LASCARIS, Constantine (? –1493), an eminent Greek scholar, was a member of the family which in the 13th century had furnished three emperors of Nicæa, and was born at Constantinople, but in what year is unknown. After the fall of Constantinople in 1453, he took refuge in Italy, where Francesco Sforza, duke of Milan, appointed him Greek tutor to his daughter Hippolyta, afterwards married to Alphonso, king of Naples. It was at Milan that Zarot published in 1476 the *Grammatica Græca, sive Compendium octo Orationis Partium*, of Lascaris, remarkable as being the first book entirely in that language issued from the printing press. After leaving Milan, Lascaris taught for some time in Rome and in Naples, but ultimately, on the invitation of the inhabitants, settled in Messina, where he continued to teach publicly until his death in 1493. Among his numerous pupils here was the celebrated Pietro Bembo. Lascaris bequeathed his library of valuable MSS. to the senate of Messina; the collection was afterwards carried off to Spain and lodged in the Escorial.

Besides the *Grammatica*, which has often been reprinted, Lascaris wrote little of any kind and nothing of any value apart from the importance which attaches to his position as one of the promoters of the revival of Greek learning in Italy. Two little treatises by him on Sicilians and Calabrians who had written in Greek were first published by Maurolico in 1562, and afterwards reprinted by Zaccaria in the *Biblioteca di Storia Letteraria*. His dissertation on Orpheus is to be found in the first volume of the *Marmora Taurinensia*. Iriarte gives some letters of Lascaris in the *Regiæ Bibliothecæ Matritensis Codices Græci manuscripti*. See Villemain, *Lascaris, ou les Grecs du quinzième siècle*, Paris, 1825.

LASCARIS, Joannes or Janus (*c.* 1445–1535), surnamed Rhyndacenus from the river Rhyndacus in Bithynia, his native province, was born about 1445. He was a member of the imperial family of Lascaris, and after the fall of Constantinople fled into Italy, where ultimately he found refuge at the court of Lorenzo de' Medici, whose intermediary he was with the sultan Bajazet II. in the purchase of Greek MSS. for the Medicean library. On the expulsion of the Medici from Florence, he, at the invitation of Charles VIII. of France, removed to Paris (1495), where he taught publicly, although he does not appear to have had any official or salaried connection with the university. Among his pupils were Gulielmus Budæus and Danesius. By Louis XII. he was several times employed on various public missions; and in 1515 he appears to have accepted the invitation of Leo X. to take charge of the Greek college he had founded at Rome. We afterwards find Lascaris employed along with Budæus by Francis I. in the formation of the royal library at Fontainebleau, and also again sent in the service of the French crown to Venice. He died at Rome in 1535.

He edited or wrote *Anthologia Epigrammatum Græcorum*, in seven books, Florence, 1494; *Callimachi Hymni, cum Scholiis Græcis*, Florence, about 1494; *Scholia Græca in Iliadem, in integrum restituta*, Rome, 1517; *Homericarum quæstionum liber, et de Nympharum antro in Odyssea opusculum*, Rome, 1518; *De veris Græcarum litterarum formis ac causis apud antiquos*, Paris, 1536. See Jovius, *Elogia clarorum virorum;* Hody, *De Græcis Illustribus;* and Bayle's *Dictionary*, *s.v.*

LAS CASAS, Bartolomé de (1474–1556), for some time bishop of Chiapa in Mexico, and known to posterity as "The Apostle of the Indies," was a native of Seville, where he was born in 1474. His father, one of the companions of Columbus in the voyage which resulted in the discovery of the New World, was rich enough to be able to send him to Salamanca, where he graduated. In 1498 he accompanied his father in an expedition under Columbus to the West Indies, from which he returned in 1500; and in 1502 he went with Nicolas de Ovando, the governor, to Hayti, where eight years afterwards he was admitted to priestly orders, being the first person to receive that consecration in the colonies. In 1511, the conquest of Cuba having been resolved on, he passed over to that island to take part in the work of "population and pacification," and in 1513 or 1514 he witnessed and vainly endeavored to check the fearful massacre of Indians at Caonao. Soon afterwards there was assigned to him and his friend Renteria a large village in the neighborhood of Xagua, with a number of Indians attached to it in what was known as "repartimiento" (allotment), and like the rest of his countrymen he sought to make the most of this opportunity for growing rich, but at the same time he occasionally celebrated mass and preached. Soon, however, having become deeply convinced of the injustice and other moral evils connected with the repartimiento system, he began to preach against it, at the same time giving up his own slaves. With the consent of his partner he resolved to go to Spain in the cause of the oppressed natives, and the result of his representations was that in 1616 Cardinal Jimenez caused a commission of three Hieronymites to be sent out for the reform of abuses, Las Casas himself, with the title of "protector of the Indians," being appointed, with a salary, to advise and inform them. This commission had not been long at San Domingo, however, before Las Casas became painfully aware of the indifference of his coadjutors to the cause which he himself had so closely at heart, and July, 1517, found him again in Spain, where he developed his scheme for the complete liberation of the Indians,—a scheme which not only included facilities for emigration from Spain, but was intended to give to each Spanish resident in the colonies the right of importing twelve negro slaves. The emigration movement proved a failure, and Las Casas lived long enough to express his sorrow and shame for having been so slow to perceive that the Africans were as much entitled to the rights of man as were the natives of the New World. Overwhelmed with disappointment, he retired to the Dominican monastery in Hayti, where he joined the order in 1522, and devoted eight years of extreme seclusion to the acquisition of that store of classical and scholastic learning which appears so curiously in all his writings. About 1530 he appears to have revisited the Spanish court, but on what precise errand or with what result is not known; the vagueness and confusion of the records of this period of his life extends to the time when, after visits to Mexico, Nicaragua, Peru, and Guatemala, in the cause of religion and of his order, he undertook an expedition in 1537 into Tuzulutlan or the Tierra de Guerra ("Land of War"), the inhabitants of which were, chiefly through his tact and skill, peaceably converted to Christianity, mass being celebrated for the first time amongst them in the newly founded town of Rabinal in 1538. In 1539 Las Casas was sent to Spain to obtain Dominican recruits, and through Loaysa, general of the order, and confessor of Charles V., he was successful in obtaining many royal orders and letters which were supposed to be favorable to his enterprise, among others that which prohibited for the time being the entrance of any lay Spaniard into Tuzulutlan. During this stay in Europe, which lasted more than four years, he more than once visited Germany to see Charles, whom the business of the empire was detaining there, he also (1542) wrote his *Veynte Razones* ("Twenty Reasons") in defence of the liberties of the Indians and the *Brevisima Relacion de la Destruycion des las Indias*, the latter of which was published some twelve years later, and has since been translated into several European languages. In 1543 he refused the Mexican bishopric of Cuzco, but was prevailed upon to accept that of Chiapa, for which he sailed in 1544. Thwarted at every point by the officials, and outraged with passionate hatred by his countrymen in his attempt to carry out the "new laws" which his humanity had procured (see the "Remedios que refirio" in the Seville edition of his *Obras*, 1552), he returned to Spain and resigned his dignity three years afterwards (1547). In 1550 he met Sepulveda in public debate on the theses drawn from the recently published *Apologia pro Libro de Justis Belli Causis*, in which the latter had maintained the lawfulness of waging unprovoked war upon the natives of the New World. The course of the discussion may still be traced in the account of the "Disputa" contained in the *Obras* (1552). In 1555 Las Casas successfully remonstrated with Philip II. against the financial project for selling the reversion of the "encomiendas,"—a project which would have involved the Indians in hopeless bondage. In July of the following year he died at Madrid, whither he had gone to urge (and with success) the necessity of restoring a court of justice which had been repressed in Guatemala.

A *Historia de las Indias* was left by Las Casas to the convent of San Gregorio at Valladolid, with directions that it should not be printed for forty years. Herrera, however, was permitted to consult it for his *Historia General* (1601). It afterwards lay neglected until the Royal Academy of History took it up with an intention of publishing it. That intention was afterwards abandoned; Prescott, who appears to have seen the MS., hopes that it may yet be given to the world. Sketches of the life of Las Casas have been given by Llorente and by Quintana. The English reader will find adequate notices in the appendix to bk. ii., chap. viii., of Prescott's *Conquest of Mexico*, and in the copious monograph of Sir Arthur Helps (*Life of Las Casas*, 1868).

LASCO, or Lasoki, John. See Alasco, vol. i. p. 393.

LASSA. See Lhasa.

LASSALLE, Ferdinand (1825-1864), the originator of the social-democratic movement in Germany, was born at Breslau in 1825. Like Karl Marx, the chief of international socialism, he was of Jewish extraction. His father, a prosperous merchant in Breslau, intended Ferdinand for a business career, and with this view sent him to the commercial school at Leipsic; but the boy, having no liking for that kind of life, got himself transferred to the university, first at Breslau, and afterward at Berlin. His favorite studies were philology and philosophy; he became an ardent Hegelian, and in politics was one of the most advanced. Having completed his university studies in 1845, he began to write a work on Heraclitus from the Hegelian point of view;

but it was soon interrupted by more stirring interests, and did not see the light for many years. From the Rhine country, where he settled for a time, he went to Paris, and made the acquaintance of his great compatriot Heine, who conceived for him the deepest sympathy and admiration. In the letter of introduction to Varnhagen von Ense, which the poet gave Lassalle when he returned to Berlin, there is a striking portrait of the young man. Heine speaks of his friend Lassalle as a young man of the most remarkable endowments, in whom the widest knowledge, the greatest acuteness, and the richest gifts of expression are combined with an energy and practical ability which excite his astonishment, but adds, in his half-mocking way, that he is a genuine son of the new era, without even the pretence of modesty or self-denial, who will assert and enjoy himself in the world of realities. At Berlin Lassalle became a favorite in some of the most distinguished circles; even the veteran Humboldt was fascinated by him, and used to call him the *Wunderkind*. Here it was, also, towards the end of 1845, that he met the lady with whom his life was to be associated in so remarkable a way, the Countess Hatzfeldt. She had been separated from her husband for many years, and was at feud with him on questions of property and the custody of their children. With characteristic energy Lassalle attached himself to the cause of the countess, whom he believed to have been outrageously wronged, made a special study of law, and, after bringing the case before thirty-six tribunals, reduced the powerful count to a compromise on terms most favorable to his client. The process, which lasted ten years, gave rise to not a little scandal, especially that of the *Cassettengeschichte*, which pursued Lassalle all the rest of his life. This "affair of the casket" arose out of an attempt by the countess's friends to get possession of a bond for a large annuity settled by the count on his mistress, a Baroness Meyendorf, to the prejudice of the countess and her children. Two of Lassalle's comrades succeeded in carrying off the casket, which contained the lady's jewels, from the baroness's room at a hotel in Cologne. They were prosecuted for theft, one of them being condemned to six months' imprisonment; Lassalle, accused of moral complicity, was acquitted on appeal. He was not so fortunate in 1849, when he underwent a year's durance for resistance to the authorities at Düsseldorf during the troubles of that stormy period. But going to prison was quite a familiar experience in Lassalle's life. Till 1859 Lassalle resided mostly in the Rhine country, prosecuting the suit of his friend the countess, finishing the work on Heraclitus, which was not published till 1858, and taking little part in political agitation, but ever a helpful friend of the working men. He was not allowed to live in Berlin because of his connection with the disturbances of '48. In 1859, however, he entered the city disguised as a carter, and finally, through the influence of Humboldt with the king, got permission to stay there. The same year he published a remarkable pamphlet on the *Italian War and the Mission of Prussia*, in which he came forward to warn his countrymen against going to the rescue of Austria in her war with France. He pointed out that if France drove Austria out of Italy she might annex Savoy, but could not prevent the restoration of Italian unity under Victor Emmanuel. France was doing the work of Germany by weakening Austria, the great cause of German disunion and weakness; Prussia should form an alliance with France in order to drive out Austria, and make herself supreme in Germany. After their realization by Bismarck, these ideas have become sufficiently commonplace; but they were nowise obvious when thus published by Lassalle. In 1861 he published a great work in two volumes, the *System of Acquired Rights*.

Hitherto Lassalle had been known only as the author of two learned works, as connected with an extraordinary lawsuit which had become a widespread scandal, and as a young man of whom even the most distinguished veterans expected great things. Now began the short-lived activity which was to give him an historical significance. It was early in 1862, when the struggle of Bismarck with the Prussian liberals was already begun. Lassalle, who had always been a democrat of the most advanced type, saw that an opportunity had come for asserting a third great cause—that of the working men—which would outflank the liberalism of the middle classes, and might even command the sympathy of the Government. His political programme was, however, entirely subordinate to the social, that of bettering the condition of the working-classes, for which he believed the schemes of Schulze-Delitzsch were utterly inadequate. Lassalle flung himself into the career of agitator with his accustomed vigor. His worst difficulties were with the working men themselves, among whom he met the most discouraging apathy. For a war to the knife with the liberal press he was quite prepared, and he accepted it manfully. His mission as organizer and emancipator of the working class lasted only two years and a half. In that period he issued about twenty separate publications, most of them speeches and pamphlets, but one of them, that against Schulze-Delitzsch, a considerable treatise, and all full of keen vigor and thought. He founded the "Allgemeiner Deutscher Arbeiterverein," was its president and almost single-handed champion, conducted its affairs, and carried on a vast correspondence, not to mention about a dozen state prosecutions in which he was during that period involved. Berlin, Leipsic, Frankfort, and the industrial centres on the Rhine, were the chief scenes of his activity. His greatest success was on the Rhine, where in the summers of 1863 and 1864 his travels as missionary of the new gospel resembled a triumphal procession. The agitation was growing rapidly, but he had achieved little substantial success when a most unworthy death closed his career.

While posing as the Messiah of the poor, Lassalle was a man of decidedly fashionable and luxurious habits. His suppers were well known as among the most exquisite in Berlin. It was the most piquant feature of his life that he, one of the gilded youth, a connoisseur in wines, and a learned man to boot, had become agitator and the champion of the working man. In one of the literary and fashionable circles of Berlin he had met a young lady, a Fräulein von Dönniges, for whom he at once felt a passion, which was ardently reciprocated. In the summer of 1864 he met her again on the Rigi, when they resolved to marry. She was a young lady of twenty, decidedly unconventional and original in character, but the daughter of a Bavarian diplomatist then resident at Geneva, who was angry beyond all bounds when he heard of the proposed match, and would have absolutely nothing to do with Lassalle. The lady was imprisoned in her own room, and soon, apparently under the influence of very questionable pressure, renounced Lassalle in favor of another admirer, a Wallachian, Count von Racowitza. Lassalle, who had resorted to every available means to gain his end, was now mad with rage, and sent a challenge both to the lady's father and her betrothed, which was accepted by the latter. At the Carouge, a suburb of Geneva, the meeting took place on the morning of August 28, 1864, when Lassalle was mortally wounded. In spite of such a foolish ending, his funeral was that of a martyr, and by many of his adherents he has been regarded since with feelings almost of religious devotion.

Lassalle did not lay claim to any special originality as a socialistic thinker, nor did he publish any systematic statement of his views. His aim was not scientific or theoretic completeness, but the practical one of organizing and emancipating the working classes; and his plans were promulgated in occasional speeches and pamphlets, as the crises of his agitation seemed to demand. Yet his leading ideas are sufficiently clear and simple. Like a true Hegelian he saw three stages in the development of labor; the ancient and feudal period, which, through the subjection of the laborer, sought solidarity without freedom; the reign of capital and the middle classes, established in 1789, which sought freedom by destroying solidarity; and the new era, beginning in 1848, which would reconcile solidarity with freedom by introducing the principal of association. It was the basis and starting-point of his opinions that, under the empire of capital and so long as the working man was merely a receiver of wages, no improvement in his condition could be expected. This position he founded on the well-known law of wages formulated by Ricardo, and accepted by all the leading economists, that wages are controlled by the ordinary relations of supply and demand, that a rise in wages leads to an increase in the laboring population, which, by increasing the supply of labor, is followed by a corresponding fall of wages. Thus population increases or decreases in fixed relation to the rise or fall of wages. The condition of the working man will never permanently rise above the mere standard of living required for his subsistence, and the continued supply of his kind. Lassalle held that the co-operative schemes of Schulze-Delitzsch on the principal of "self-help" were utterly inadequate, for the obvious reasons that the working classes were destitute of capital. The struggle of the working man helping himself with his empty pockets against the capitalists he compared to a battle with teeth and nails against modern artillery. In short, Lassalle accepted the orthodox political economy to show that the inevitable operation of its laws left no hope for the working classes, and that no remedy could be found but by abolishing the conditions in which these laws had their validity—in other words, by abolishing the present relations of labor and capital altogether. And this could only be done by the productive association of the working men with money provided by the state. The states of Europe had spent hundreds of millions in silly dynastic squabbles, or to appease the wounded vanity of royal mistresses; why refuse to advance a few millions to solve the greatest problem of modern civilization? Lassalle's estimate was that a loan of a hundred million thalers would be more than enough to bring the principle of productive association into full movement throughout the kingdom of Prussia. And he held that such association should be the voluntary act of the working men themselves, the Government merely reserving to itself the right to examine the books of the various societies. All the arrangements should be carried out according to the rules of business usually followed in such transactions. But how move the Government to grant such a loan? Simply by introducing (direct) universal suffrage. The working men were an overwhelming majority; they were the state, and should control the Government. The aim of Lassalle, then, was to organize the working classes into a great political power, which in the way thus indicated, by peaceful resolute agitation, without violence or insurrection, might attain the goal of productive association. In this way the fourth estate would be emancipated from the despotism of the capitalist, and a great step taken in the solution of the great "social question."

It will be seen that the net result of Lassalle's life was to produce a European scandal, and to originate a socialistic movement in Germany, which, in spite of repressive laws, at last election (1881) was able to return thirteen members to the reichstag. This result was hardly commensurate with his ambition, which was boundless. In the heyday of his passion for Fräulein von Dönniges, his dream was to be enthroned as the president of the German republic with her seated at his side. With his energy, ability, and gift of dominating and organizing he might indeed have done a great deal. Bismarck coquetted with him as the representative of a force that might help him to combat the Prussian liberals; so late as 1878, in a speech before the reichstag, he spoke of him with deep respect, as a man of the greatest amiability and ability from whom much could be learned. Even Bishop Ketteler of Mainz had declared his sympathy for the cause he advocated.

Lassalle's two learned works were *Die Philosophie Herakleitos des Dunklen von Ephesos* (Berlin, 1858), and the *System der erworbenen Rechte* (Leipsic, 1861), both marked by great learning and intellectual power. But of far more historical interest are the speeches and pamphlets connected with his socialistic agitation, of which the most important are—*Ueber Verfassungswesen; Arbeiterprogramm; Offenes Antwortschreiben; Zur Arbeiterfrage; Arbeiterlesebuch; Herr Bastiat-Schulze von Delitzsch, oder Kapital und Arbeit.* His drama, *Franz von Sickingen*, published in 1859, is a work of no poetic value.

The best authority on Lassalle's life and writings is George Brandes's Danish work, *Ferdinand Lassalle* (German translation, Berlin, 1877). See also Laveleye, *Le socialisme contemporain*, Paris, 1881; *Fortnightly Review*, 1869; *Contemporary Review*, 1881. There is already a considerable literature on his love affair and death:—*Meine Beziehungen zu F. Lassalle*, by Helene von Racowitza, a very strange book; *Enthüllungen über das tragische Lebensende F. Lassalle's* by B. Becker; *Im Anschluss an die Memoiren der H. von Racowitza*, by A. Kutschbach; and an English and Italian novel. (T. K.)

LASSEN, Christian (1800–1876), an eminent Orientalist, was born on October 22, 1800, at Bergen in Norway. Having received his first university education at Christiania, he went to Germany, continued his philological studies at Heidelberg and Bonn. The latter university, though only founded a few years previously (in 1818), had already become one of the chief centres of Oriental studies. The lectures of A. W. von Schlegel, the distinguished critic and leader of the German Romantic school, who shares with F. Bopp the honor of having founded the critical school of Sanskrit philology, were especially attractive to the young Norwegian, and determined him henceforth to devote his energies chiefly to the exploration of the newly-opened mine of Indian literature. Having acquired a sound knowledge of Sanskrit, he spent three years in Paris and London, engaged in copying and collating MSS., and collecting materials for future research, especially in reference to the Hindu drama and philosophy. During this period he published, jointly with E. Burnouf, his first work, *Essai sur le Pali* (Paris, 1826). On his return to Bonn he studied Arabic, for some time, under Freytag, and took the degree of Ph.D., his dissertation discussing the Arabic notices of the geography of the Punjab (*Commentatio geographica atque historica de Pentapotamia Indica*, Bonn, 1827). Soon after he was admitted privat-docent, and entered on his academical career with an inaugural dissertation *De Taprobane insula*. In 1830 he was appointed "extraordinary" and in 1840 "ordinary" professor to the newly-created chair of Old Indian language and literature, Schlegel continuing to hold (till his death in 1845) the chair of history. In spite of a tempting offer of the Sanskrit chair at Copenhagen, in 1841, Lassen remained faithful to the university of his adoption to the end of his life. He died at Bonn on May 8, 1876, having been affected with almost total blindness for many years. As early as 1864 he was relieved of the duty of lecturing.

The numerous works and essays published by Lassen during half a century of unremitting labor, cover a wide field of Oriental research, and afford ample evidence of the thorough accuracy of his scholarship and the comprehensiveness of his learning. In 1829–31 he brought out, in conjunction with Schlegel, a critical annotated edition of the *Hitopadeśa*, the now well-known manual of political ethics in the form of fables, interspersed with moral maxims. The appearance of this edition marks the starting-point of the critical study of the Sanskrit literature. At the same time Lassen assisted his teacher and friend in editing and translating the first two cantos of the epic *Rámáyana* (1829–38). In 1832 he brought out the text of the first act of Bhavabhûti's drama, *Mâlatîmâdhava*, and a complete edition, with a Latin translation, of the *Sânkhya-kârika*, one of the chief works of the Sânkhya philosophy. In 1837 followed his edition and translation of Jayadeva's charm-ng lyrical drama, *Gitagovinda*, and his *Institutiones linguæ Pracriticæ*, which still forms the standard work on the popular dialects of the Indian dramas. His *Anthologia Sanscritica*, which came out the following year, contained several hitherto unpublished texts, and did much to stimulate the study of Sanskrit in German universities, where, indeed, it continues to be used, new editions of it having been published by Gildemeister in 1865 and 1868. In 1845 Lassen brought out a new and improved edition of Schlegel's text and translation of the famous philosophical episode of the *Mahâbhârata*, the "Bhagavadgîtâ." He did not, however, confine himself to the study of Indian languages, but acted likewise as a scientific pioneer in other ields of philological inquiry. In his *Beiträge zur Deutung der Eugubinischen Tafeln* (1833), he prepared the way for the correct interpretation of the Umbrian inscriptions; and the *Zeitschrift für die Kunde des Morgenlandes* (7 vols., 837–50), started and conducted by him,—the first three volumes in conjunction with Ewald and Rödiger,—contains, among other valuable papers from his pen, grammatical ketches of the Beluchi and Brahui languages, and an essay m the Lycian inscriptions. Soon after the appearance of Burnouf's *Commentaire sur le Yaçna* (1833), Lassen also lirected his attention to the Zend, and to Iranian studies generally; and in his work *Die altpersischen Keilinschriften von Persepolis* (1836) he first made known the true character f the Old Persian cuneiform inscriptions, thereby anticipating, by one month, Burnouf's *Mémoire* on the same subject, while Major (Sir Henry) Rawlinson's famous memoir n the Behistun inscription, though drawn up in Persia, ndependently of contemporaneous European research at bout the same time, did not reach the Royal Asiatic ociety until three years later. Subsequently Lassen pubished, in the sixth volume of his journal (1845), a complete ollection of all the Old Persian cuneiform inscriptions nown up to that date. He was also the first scholar in Europe who took up, with signal success, the decipherment f the newly discovered Bactrian coins, which furnished im the materials for his important essay *Zur Geschichte er griechischen und indo-scythischen Könige in Baktrien, Kabul, nd Indien* (1838). He likewise contemplated bringing out critical edition of the *Vendidad;* but, after publishing the irst five fargards (1852), he felt that his whole energies vere required for the successful accomplishment of the reat undertaking of his life, with which his name will lways be inseparably connected—his *Indische Alterthumskunde*. In this work—completed in four volumes, pubished respectively in 1847 (2d ed., 1867), 1849 (2d ed., 1874), 858, and 1861—which forms one of the greatest monuments f untiring industry and critical scholarship, everything that ould be gathered from native and foreign sources, relative o the political, social, and intellectual development of India, from the earliest times down to Mohammedan invasion, vas worked up by him into a connected historical account. Only those acquainted with Indian history and literature, vhere nothing is fixed, can realize the enormous difficulty f the task; but in spite of much that may turn out to be rroneous, and in spite of still more that is, and from the ature of the subject must always be, uncertain and hypothetical, there can be no doubt that Lassen has laid in this vork a solid foundation for future Indian historical and ntiquarian research.

LATAKIA, or **LADIKIYEH**, a seaport town of Syria, ituated opposite the island of Cyprus, about 72 miles orth of Tripoli, and administratively dependent on he mutassarrif of that city. It is a rather poor-looking place; but, besides being the most important town f a considerable district, the residence of several foreign consuls, and the seat of an American mission, it as considerable historical interest. Remains of the Roman period are still to be seen, the best preserved f which is a sort of triumphal arch hypothetically ssigned to the time of Septimius Severus. As a trading port Latakia has recently declined. The harbor, bout a mile from the town, is naturally small, and has een silted up so as to be serviceable only for the lesser ative craft. The Russian and French steamers, which make Latakia a point of call, lie in the roadstead; and he whole trade of the place, with Egypt and European ountries, does not exceed the value of £100,000 per nnum. The great article of export is the famous atakia tobacco, mainly purchased by Egypt and England. It is grown among the Nosairiyeh hills; and he hillmen, each with his little plot of ground, bestow reat care on the cultivation of the plant. The best and most fragrant is brought from the districts of Diryus and Amamareh. Consul Jago gives the population of the town as about 12,000 in 1874; other estimates vary from 5000 to 14,000.

The oldest name of the town, according to Herennius Philo, was Ραμιθα or Λευκὴ ἀκτή; it received that of Laodicea (*ad mare*) from Seleucus Nicator, who founded it in honor of his mother as one of the four "sister" cities of the Syrian Tetrapolis (Antioch, Seleucia, Apamea, Laodicea). In the Roman period it was favored by Julius Cæsar, and took the name of Julia; and, though it suffered severely when Dolabella was besieged within its walls (43 B.C.), Strabo describes it as a flourishing port, which supplied, from the vineyards on the mountains, the greater part of the wine imported to Alexandria. The town received the privileges of an Italian colony from Severus, for taking his part against Antioch in the struggle against Niger. Laodicea was the seat of an ancient bishopric, and even had some claim to metropolitan rights. At the time of the Crusades, "Liche," as Jacques de Vitry says it was popularly called, was a wealthy city. It fell to Tancred with Antioch in 1102, and was recovered by Saladin in 1188. A Christian settlement was afterwards permitted to establish itself in the town, and to protect itself by fortifications; but it was expelled by Sultan Kiláwún and the defences destroyed. By the 16th century Laodicea had sunk very low; the revival in the beginning of the 17th was due to the new trade in tobacco. The town has several times been almost destroyed by earthquakes—in 1170, 1287, and 1822.

LATHE. In its simplest form—a form which is still employed by the natives of India—the lathe consists of two upright posts each carrying a fixed pin or dead centre, between which the work in hand is caused to revolve by an assistant pulling alternately the two ends of a cord passed round it. A tool held firmly on a bar which forms a "rest" then attacks in succession the projecting parts, and in this way the entire surface is brought to an equal distance from the central axis; in other words, the cross section becomes everywhere circular.

Fig. 1 shows a "dead-centre lathe" of the kind used in Europe during the 18th century, in which the centres are carried by "puppets" or "poppets" which can be adjusted to suit the length of the work, the turner giving the rotation by means of the treadle and spring-lath attached to the ceiling. This lath, having immortalized itself by giving its name to the "lathe," has now almost entirely disappeared, the waste of time in its upward stroke (during which the work revolves in the wrong direction) being a fatal objection to its use in an age in which economy in that respect is of such importance. Dead-centre lathes themselves are now

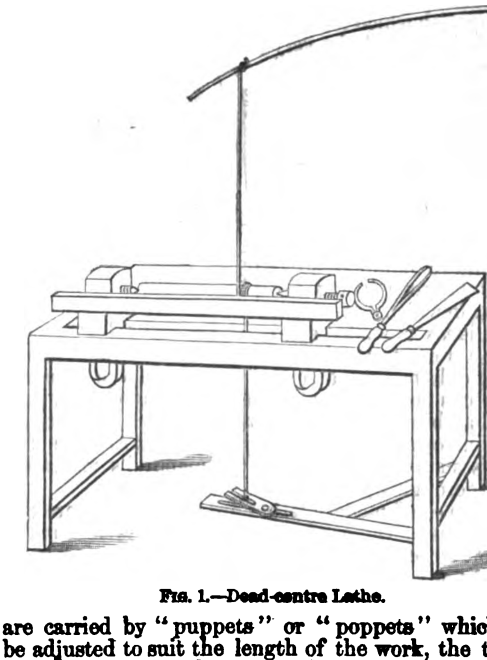

FIG. 1.—Dead-centre Lathe.

almost things of the past, though within their own limits,—which are of course confined to such articles as are turned on the outside only, and can be supported at the ends (such as fig. 2)—they offer a steadiness of support and a freedom of rotation which others seldom equal and never surpass. The system, however, still survives in the small lathes or "throws" used by watch and clock makers; and for their purposes it is not likely to be soon superseded.

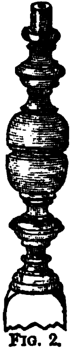
FIG. 2.

The lathe seems to have but tardily developed into the "foot-lathe," the application to it of a fly-wheel worked by a crank and treadle having been exceptional rather than usual even in the early part of the present century, though a separate fly-wheel turned by an assistant had long previously been employed, and must have rendered possible the turning of heavy work which could not have been attempted without it. The naves of cart-wheels were doubless a case in point, and for these as well as for many other purposes detached fly-wheels still render good service where steam or other motive power is not available.

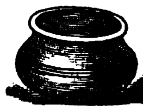
FIG. 3.

The early attempts at modifying the dead-centre lathe so that articles such as fig. 3 could be turned "en l'air," or without the support of a "back-centre," cannot have been very encouraging. The introduction of a spindle or mandrel carrying a pulley for the lathe band and screwed at one end so that the work could be attached to it was a tolerably obvious mode of effecting it, a "headstock" resembling fig. 4 being the result. But the discarding of the dead-centre point and the substitution of a front bearing—a step which was essential to setting free the end of the mandrel, and so enabling it to carry the work—must have been accompanied by a loss of power and an amount of unsteadiness which quite account for the tenacity with which the simple pole-lathe and the very similar "spring-bow lathe" survived, and make it improbable that the mandrel was at first ever used in cases for which the older form was admissible. For even if it had been possible with the then existing means to render a mandrel sufficiently true, and to obtain an accurate fit between it and the bearing in which it revolved, wrong ideas prevailed as to the best form to be given to it,—the question indeed having only become a settled one within the memory of persons now living, after various unsatisfactory patterns had been tried and discarded. It is a matter of great importance, since the proper performance of a lathe is mainly dependent on the mandrel's maintaining a thoroughly good fit.

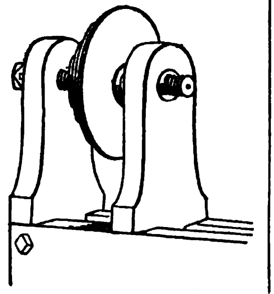
FIG. 4.—Headstock.

The types of modern lathes are as various as are the occupations of those who use them. The mechanic, the soft-wood turner, and the amateur, for instance, differ so greatly in their requirements that a lathe which would be well suited to the one would be very ill adapted, even if not wholly useless, to the other. Thus the professional turner of soft wood, with a lathe of which the frame and even the fly-wheel are of timber (its value in shillings being not very different from the price of an amateur's lathe in pounds) will use a high rate of speed and sharp tools and light cuts, and so obtain results with which the owner of an elaborate instrument cannot at all compete. A modern mechanic's lathe on the other hand, such as fig. 5, has very different demands made upon it. For this the greatest possible steadiness in all the working parts is the main desideratum, and it is of great advantage to have the means of obtaining a slow speed, so as to be able to take the heaviest cuts which its strength and the power available warrant. Timber has accordingly given place either to cast iron or gun-metal or steel in almost every part of a lathe of this class, the resulting increase of weight and firmness enabling the hand turner successfully to operate on small sizes of wrought iron or even steel, notwithstanding that in driving the fly-wheel his force can be applied only during a portion of each revolution.

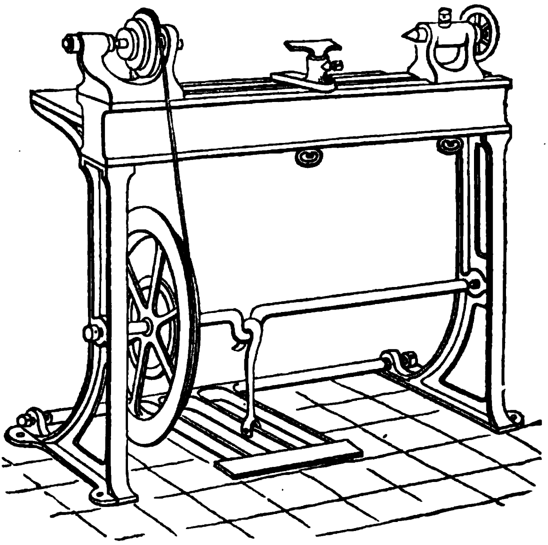
FIG. 5.—Mechanic's Lathe.

In turning hard materials such as these it is of primary importance that the tool should be held more rigidly than it can with the hand when no support is available except that of a narrow T-headed rest. The difficulty of doing this was to some extent got over formerly by employing "heel tools," which transferred most of the strain directly to a flat-topped rest and made correspondingly reduced demands upon the arm of the turner; but it was never completely overcome till the introduction of the "slide-rest" placed the movement of the tool under complete control, and grasped it in a hand that never tires. Fig. 6 shows a slide-rest such as would be used with the lathe in the previous engraving, for which purpose simplicity of construction and steadiness in all its parts are the points chiefly aimed at. Slide-rests designed for amateurs' use are sometimes very different from this in respect of complication and the number of different movements of which they are capable, but each increase in the number of parts intervening between the lathe-bed and the tool is a source of possible unsteadiness which should not be introduced without reason.

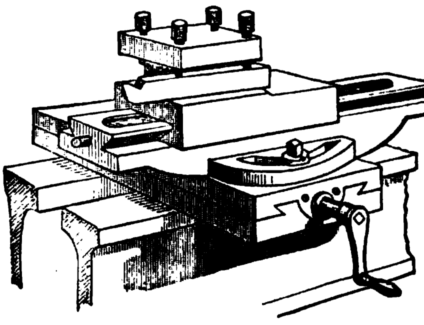
FIG. 6.—Slide-Rest.

Foremost amongst the more complicated lathes both utility and in the date of their introduction stand screw-cutting lathes," in which a regular spiral can traced upon the work by self-acting means. The aversing mandrel, in which this end was formerly tained by giving a longitudinal motion to the mandrel nd the work attached to it, and keeping the tool sta-onary, is now but little used, the modern plan of ausing the slide-rest to travel along the bed automati-ally being more convenient in most instances. It in-olves, however, an amount of gearing almost inad-aissible in a foot-lathe, and it is for those driven by team-power that it is chiefly employed. These, being nachine tools, do not come within our present subject. t should be mentioned that screws can be cut in foot-athes by hand-chasing tools without any special ar-rangement, and they are done in this way to a great xtent by telescope makers and others with beautiful regularity.

"Chucks"—a term which embraces most of the ontrivances by which the turner establishes connection between his work and the mandrel—have been made to contribute in various ways to the production of abnormal forms. The oval chuck is used (as its name implies) for giving an elliptical path to the work in lieu of a circular one. The eccentric chuck enables any point or any series of points in succession to be brought into a line with the axis of the mandrel. With the former chuck, therefore, a fixed tool can trace an ellipse on the face of the work, and with the latter a series of intersecting or adjacent circles can be described by it. In this way a great variety of intricate "engine-turned" patterns can be produced in the lathe, some idea of which may be gathered from the comparatively simple one shown in fig. 7. To the complicated apparatus known as the geometric chuck neither straight lines nor irregular curves are impossible. The "rose-engine" is a very old device for producing a somewhat similar kind of ornament, such as fig. 8, by giving a chattering motion to the mandrel, which is specially mounted on a vibrating frame for that purpose. The wavy lines on the backs of watches are engraved in this way, the curvature of the case not preventing the use of the rose-engine, as it would that of the eccentric chuck. But it is probable that these methods of producing face-work ornament will gradually disappear, and that all who still have leisure for doing them will prefer to use elliptic and eccentric and rose cutters fixed in the slide-rest and driven independently of the mandrel by overhead motion. With these similar results can be obtained, and the tool only instead of the entire mass of the work has to follow the desired curve.

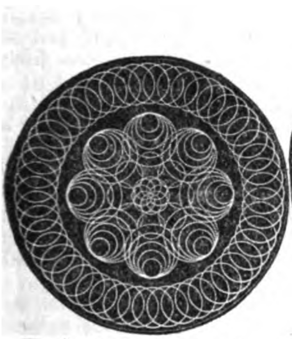

FIG. 7.—An Engine-turned Pattern.

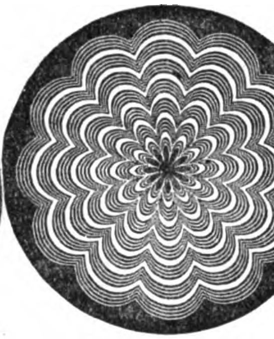

FIG. 8.—Rose-engine Pattern.

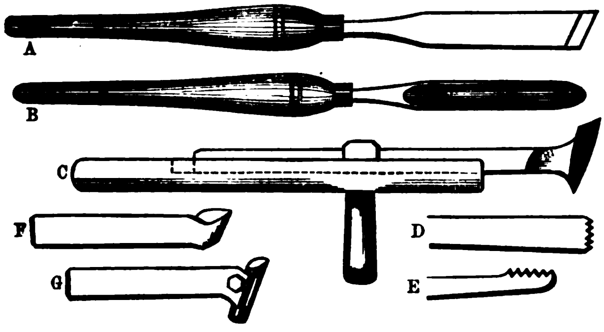

FIG. 9.—Turning Tools.

Sketches of a few characteristic turning tools are given in fig. 9; A, a chisel, and B, a gouge, for soft wood; C, a heel tool, for wrought iron; D, E, the enlarged ends of a pair of chasing tools for cutting outside and inside screw-threads; and F, G, two slide-rest tools. Of these last F is forged from a square bar of steel (an operation which must be repeated from time to time as the edge gets worn away) and G has an iron shank made once for all, from which the steel-cutting portion can be removed for the purpose of sharpening or renewal. The saving of tool-steel thus effected is of course no great consideration in the case of these small tools, but it is very considerable in the large sizes used with the power lathes of the present day. Examples of these will be found under the heading MACHINE TOOLS (*q. v.*). (C. P. B. S.)

LATIMER, HUGH (*c.* 1490–1555), bishop of Worcester, and one of the chief promoters of the Reformation in England, was a native of Thurcaston, Leicestershire, and the son of a yeoman, who rented a farm "of three or four pounds by year at the uttermost." Of this farm he "tilled as much as kept half a dozen men," retaining also grass for a hundred sheep and thirty cattle. The year of Latimer's birth is not definitely known. In the *Life* by Gilpin it is given as 1470, a palpable error, and possibly a misprint for 1490.[1] Foxe states that at "the age of fourteen years he was sent to the university of Cambridge," and as he was elected fellow of Clare in 1509, his year of entrance was in all likelihood 1505. Latimer himself also, in mentioning his conversion from Romanism about 1523, says that it took place after he was thirty years of age. According to Foxe, Latimer went to school "at the age of four or thereabout." The purpose of his parents was to train him up "in the knowledge of all good literature," but his father "was as diligent to teach him to shoot as any other thing." As the yeomen of England were then in comparatively easy circumstances, the practice of sending their sons to the universities was quite usual; indeed Latimer mentions that in the reign of Edward VI., on account of the increase of rents, the universities had begun wonderfully to decay. He graduated B.A. in 1510, and M.A. in 1514. Before the latter date he had taken holy orders. While a student he was not unaccustomed "to make good cheer and be merry," but at the same time he was a punctilious observer of the minutest rites of his faith and "as obstinate a Papist as any in England." So keen was his opposition to the new learning that his oration on the occasion of taking his degree of bachelor of divinity was devoted to an attack on the opinions of Melanchthon. It was this sermon that determined Bilney to go to Latimer's study, and ask him "for God's sake to hear his confession," the result being that "from that time forward he began to smell the word of God, and forsook the school doctors and such fooleries." Soon his discourses exercised a potent influence on learned and unlearned alike; and, although he restricted himself, as indeed was principally his custom through life, to the inculcation of practical righteousness, and the censure of clamant abuses, a rumor of his heretical tendencies reached the bishop of Ely, who resolved to become unexpectedly one of his audience. Latimer on seeing him enter the church boldly changed his theme to a portrayal of Christ as the pattern priest and bishop. The points of comparison were of course deeply distasteful to the prelate, who, though he professed his "obligations for the good admonition he had received," informed the preacher that he "smelt somewhat of the pan." Latimer was prohibited from preaching in the university or in any pulpits of the diocese, and on his occupying the pulpit of the Augustinian monastery, which enjoyed immunity from episcopal control, he was summoned to answer for his opinions before Wolsey, who, however, was so sensible of the value of such discourses that he gave him special license to preach throughout England. At this time Protestant opinions were being disseminated in England chiefly by the surreptitious circulation of the works of Wickliffe, and especially of his translations of the New Testament. The new leaven had begun to communicate its subtle influence to the universities, but was working chiefly in secret and even to a great extent unconsciously to those affected by it, for many were in profound ignorance of the ultimate tendency of their own opinions. It was perhaps, as regards England, the most critical conjuncture in the history of the Reformation, both on this account and on account of the position in which Henry VIII. then stood related to it. In no small degree its ultimate fate seemed also to be placed in the hands of Latimer. In 1526 the imprudent zeal of Barnes had resulted in an ignominious recantation, and in 1527 Bilney, Latimer's most trusted coadjutor, incurred the displeasure of Wolsey, and did humiliating penance for his offences. Latimer, however, besides possessing far-seeing sagacity, quick insight into character, and a ready and formidable wit which thoroughly disconcerted and confused his opponents, had naturally a distaste for mere theological discussion, and the truths he was in the habit of inculcating could scarcely be controverted, although, as he stated them, they were diametrically contradictory of prevailing errors both in doctrine and practice. In December, 1529, he preached his two "Sermons on the Cards," which awakened a turbulent controversy in the university, and his opponents, finding that they were unable to cope with the dexterity and keenness of his satire, would undoubtedly have succeeded in getting him silenced by force, had it not been reported to the king that Latimer "favored his cause," that is, the cause of the divorce. While, therefore, both parties were imperatively commanded to refrain from further dispute, Latimer was invited to preach before Henry in the Lent of 1530. The king was so pleased with the sermon that after it "he did most familiarly talk with him in a gallery." Of the special regard which Henry seemed to have conceived for him Latimer took advantage to pen the famous letter on the free circulation of the Scriptures, an address remarkable, not only for what Mr. Froude justly calls "its almost unexampled grandeur," but for its striking repudiation of the aid of temporal weapons to defend the faith; "for God," he says, "will not have it defended by man or man's power, but by his word only, by which he hath evermore defended it, and that by a way far above man's power and reason." Though the appeal was without effect on the immediate policy of Henry, he could not have been displeased with its tone, for shortly afterwards he appointed Latimer one of the royal chaplains. In times so "out of joint" Latimer soon became "weary of the court," and it was with a sense of relief that he accepted the living of West Kingston, Wiltshire, conferred on him by the king in 1531. Harassed by severe bodily ailments, encompassed by a raging tumult of religious conflict and persecution, and aware that the faint hopes of better times, which seemed to gild the horizon of the future, might be utterly darkened by a failure either in the constancy of his courage or in his discernment and discretion, he exerted his eloquence with unabating energy in the furtherance of the cause he had at heart. At last a sermon he was persuaded to preach in London exasperated Stokesley, bishop of the diocese, and seemed to furnish that fervent persecutor with an opportunity to overthrow the most dangerous champion of the new opinions. Bilney, of whom Latimer wrote, "if such as he shall die evil, what shall become of me?" perished at the stake in the autumn of 1531, and in January following Latimer was summoned to answer before the bishops in the consistory. After a tedious and captious examination, he was in March brought before convocation, and on refusing to subscribe certain articles was excommunicated and imprisoned; but through the interference of the king he was finally released after he had voluntarily signified his acceptance of all the articles except two, and confessed that he had erred not only "in discretion but in doctrine." If in this confession he to some extent tampered with his conscience, there is every reason to believe that his culpable timidity was occasioned, not by personal fear, but by anxiety lest by his death he should hinder instead of promoting the cause of truth. After the consecration of Cranmer in 1533 his position was completely altered. A commission appointed to inquire into the disturbances caused by his preaching in Bristol severely censured the conduct of his opponents; and, when the bishop prohibited him from preaching in his diocese, he obtained from Cranmer a special license to preach throughout the province of Canterbury. In 1534 Henry formally repudiated the authority of the pope, and from this time Latimer was the chief co-operator with Cranmer and Cromwell in advising the king regarding the series of legislative measures which rendered that repudiation complete and irrevocable.

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[1] The only reasons for assigning an earlier date are that he was commonly known as "Old Hugh Latimer," and that Bernher, his Swiss servant, states incidentally that he was "above threescore and seven years" in the reign of Edward VI. Bad health and anxieties probably made him look older than his years, but under Edward VI. his powers as an orator were in full vigor, and he was at his book winter and summer at two o'clock in the morning.

It was, however, the preaching of Latimer more than the edicts of Henry that established the principles of the Reformation in the minds and hearts of the people; and from his preaching the movement received its chief color and complexion. The sermons of Latimer possess a combination of qualities which constitute them unique examples of that species of literature. It is possible to learn from them more regarding the social and political condition of the period than perhaps from any other source, for they abound, not only in exposures of religious abuses, and of the prevailing corruptions of society, but in references to many varieties of social injustice and unwise customs, in racy sketches of character, and in vivid pictures of special features of the time, occasionally illustrated by interesting incidents in his own life. The homely terseness of his style, his abounding humor, rough, cheery, and playful, but irresistible in its simplicity, and occasionally displaying sudden and dangerous barbs of satire, his avoidance of dogmatic subtleties and noble advocacy of practical righteousness, his bold and open denunciation of the oppression practised by the powerful, his scathing diatribes against ecclesiastical hypocrisy, the transparent honesty of his fervent zeal, tempered by sagacious moderation—these are the qualities which not only rendered his influence so paramount in his lifetime, but have transmitted his memory to posterity as perhaps that of the one among his contemporaries most worthy of our interest and admiration.

In September, 1535, Latimer was consecrated bishop of Worcester. While holding this office he was selected to officiate as preacher when the friar Forest, whom he vainly endeavored to move to submission, was burned at the stake for teaching treason to his penitents. In 1539, being opposed to the "Act of the Six Articles," Latimer resigned his bishopric, learning from Cromwell that this was the wish of the king. It would appear that on this point he was deceived, but as he now declined to accept the articles he was confined within the precincts of the palace of the bishop of Chichester. After the attainder of Cromwell little is known of him until 1546, when, on account of his connection with the preacher Crome, he was summoned before the council at Greenwich, and committed to the Tower. Henry died before his final trial could take place, and the general pardon at the accession of Edward VI. procured him his liberty. He declined to resume his see, notwithstanding the special request of the Commons, but in January, 1548, again began to preach, and with more effectiveness than ever, crowds thronging to listen to him both in London and in the country. Shortly after the accession of Mary in 1553 a summons was sent to Latimer to appear before the council at Westminster. Though he might have escaped by flight, and though he knew, as he quaintly remarked, that "Smithfield already groaned for him," he at once joyfully obeyed. The pursuivant, he said, was "a welcome messenger." The hardships of his imprisonment, and the long disputations at Oxford, told severely on his health, but he endured all with unbroken cheerfulness. On October 16, 1555, he and Ridley were led to the stake at Oxford. Never was man more free than Latimer from the taint of fanaticism or less dominated by "vainglory," but the motives which now inspired his courage not only placed him beyond the influence of fear, but enabled him to taste in dying an ineffable thrill of victorious achievement. Ridley he greeted with the words, "Be of good comfort, Master Ridley, and play the man; we shall this day light such a candle by God's grace in England as (I trust) shall never be put out." He "received the flame as it were embracing it. After he had stroked his face with his hands, and (as it were) bathed them a little in the fire, he soon died (as it appeared) with very little pain or none."

Two volumes of Latimer's sermons were published in 1549. Various volumes of his remains appeared after his death, edited by Bernher and Thomas Some. A complete edition of his works, edited for the Parker Society by the Rev. George Elwes Corrie, appeared in two volumes, 1844-45. His *Sermon on the Plough* and *Seven Sermons preached before Edward VI.*, the best known of his sermons, were reprinted by Arber, 1869. In addition to memoirs attached to editions of his sermons, there are *Lives* by Gilpin (1755) and Demaus (1869). The principal contemporary authorities are Foxe's *Book of Martyrs*, Stowe's *Chronicles* and *Annals*, and his own *Sermons*. (T. F. H.)

LATIN LANGUAGE.

THE Latin language first appears in history as the language spoken in the plain of LATIUM (*q. v.*). In the 3d century B.C., at which date it first becomes known to us from extant inscriptions and contemporary history, its range as a vernacular was still limited to this district, although the arms of Rome had carried some knowledge of it to the utmost boundaries of the peninsula of Italy. Of the dialects commonly spoken outside the limits of Latium, two appear to have been entirely distinct in character from the rest. In the extreme southeast, inscriptions have been found in considerable numbers written in a language known as Iapygian or Messapian; but no progress has as yet been made in their interpretation, and it is quite impossible to determine with certainty even to what stock the language may have belonged. There are indications which seem to point in the direction of some kinship with the Albanian, but these are far too slight and untrustworthy to be accepted with any confidence. In Etruria, and at one time in Campania and in the plain of the Po, a language was spoken the affinities of which have not yet been determined satisfactorily (*cf.* vol. viii. pp. 560-61).

Languages of Italy.

The other dialects of the Italian peninsula may be divided into two main groups, the Umbro-Sabellian and the Latin. The former is the more extensive in range in the earlier historic times, and includes Umbrian and Oscan or Samnite, still known to us by inscriptions, and (according to tradition) the language of the Sabines, the Marsians, and the Volscians, of which but scanty traces remain. The latter probably had in prehistoric times a much wider range than that to which we find it afterwards confined. There are no facts to contradict the hypothesis, to which a consideration of the geographical relations of the several tribes seems to point, that at one time, not only Latium, but also Campania, Lucania, Italia proper, and the eastern half of Sicily, were inhabited by tribes belonging to the Latin race. But these regions were early subjected to Hellenizing influences, or conquered by Sabellian invaders, and the only dialect closely akin to the Latin of which any specimens are preserved in inscriptions is that of Falerii in Southern Etruria.

Common features of the Italian languages.

The Umbro-Sabellian and the Latin share many characteristics which enable us to unite them as members of a common Italian group; but what is the exact position to be assigned to this group in the Indo-European stock is a question which cannot be regarded as finally determined. Some scholars of eminence, as Schleicher, maintain that its closest affinities are with the Celtic group, mainly on the strength of the agreement of both in the loss of aspirates and retention of spirants, in the form adopted for the expression of the middle or reflexive voice in verbs, and in the dative plural, and on other less significant points. But the more common opinion is that its connection is closest with the Hellenic group, and that we may safely assume the existence of a common Italo-Hellenic nationality. Hence in vol. xi. pp. 115-17 an attempt was made to reconstruct the main outlines of the language spoken by the ancestors of both Greeks and Romans, and to point out what phonetic changes and what developments of inflexion must have already taken place. Starting from the basis there laid down, we may now proceed to notice the following leading features, as marking the course of the Italian group of languages after their separation from the Hellenic group. Even for scholars who do not accept this genealogical classification of languages such a survey will not be without its value as a statement of the facts which every theory has to take into account.

1. The vowels remained on the whole unaltered in Latin up to the time of the earliest inscriptions. After that date there was a rapid development of a tendency, of which traces are to be found even earlier, of the degradation of the diphthongs to simple vowels. But in the earlier records we find, *e.g.*, still *praidad* = *praeda* (*C. I. R.*, 63), *utei* = *uti* (*ib.*, 196), *virtutei* = *virtute* (*ib.*, 34), *ploirume* = *plurimi* (*ib.*, 32), *Leucesius* = *Lucetius* (Carm. Saliar.), *abdoucit* = *abducit* (*C. I. R.*, 30). Of these diphthongs *ai* is found almost exclusively in the inscriptions older than the 7th century of Rome, in words afterwards spelt with *ae*: *ei* is found representing an ē or an ī as late as the time of Augustus, *oi* occurs regularly for *oe* or ū up to the time of the Gracchi, and occasionally later; *eu* is apparently found in the place of a later ū only in the one form quoted, although it is probable that in many cases *ou* represents a still earlier *eu*, as is shown by

Marti Loucetio (*C. I. Rhen.*, 929) by the side of *Marti Leucetio* (*ib.*, 930), and by the transliteration of *Lucius* by Λεύκιος; *ou* is found regularly for ū, with rare exceptions, up to the time of the Social War.

Umbrian in this respect shows evidence of a much more rapid decay of the vowel-system, and had reached, at the time at which we learn to know it, a stage of monotony to which Latin only attained several centuries later: *e.g. vīnū* = O. Lat. *veinōd*, *kvēstur* = O. Lat. *quaistor*, *ētu* = O. Lat. *eito*, *āsē* = Lat. *ārae*, *tōru* = Lat. *tauros*.

On the other hand, Oscan was much more faithful than the contemporary classical Latin to the complex diphthong-system, coming in this respect very near to archaic Latin: *e.g.*, *Fluus-ai*ᵉ = *Florae*, *deicum* (infinitive, answering to *dicere*), *touticom* = *tūticum* (*i.e.*, *publicum*).

The change of *o* to *u*, *u* to *i*, and *e* to *i* takes place later. Within the history of the Latin language the *u* retains its full sound, not weakened like the Greek υ to ü.

2. In respect of the consonants the principal change is in the aspirates. While a comparison of Greek shows that they must have retained their character as sonant aspirates up to the time of the separation, none of the Italian languages have preserved them in this form. In Latin the guttural aspirate becomes *g* in the middle of a word (comp. ἄγχω and *ango*, λείχω and *lingo*) and before *r* (comp. *grā-tu-s* and χάρις, *grando* and χάλαζα); with a parasitic *v* frequently appended (*angui-s* and ἔχι-ς), which sometimes leads to the loss of the *g* (*brevi-s* and βραχύ-ς). At the beginning it becomes *h* (*hiemps* and χιών, *holus* and χλο-η) or *f* (*fel* and χόλ-ος, *for-mus* and θερ-μό-ς), the two representative letters sometimes alternating dialectically (*haedus* and *faedus*, our *goat*; *fostis* and *hostis*, our *guest*). The dental aspirate became medially *d* (*medius* and μέσσος for μεθ-yος), or sometimes *b* (*uber* and οὖθαρ, *ruber* and ἐ-ρυθ-ρό-ς; comp. also *verbum* and *word*, *barba* and *beard*), initially only *f* (*fores* and θύρα, *ferus* and θήρ). The labial aspirate passes medially into *b* (*ambo* and ἄμφω; comp. *navibus* and ναῦφιν, containing the same element *bhi*, although the terminations are not identical), initially into *f* (*fā-ri* and φημί, *fero* and φέρω), and rarely into *h* (perhaps dialectically in *horda* by the side of *forda*, and by dissimilation in *mi-hi* for *mi-bi*). Hence it appears that in Latin any one of the three original aspirates may be represented by *f*; we may compare our *laugh* (Germ. *lachen*), *dwarf* (Germ. *zwerg*), Middle Eng. *dwerth*, the Russian *Feodor* for *Theodore*, and the change in Greek from *p-h* (pronounced separately) to *ph* = *f*.

The spirants (*y*, *w*, *s*), the loss of which is so marked a feature in the Greek consonant system, are retained with but few important exceptions. The most important of these is the *rhotacism* whereby an *s* between two vowels passes regularly (probably through the intermediate stage of a sibilant pronounced like *z*) into *r* between two vowels, as in *uro* for an earlier *uso*. The loss of a *y* (*i*) between vowels is not uncommon, *e.g.*, *sēdo* for *sedaio* through *sedao*; it is less frequent after consonants, as in *obex* for *ob-iec-s*; under similar circumstances *w* (*u*) disappears, as in *amasti* for *amavisti*, *canis* for *cuanis*.

With regard to inflection, the following may be noted as the chief developments subsequent to the stage described in vol. xi. p. 117:

1. In substantives there was a considerable extension of the class of *i*-stems, due partly to new creations, partly to the transformation of stems belonging to other classes. Thus a primitive *garu-s*, Gr. βαρύ-ς, in Latin is *grau-i-s*, a primitive *kvan-s* becomes *cani-s*. Very few of the Latin *i*-stems have corresponding *i*-stems in Sanskrit or Greek. In some cases the *i* appears to have been originally an *a*; comp. *imbri*- and ὄμβρο-.

2. The final *-d* of the ablative was retained, and (in Latin at any rate) the *-bus* of the dative plural; on the other hand, the instrumental in *-bhi* (Gr. φι) does not appear at all on Italian soil.

3. The dual number was lost both in nouns and in verbs, as in the later Greek.

4. An entirely new system of inflection for the reflexive tenses (the middle, or, as it subsequently became, the passive voice) was created by the use of the reflexive pronoun *se* as a suffix. (Whether this system is common to the Italian and the Celtic languages, or whether the apparently similar formations in the latter are of different origin, is a question not yet definitely settled.)

5. In many verbs the compound aorist with an *s* element was made by the action of analogy into a perfect in *si*.

6. Numerous verbs adopted for their perfect tenses a suffix in *-vi* or *-ui*. This has been commonly supposed to represent a new process of combination with the root *bhu* instead of *es*; but weighty objections have recently been brought against this explanation, and it can no longer be propounded with confidence.

7 The root *bhu* was employed to form a past imperfect in *-bam*, and a future in *-bo*, but in the case of consonant verbs and *i*-verbs the latter formation was usually replaced by an optative form used as a future.

8. Imperfect and pluperfect tenses of the subjunctive were formed apparently by compounding the present and perfect stems with the optative of the root *es*, "to be."

9. The infinitive and participle system received a considerable expansion, especially by the formation of gerundives and supines, which, however, were differentiated in usage in the various Italian dialects (see below).

10. The pronominal elements, though for the most part the same as in Greek, were commonly used in composition one with another, and thus acquired a different form.

11. The *u*-class also was extended by the more common use of the suffix *-tu* for verbal nouns.

With regard to the vocabulary, very extensive additions were made, probably in many instances from Celtic sources. Many of the most common Latin words are entirely without demonstrable cognates in the other Indo-European languages; and, even when the common root may be suggested with considerable plausibility, the particular Latin word has evidently behind it a long and independent history, during which its meaning and usage have been greatly modified. Hence all attempts to deal with the etymology of the Latin stock of words are confronted with a residuum which the materials at our command do not allow us to deal with satisfactorily.[1]

Distinctive features of Latin.

The principal distinctions between the Latin branch of the Italian group and the Umbro-Sabellian are the following:

1. Neither Umbrian nor Oscan had any character for *o*; for this the former language used *v* = *u*, *e.g.*, *puplum* = *populum*; the latter ú (perhaps approximating to *o*), *e.g.*, *púd* = *quod*, or sometimes ú, as in *aragetúd* = *argentōd*.

2. The old Umbrian did not distinguish between surds and sonants in the case of gutturals and dentals, having no *g* or *d*; but both these letters were used in Oscan.

3. Oscan distinguished between *i* and *i*ᵉ, the latter a sound probably intermediate between *i* and *e*.

4. In Umbrian *d*, when occurring between vowels, or at the end of a word after a vowel, was replaced by *ṛ*, in later Umbrian by *rs*, *e.g.*, *asam aṛ* = *aram ad*, *i.e.*, *ad aram*, *dupursus* = *bipedibus*. K before *e* and *i* acquired a palatal sound, not existing in Latin until long afterwards, which was denoted by ȡ, *i.e.*, *ç*; *e.g.*, *çesna* = *cena*.

5. The Umbro-Sabellian dialects agreed in retaining the earlier genitive in *s* (becoming afterwards in Umbrian *r*), *e.g.*, *tuta-s*, "of a city," *molta-s* = *multae*, while the Latin has in the case of *a*-, *e*-, and *o*-stems substituted for this a form in *i*, probably a locative.

6. They retain also the future compounded with *es*, *e.g.*, Umb. *heriest*, Osc. *herest* = *volet*, replaced in Latin either by the optative or by a new form in *-bo*.

7. Both Oscan and Umbrian allowed the velar guttural (*q*) to pass into *p*, as in the Gallo-British branch of Celtic and in Greek, while this is never the case in Latin; comp. *qui-s* and *pis*, *Quintius* with its Samnite equivalent *Pontius* = *Pompeius*.

Stages in the history of the Latin language.

Three clearly marked stages present themselves in the history of the Latin language:—(1) the archaic stage, previous to the development of literature, (2) the stage of literary culture, during which the popular spoken language runs, as it were, underground, giving but few traces of its existence; (3) the stage at which the popular language reappears as coloring literature, and finally recasting it in its own mould.

The archaic stage.

The archaic stage is known to us almost wholly from inscriptions, and from isolated forms and words quoted by the grammarians; although a careful study of the phenomena of the diction and especially the metre of the early Roman dramatists reveals to us many of its characteristic tendencies. It may be said to have lasted until the time of Ennius (d. 169 B.C.), whose growing influence is intimated in the epitaph composed for himself by Nævius (d. 204 B.C.):—

> "itaque postquam est Orci traditus thesauro
> obliti sunt Romai loquier Latina lingua."

Perhaps the oldest specimen of the Latin language preserved to us is to be found in two fragments of the Carmina Saliaria preserved by Varro (*De ling. Lat.*, vii. 26, 27), and one in Terentianus Scaurus, but unfortunately they are so corrupt as to be quite unintelligible without the help of very extensive conjectural changes in the reading (*cf.* Jordan, *Krit. Beiträge.* pp. 211–224). More valuable evidence is supplied in the *Carmen Fratrum Arvalium*, which was found in 1778 engraved on one of the numerous tablets recording the transactions of the college of the Arval brothers, dug up on the site of their grove by the Tiber, 5 miles from the city of Rome; but this also supplies many points for discussion, and even its general meaning is by no means clear (*ib.*, pp. 203–11; *cf.* Wordsworth, *Fragments and Specimens*, pp. 157, 158, with the notes).

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[1] The Celtic element in Latin has been discussed by Professor Newman in his *Regal Rome*, and more satisfactorily by Mr. Wordsworth in an appendix to his *Lectures on Early Roman Literature*; but the question still requires further examination (comp. also Cuno's *Geschichte Italiens*).

The text of the Twelve Tables (451–450 B.C.), if preserved in its integrity, would have been invaluable as a record of antique Latin; but it is known to us only in quotations, and it is doubtful whether any accurate reproduction of the laws in their primitive form was accessible to our authorities. Hence the language has been much modernized, and any archaic forms which have been preserved are due rather to the citations of the grammarians than to continuous quotations.

Schoell, whose edition and commentary (Leipsic, 1866) is the most complete, notes the following traces, among others. of an archaic syntax:—(1) both the subject and the object of the verb are often left to be understood from the context, *e.g.*, *ni it antestamino*, *igitur em capito*; (2) the imperative is used even for permissions, *si volet*, *plus dato*, if he choose, he may give him more; (3) the subjunctive is apparently never used in conditional, only in final sentences, but the future perfect is common; (4) the connection between sentences is of the simplest kind, and conjunctions are rare; *ast* (= *si*) and *igitur* (= *tum demum*) have a different force from that found in later Latin. There are of course numerous isolated archaisms of form and meaning, such as *calvitur*, *pacunt*, *endo*, *escit*; but on the whole the diction cannot have been accurately preserved.

In the case of inscriptions there is rarely any question of their faithful reproduction of the language at the time at which they were made; but there may be a difficulty about determining their date. Perhaps the oldest fragment of Latin preserved in this way is furnished by a vessel dug up in the valley between the Quirinal and the Viminal early in 1880. The vessel is of a dark brown clay, and consists of three small round pots, the sides of which are connected together by short broad pipes, so that there is easy communication from one to the other. All round this vessel runs an inscription, in three clauses, two nearly continuous, the third written below; the writing is from right to left, and is still clearly legible; the characters include some signs not belonging to the Latin alphabet proper, but to the other Italian alphabet, *e.g.*, ꟼ for R, and I for Z, while the M has five strokes and the Q has the form of a Koppa.

The inscription is as follows:

Jovei Sat deivos qoi med mitat, nei ted endo cosmis virco sied, asted noisi Ope Toitesiai pacari vois.

Dvenos med feced en manom einom dzenoine med maao statod.

The general style of the writing and the phonetic peculiarities make it pretty certain that this work must have been produced not later than 300 B.C.; the characters employed prove that the writer was familiar with one of the dialects spoken in the hilly country to the east of Rome; but on the whole the language may be taken as Latin. Some points in its interpretation are still open to doubt;[1] but the probable interpretation is—

Jovi Saturno divis qui (= si quis) me mittet, ne te endo (= in te) comis virgo sit, ast nisi Opi Tutesiæ pacari vis.

Duenus me fecit in manum: enim die noni me mano stato.

"If any one brings me to the Gods Jupiter and Saturn, let not any maiden be kindly to thee, except unless thou wilt offer a sacrifice to Ops Tutesia.

"Duenas made me for the offering to the dead; therefore on the ninth day place me for the offering for the dead."

The noteworthy phenomena here are the retention not only of e^i but of the much more archaic *oi*, apparently taking the place of the former by a dialectic variation; *ei* in *einom* for a short e^i, *e* for *i* in *feced*, *q* before *o*, and *dz* apparently to represent the sound of *dy* (= *j*).

A bronze tablet recently discovered near the Fucine Lake, and some works of art found at Palestrina, belong to the same period. They are undoubtedly Latin, but the Latin has been mixed with other elements so that it would have been quite unintelligible to a native of Rome.

Of the earlier long inscriptions the most important would be the *Columna Rostrata*, or column of Duilius, erected to commemorate his victory over the Carthaginians in 260 B.C., but for the uncertainty as to the extent to which it has suffered from the hands of restorers. The shape of the letters plainly shows that the inscription, as we have it, was cut in the time of the empire. Hence Ritschl and Mommsen suppose that the language was modified at the same time, and that, although many archaisms have been retained, some were falsely introduced, and others replaced by more modern forms. The most noteworthy features in it are—C always for G (CESET = *gessit*), D retained in the ablative (*e.g.*, *in altod marid*), *o* for *u* in inflections (*primos*, *exfociont* = *exfugiunt*), single for double consonants (*clases* = *classes*), *e* for *i* (*navebos* = *navibus*, *exemet* = *exemit*); of these the first is probably an affected archaism, G having been introduced some time before the assumed date of the inscription. On the other hand, we have *praeda* where we should have expected *praida*; no final consonants are dropped; and the forms *-es*, *-eis*, and *-is* for the accusative plural are interchanged capriciously. The doubts hence arising preclude the possibility of using it with confidence as contemporary evidence for the state of the language.

Of unquestionable genuinenees and the greatest value are the *Scipionum Elogia*, inscribed on stone coffins, found in the monument of the Scipios outside the Capene gate. The earliest of the family whose epitaph has been preserved is L. Cornelius Scipio Barbatus (consul 298 B.C.), the latest C. Cornelius Scipio Hispanus (prætor in 139 B.C.); but there are good reasons for believing with Ritschl that the epitaph of the first was not contemporary, but was somewhat later than that of his son (consul 259 B.C.). The last may therefore be taken as the earliest specimen of any length of Latin as it was written at Rome; it runs as follows:—

honcoino . ploirume . cosentiont . r[*omai*]
duonoro . optumo . fuise . uiro [*virorum*]
luciom . scipione . filios . barbati
co]nsol . censor . aidilis . hic . fuet a [*pud vos*]
he]c . cepit . corsica . aleriaque . urbe[*m pugnandod*]
de]det . tempestatebus . aide . mereto[*d votum*].

The archaisms in this inscription are—(1) the retention of *o* for *u* in the inflection of both nouns and verbs; (2) the diphthongs *oi* (= *u*) and *ai* (= *ae*); (3) *-et* for *-it*, *hec* for *hic*, and *-ebus* for *-ibus*; (4) the absence of doubled consonants; and (5) *duon-* for *bon-*. On the other hand, the dropping of a final *m* in every case except in Luciom is a sign of the tendency to lighten final syllables, which is a marked characteristic of the language of this period.

In the epitaph on Scipio Barbatus *o* nowhere appears where the later language has *u* except in the doubtful case of *Samnio* (? = *Samnium*). The diphthongs *oi* and *ai*, as well as *ei*, are found in the latest of all the Scipio inscriptions (*aid. cur.* = *aedilis curulis*), as well as in the *Epistola Consulum ad Teuranos* (187 B.C.), and in the almost exactly contemporary decree of L. Æmilius (*Hermes*, iii. 243 *sq.*); but in a somewhat earlier epitaph to a Scipio (L. Cornelius Cn. f. Cn. n. Scipio), we have *aetate*. Of *-et* for *-it* and the like there is another example in *dedet* (*C. I. R.*, 63), comp. *dede* in *C. I. R.*, 62; *navebous* (*-bus*) of the Duilian column.

Doubled consonants first appear in the decree of Æmilius, though not regularly (comp. *posedisent* by *essent* and *possidere*); in the *Epist. ad Teur.* they are still not used. *Duonus* is not found elsewhere, except in the Carmen Saliare, but *Duelonai* for *Bellonae* appears in the *Epist. ad Teur.*; and *duellum* for *bellum* occurs in Ennius and Plautus, as a legal archaism in Cicero, and as a poetic variation in Horace, Ovid, and Juvenal.

A number of precious indications of archaisms on the one hand and mutilated forms on the other are supplied by dedicatory tablets of about the same age found in Picenum and Latium. As specimens of the former we may select *Maurte* = *Marti*, *praidad* = *praeda*, *Junone* = *Junoni*; of the latter *dedrot* or *dedro* or *dederi* = *dederunt*, *dede* = *dedit*, *cupa* = *cubat*; the omission of a final *m* is also common.

Beginnings of literary Latin.

It was a turning point in the history of the Latin language when Roman literature took its rise under the influence of the Greek culture. It is a reasonable conjecture that the much greater corruption of the Umbrian dialect as compared with the Latin, and of the Latin as compared with the Oscan, in regard to the precise representation of sound, was due mainly to the varying degrees of contact with Greek civilization. The inscriptions dating from the 5th century of the city show the greatest arbitrariness in such points as the insertion or omission of final *s* and *m*, and of *n* before *s*, and in the distinction of *e* and *u*, *e* and *i*. The language of Plautus shows us the struggle of the two tendencies in the plainest manner. On the one hand we have numerous archaisms not only in form but in quantity. Of the old long vowels in final syllables we have the following still retained, not indeed always, but when it is convenient for the verse:

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[1] Comp. Jordan in *Hermes*, xvi, 225–60; Bucheler in *Rhein. Mus.*, xxxvi, 235 *sq.*

Archaisms.

-*ā* in the nom. and voc. of the first declension:
ne epístulā quidem úlla sit in aédibus (*Asin.*, 762).
-*būs* in dat. and abl. plur. [usually when a pause in the sense affords some justification]:
út ego illic oculís exuram lámpadibūs ardéntibus (*Men.*, 842).
-*ōr* in nom. of substantives, and comparatives, and also in verbs;
módo, quom dicta in me íngerebas, ódium non uxór eram (*Asin.*, 927).
tantó mi aegritúdo auctiró est in ánimo (bacchiac) (*Capt.*, 782).
pól id quidem experiór ita ut praédicas, Palaéstrio (*Mil.*, 633).
-*ēr* in nom;
méus fuit patér Antimachus, ego vocór Lyconides (*Aul.*, 772).
-*īt*, not only in the subj. (where it is a contraction for -*iēt*) and in the perf. ind., but even in the present:
pótionis áliquid, prius quam pércipit insánia (*Men.*, 921).
ēt:
quod quísque in animo habét aut habiturúst, sciunt *Trin.*, 206).
[Ritschl, "in animod habet"].
āt:
fúndum alienum arát, incultum fámiliarem déserit (*Asin.*, 874).

On the other hand we have much more commonly traces of the destructive influence which was beginning to affect so powerfully the form of Latin words, especially in their final syllables. From causes which it is now impossible to discover, the freer accentuation of earlier times, the existence of which was proved incidentally by Verner in his famous paper on some exceptions to the law of "Lautverschiebung" (Kuhn's *Zeitschrift*, xxiii. 97–138), had been given up in favor of a more rigid system, which never allowed the accent to fall on the final syllable. Hence there was a constant struggle between the desire to preserve the older quantity of the final vowel and the tendency to shorten an unaccented syllable. This difficulty of preserving the quantity of the final vowel is naturally greatest when the accented syllable is short; hence we are led to the formula that for Plautus, and therefore for the spoken language of his time, ˘́ – — ˘́ ˘.

Destructive tendencies.

This holds good for all vowels, whether in nouns or in verbs, *e.g.*:
a: satis sí futurumst; rógă me vigintí minas (*Pseud.*, 114).
e: cavĕ praéterbitas úllas aedis quín roges (*Epid.*, 433).
i: merĭ béllatores gígnuntur, quas híc praegnantis fécit (*Mil.*, 1077).
o: nóvŏ liberto opus ést quod pappet. dábitur, praebebó cibum (*Epid.*, 727).
u: quód manŭ nequeunt tángere, tantum fás habent, quo mánus apstineant (*Trin.*, 288).
The last case is a rare one; the others are very common.

But further, forms like those quoted above from the inscriptions, *e.g.*, *dedro*, *oino*, *cuba*, etc., led Ritschl and his followers to the recognition of the fact that even at this early time there was a strong tendency to drop the final consonant in Latin; and this at once furnished a clue to the proper interpretation of many metrical phenomena in Plautus, which had previously been explained on wholly incorrect assumptions.

In the case of a line like *Trin.*, 306,

né tibi aegritúdinem pătĕr párerem, parsi sédulo,

it was assumed that *pater* was pronounced like *père*, in order to avoid the apparent neglect of the law of position, which would, according to the practice of the classical poets, have lengthened the syllable -*ter*. Two considerations suffice to dispose of this hypothesis:—first, there is no evidence whatever that a mute between two vowels was ever dropped in early Latin; secondly, if *pāter* become by "compression" *père*, it would be natural to find *māter* becoming *mère*; but in no case does a form with the first syllable long and the second lengthened by position take the place of one long syllable. On the other hand, there is positive evidence of a varied and unquestionable character to show that a final consonant was frequently dropped in pronunciation, especially in an iambic word. Hence it is clear that *pater* was pronounced *pătĕ*, not *père*. This shows too that it was not the case, as has been asserted, that a final *r* was dropped only when it took the place of an earlier *s*, although this is doubtless the most common instance of its omission. The consonants most commonly dropped are the following:—

s: *e.g.*, nimi(s) lépide fecit vérba ad parsimóniam (*Aul.*, 493).

This license is retained by Ennius (*e.g.*, *Ann.*, 601), tam laterali(s) dolor, certissumu(s) nuntiu(s) morti(s), and is common even in Lucretius. Cicero (*Orat.*, 48, 161) speaks as if it had been the usual pronunciation in his own earlier days, and he admits it seven or eight times in his version of Aratus, *e.g.*, magnu(s) Leo, etc.

m: *e.g.*, dúm quide(m) ne quid pérconteris quód mi haud lubeat próloqui.

The practice of eliding a syllable ending in *m* before a following vowel shows how lightly this consonant was pronounced even by the classical poets. It is very frequently omitted in inscriptions of every period (comp. Corssen, i. 267–74). As Quintilian (ix. 4, 40) says, "*m* parum exprimitur . . . neque enim eximitur, sed obscuratur." In this respect Umbrian quite agreed with popular Latin, but Oscan and Volscian carefully preserved the *m* (Corssen, i. 276).

t: *e.g.*, set árraboni dédi(t) quadragintá minas (*Most.*, 648). So in inscriptions *dede* (*C. I. L.*, i. 621*b*).

d: *e.g.*, hic ápu(d) nos magna túrba ac *magna* fámiliast (*Aul.*, 340).

r: as above; or, *e.g.*, pater vénit. sed quid pértimui autem, bélua (Ter., *Phorm.*, 601).

l: *e.g.*, et símu(l) conficiam fácilius ego quód volo (Ter., *Heaut.*, 803).

n: *e.g.*, aút quid istuc est quód vos agitis? nón licet. tame(n) súspicor (Ter., *Hec.*, 874).

It is doubtful whether the last two licenses occur in Plautus.

Occasionally we find these two tendencies concurring, and producing a short final syllable by the loss of a final consonant and the shortening of a vowel naturally long under the influence of the accent; so that we have forms like *oves*, *boves*, *vides*, *rogas*, *manus*, scanned as two short syllables, not only (*a*) before vowels, but (*b*) even before consonants, *e.g.*:

(*a*) ásini mordiciús me scindunt, bóvĕs incursent córnibus (*Aul.*, 232).
(*b*) fórăs fóras lumbríce qui sub térra erepsistí modo (*Aul.*, 620).
víróс nostros quibus tú nos voluisti ésse matres fámilias (*Stich.*, 98).
ád papillas mánŭs ferat, labra á labris núsquam aúferat (*Bacch.*, 480).

The tendency to drop the final consonant of an iambic word is further extended to groups of words of the same scansion, especially when the second is a preposition, as in

quís ăd fores est? etc. (*Amphitr.*, 1014).
ópta id, quod ŭt contingat tibi vis (*Asin.*, 713).

Accent had also an important effect in inducing the voice to hurry over unaccented syllables, even though long by position, in order to lay full stress upon an accented syllable. But this naturally took place only when the syllable thus shortened was itself preceded by a short syllable, so that the formula for this process is ˘ – ´ — ˘ ˘ ´. Under this head we may bring a large number of instances of apparent neglect of quantity. Many of these are cases where the usual spelling is with a double consonant. Some have argued that as doubled consonants were not used in writing before the time of Ennius (*Fest.*, *s. v.* "Solitaurilia," p. 293, confirmed from inscriptions by Ritschl, *P. L. M. E.*, p. 123), this is an indication that the pronunciation fluctuated; but it is doubtful whether this was ever the case except under the influence of the accent; and this influence was quite as powerful over syllables followed by two different consonants as by a doubled consonant.

Thus,

per ănnónam caram díxit me natúm pater (*Stich.*, 179)

does not differ in principle from

quia ŏmnís bonas bonásque adcurare áddecet (*Trin.*, 78) and the unusual quantity of the last two words in

nós potius onerémus nosmet vícissatim volŭptátibus (*Stich.*, 532)

is to be explained in precisely the same way, except that in the latter the voice is hurrying on to dwell upon a long accented syllable, in the former the accent has already fallen on a short accented syllable, a fact which naturally tends to shorten the following unaccented one. Compare for this

configo sagíttis fúres thensaurários (*Aul.*, 395)

where Goetz after Fleckeisen reads "sagitis."

The combinations before which position is most commonly neglected are the following:—

nt: si id mea volŭntate factumst (*Trin.*, 1166).
pt: volŭptátem inesse tántam (*Rud.*, 459).
st: magĭstrátus, si quis me hanc habere viderit (*Rud.*, 477).
rn: cássidem in capút, dormibo placided in tabĕrnaculo (*Trin.*, 726).
ps: scio ĭpsúrde dictum hoc dérisores dícere (*Capt.*, 69).
rg: séd sine ărgento frústra es . . . (*Pseud.*, 378).

It is needless to dwell further upon the details of Plautine scansion. The foregoing instances will have made it clear that, while there are some archaisms still retained, on the whole the language was beginning to suffer from that process of disintegration, which has left such marked traces upon almost every modern language.

The introduction of Greek metres for the drama doubtless did much to check this process, and it is probable that, even in the earliest Roman comedies, licenses of pronunciation are much less common than they were in the popular language of the time. But the iambic and trochaic measures, especially as employed by the Roman poets, admitted of a free treatment, which left room for much laxity. It was not until the hexameter came to be used for poetry that the laws of prosody were definitely fixed. The rigid canons of dactylic verse required that the pronunciation should be strictly determined; and hence Ennius, although he does not appear to have introduced any marked changes in generally recognized rules of quantity, was compelled to settle positively much which had previously been fluctuating, and so to lay down the lines to which subsequent poetical works had to conform. From this time forward the literary language of Rome parted company from the popular dialect. It has been said with truth that even to the classical writers Latin was in a certain sense a dead language. Its vocabulary was not identical with that of ordinary life. Literary works, whether in prose or in verse, had to conform to a fixed standard. Now and again a writer of fresh originality would lend new vigor to his style by phrases and constructions drawn from homely speech. But on the whole, and in ever increasing measure, the language of literature was the language of the schools, adapted to foreign models. The genuine current of Italian speech is lost to view with Plautus and Terence, and reappears only in the semi-barbarous products of the early Romance literature.

Pronunciation of Latin.

This appears the proper place for a rapid survey of the pronunciation of the Latin language, as spoken in its best days.

I. CONSONANTS.—1. *Guttural.* (*a*) Sonant G, pronounced as in English, but never softened before about the 6th century after Christ. (*b*) Surd C, pronounced always as *k*[1] (except that in some early inscriptions the character is used for G) until about the 7th century after Christ. K went out of use at an early period, except in a few old abbreviations for words in which it had stood before *a*, *e.g.*, *kal.* for *kalendae*. Q always followed by the consonantal *u*, except in a few old inscriptions, in which it is followed by the vowel *u*, *e.g.*, *pequnia*. X, an abbreviation for *cs*; *xs* is, however, sometimes found. (*c*) Aspirate H, the rough breathing as in English.

2. *Palatal.* The spirant J, like the English *y*; it is only in late inscriptions that we find, in spellings like *Zanuari*, *Giove*, any indication of a pronunciation like the English.

3. *Lingual.* (*a*) R as in English, but probably produced more with the point of the tongue. (*b*) L as in English. (*c*) S, always surd when initial, but at one time sonant between vowels, and possibly when final. (*d*) Z only found in the transcription of Greek words in and after the time of Cicero.

4. *Dental.* (*a*) Sonant, D as in English; but by the end of the 4th century *di* before a vowel was pronounced like our *j* (comp. *diurnal* and *journal*). (*b*) Surd, T as in English. (*c*) Nasal, N as in English; but also (like the English *n*) a guttural nasal (*ng*) before a guttural. Apparently it was very lightly pronounced, and easily fell away before *s*.

5. *Labials.* (*a*) Sonant, B as in English; but occasionally in inscriptions of the later empire *v* is written for *b*, showing that in some cases *b* had already acquired the soft sound of the contemporary *β*. B before a sharp *s* was pronounced *p*, *e.g.*, in *urbs*. (*b*) Surd, P as in English. (*c*) Nasal, M as in English, but very slightly pronounced at the end of a word. (*d*) Spirant, V like the *ou* in Fr. *oui*, but probably often approximating to the South German *w*, *i.e.*, a labial, not (like the English *v*) a labio-dental *v*.

6. *Labio-dental.* Spirant, F as in English.

II. VOWELS.—*ā*, *ū*, *ī*, as the English *ah*, *oo*, *ee*; *ō*, a sound coming nearer to *aw* than the English *ō*; *ē*, an open Italian *e*, nearly as the vowel of *pet* lengthened. The short sound of each vowel was probably identical in quality with the long sound, differing only in quantity. Hence *ă* was pronounced as in the French *chatte*, *ŭ* nearly as in *pull*, *ĭ* nearly as in *pit*, *ŏ* as in *dot*, *ĕ* nearly as in *pĕt*. The diphthongs were produced by pronouncing the vowels of which they were composed very rapidly according to the above scheme. This gives—*au* somewhat broader than *ou* in *house*; *eu* like *ow* in the Yankee pronunciation of *town*; *ae* like the vowel in *hat* lengthened, with perhaps somewhat more approximation to the *i* in *wine*; *oe*, a sound intermediate between *o* and *e*; *ei*, nearly as in *feint*, with the greater stress on the *i*; *ui*, as the French *oui*.

Changes in Latin.

The changes which may be detected in the Latin language during the period of its literary development may be arranged under the heads of (1) vocabulary, (2) inflection, (3) word formation, (4) syntax.

These will be best regarded separately in connection with the four principal stages in the history of the language, which may be given, with their chief writers, as follows:—

I. *Ante-Classical* (240–80 B.C).—Nævius (? 269–204), Plautus (254–184), Ennius (239–169), Cato (234–149), Terentius (? 195–159), Pacuvius (220–132), Accius (170–94), Lucilius (? 168–103).

II. *Classical—Golden Age* (80 B.C.–14 A.D.).—Varro (116–28), Cicero (106–44), Lucretius (99–55), Cæsar (100–44), Catullus (87–? 47), Sallust (86–34), Virgil (70–19), Horace (65–8), Propertius (? 50–?), Tibullus (? 54–? 18), Ovid (43 B.C.–18 A.D.), Livy (59 B.C.–18 A.D.).

III. *Classical—Silver Age* (14–180 A.D.).—Velleius (? 19 B.C.–? 31 A.D.), M. Seneca (died *c.* 30 A.D.), Persius (34–62), Petronius (died 66), Lucan (39–65), L. Seneca (died 65 A.D.), Plinius major (23–79 A.D.), Martial (40–101), Quintilian (42–118), Plinius minor (61–? 113), Tacitus (? 60–? 118), Juvenal (? 47–? 138), Suetonius (75–160), Fronto (*c.* 90–170).

IV. *Post-Classical.*

Greek words introduced into Latin.

The additions made to the vocabulary of the Latin language from the Greek belong to four different stages (Corssen, ii. 814). The first corresponds to the period of the early intercourse of Rome with the Greek states, especially with the colonies in the south of Italy and Sicily. To this stage belong many names of nations, countries, and towns, as *Siculi*, *Tarentum*, *Graeci*, *Achivi*, *Karthago*, *Poenus*; and also names of weights and measures, articles of industry, and terms connected with navigation, as *drachuma*, *mina*, *talentum*, *purpura*, *machina*, *patina*, *ancora*, *aplustre*, *nausea*. To these may be added names of gods or heroes, like *Apollo*, *Pollux*, and perhaps *Hercules*. These were all freely adapted to the phonetic laws of the Latin language.

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[1] The evidence for this pronunciation of *c* will be found best stated in Corssen, i. 43–67, and Roby, i. xlvii.–liv. It may be summed up as follows:—(1) In some words the letter following *c* varies in a manner which makes it impossible to believe that the pronunciation of the *c* depended upon this, *e.g.*, *decumus* and *decimus*, *capis* and *recipis*; (2) if *c* was pronounced before *e* and *i* otherwise than before *a*, *o*, and *u*, it is hard to see why *k* should not have been retained for the latter use; (3) no ancient writer gives any hint of a varying pronunciation of *c*; (4) a Greek *κ* is always transliterated by *c*, and *c* by *κ*; (5) Latin words containing *c* borrowed by Gothic and early High German are always spelt with *k*. To these arguments it may be added that the varying pronunciations of *ce*, *ci* in the Romance languages are inexplicable except as derived independently from an original *ke*, *ki*.

A second stage is marked by the closer intercourse resulting from the conquest of Southern Italy, and the wars in Sicily, and by the contemporary introduction of imitations of Greek literature into Rome, with its numerous references to Greek life and culture. In this stage, also, Greek words were freely adapted to the forms familiar to Roman ears: we find words like *pessulus*, *scutula*, *amurca*, *fungus*, *balineum*, *bucina*, *techina*, *comissari*, *canistrum*, *carcer*, *sona* (ζωνή), *tarpessita*, etc. In many cases hybrid forms are freely employed, whether by the addition of Latin suffixes to Greek stems as *ballistarius*, *hepatarius*, *subbasilicanus*, *sycophantiosus*, or of Greek suffixes to Latin stems as *plagipatidas*, *pernonides*; or by derivation, as *thermopolare*, *supparasitari*; or by composition, as *ineuscheme*, *thyrsigerae*, *flagritribae*, *scrophipasci*. The character of many of these words shows that the comic poets who indulged in them must have been able to calculate upon a fair knowledge of colloquial Greek on the part of a considerable portion of their audience. The most remarkable instance of this is supplied by the burlesque lines in Plautus (*Pers.*, 702 *sq.*), where Sagaristio describes himself as

> Vaniloquidorus, Virginisvendonides,
> Nugipalamloquides, Argentumexterebronides,
> Tedigniloquides, Nummosexpalponides,
> Quodsemelarripides, Nunquampostreddonides.

During this period Greek words are generally inflected according to the Latin usage.

But with Accius begins a third stage, in which the Greek inflection is frequently preserved, *e.g.*, *Hectora*, *Oresten*, *Cithaeron*; and from this time forward the practice wavers. Cicero generally prefers the Latin case-endings, defending, *e.g.*, *Piraeeum* as against *Piraeea* (*Ad Att.*, vii. 3, 7), but not without some fluctuation, while Varro takes the opposite side, and prefers *poemasin* to the Ciceronian *poematis*. By this time also *y* and *z* were introduced, and words newly borrowed from the Greek were faithfully reproduced.

A fourth stage is marked by the practice of the Augustan poets, who, especially when writing in imitation of Greek originals, freely use the Greek inflections, such as *Arcadēs*, *Tethȳ*, *Aegida*, *Echūs*, etc. Horace probably always used the Greek form in his *Odes*, the Latin in his *Satires* and *Epistles*. Later prose writers for the most part followed the example thus set.

Language of Plautus.

In Plautus we have the best example of the vigorous native Italian idiom, enriched, but in no way fettered, by imitation of the Greek. His constructions are sometimes free, and do not square with the canons of later grammarians; but there is much life and freshness, and it is very rarely that the right phrase is lacking to set forth his meaning with telling vigor.

The chief peculiarities of his grammar are:

1. The use of some substantives with a gender different from that afterwards usual, *e.g.*, *dorsus*, *collus*, *nasum*.

2. The retention of inflections afterwards obsolete or retained only in archaic phrases: *-i-* in the subj. pres., *duint*, *creduis*, *posivi*, *dis septimi*. With regard to some of these archaic inflections it is still a question how far they may be safely restored to the text of Plautus; *e.g.*, *homonem*, *cubi*, *eunde*, etc., the ablative *d* nom. plur. in *-is*, as *fundis*.

3. The use of words excluded from the language of classical literature, but reappearing in the popular dialect: *e.g.*, *suppetias iri*, *batuere*, *clepere*, *bellus*, *exinterare*, *exanclare*, *nautea*, *savium*, etc. Under this head we may place the very frequent employment of diminutives, *e.g.*, *papillarum horridularum oppressiunculae*, especially as terms of endearment, "*meum corculum*, *melculum*, *verculum*," *passerculum*, *haedillum*, *vitellum*, *aneticulam*, *monerulam*, *catellum*, *putellum*, etc., the use of *con*, *ad*, and *de* as strengthening particles, and of abstract words, especialy in the plural,—all marks of the *plebeius sermo*.

4. Syntactical constructions afterwards unusual: *e.g.*, the accusative after verbs like *fungor* and *utor*; the accusative of the object after the gerundive (*agitandumst vigilias*); the indicative in indirect questions and with *cum* signifying "since" or "although;" present infinitive instead of future after verbs of promising; *quia* after verbs of feeling, instead of *quod*, *quoniam* = "since," "after;" infinitive with purpose of motion; *consulo* and *condono* with double accusative; *decorus*, *aequus*, and *expers* with ablative; *vereor* with genitive; *similis* with genitive; *quid hoc est hominis*; *facere tueri*, *compendi*; *faxo* with a future logically dependent; the frequent use of *figura etymologica*, *satin ut*, *praequam*, *praeut*. There is a free use of verbals in *-tio*: *quid tibi hanc curatio est rem aut muttitio*. By a laxity common in popular language verbs of seeing, knowing, asking, etc., are followed by a direct, not an indirect, question: *scire volo*, *quoi reddidisti?* Asyndeton is very frequently employed to give life and rapidity to the style: *e.g.* (*Pseud.*, 168), *lepide victu*, *vino*, *unguentis*, *inter pocula pulpamentis*.

Nævius.

In Nævius we find archaisms proportionally much more numerous than in Plautus, especially in the retention of the original length of vowels, and early forms of inflection, such as the genitive in *-as*, and the ablative in *-d*; shortenings do not seem so numerous. The number of archaic words preserved is perhaps due to the fact that so large a proportion of his fragments have been preserved only by the grammarians, who cited them for the express purpose of explaining these.

Ennius.

The language of Ennius deserves especial study because of the immense influence which he exerted in fixing the literary style. He first established the rule that in hexameter verse all vowels followed by two consonants (except in the case of a mute and a liquid) or a double consonant, must be treated as lengthened by position. The number of varying quantities is also much diminished, and the elision of final *m* becomes the rule, though not without exceptions. On the other hand he very commonly retains the original length of verbal terminations (*ponīt*, *essēt*, *faciēt*) and of nominatives in *or* and *a*, and elides final *s* before an initial consonant. In declension he never uses *-ae* as the genitive, but *-ai* or *-as*; he has an inflection *Mettoeo Fufetioeo*, probably intended for a dative; the shorter form of the gen. plur. is *-um* in common; obsolete forms of pronouns are used, as *mis*, *olli*, *sum* (= eum), *sas*, *sos*, *sapsa*; and in verbal inflection there are irregularities like *morīmur*, *fūimus*, *potestur*, *contūdit*, etc. Some experiments in the way of tmesis (saxo *cere* comminuit *-brum*) and apocope (divum domus altisonum *cael*, replet te lætificum *gau*) were happily regarded as failures, and never took root in the language. His syntax is simple and straightforward, with the occasional pleonasms of a rude style, and conjunctions are comparatively rare.

Pacuvius.

Pacuvius is noteworthy especially for his attempt to introduce a free use of compounds after the fashion of the Greek, which were felt in the classical times to be unsuited to the genius of the Latin language. Quintilian censures severely his line—

> Nerei repandirostrum incurvicervicum pecus.

Accius.

Accius, though probably the greatest of the Roman tragedians, is only preserved in comparatively unimportant fragments. We know that he paid much attention to grammar and orthography; and his language is much more finished than that of Ennius. It shows no marked archaisms of form, unless the infinitive in *-ier* is to be accounted as such.

Lucilius.

Lucilius furnishes a specimen of the language of the period, free from the restraints of tragic diction and the imitation of Greek originals. Unfortunately the greater part of his fragments are preserved only by a grammarian whose text is exceptionally corrupt; but they leave no doubt as to the justice of the criticism passed by Horace on his careless and "muddy" diction. The *urbanitas* which is with one accord conceded to him by ancient critics seems to indicate that his style was regarded as free from the taint of provincial Latinity, and it may be regarded as reproducing the language of the educated circles in ordinary life; even the numerous Græcisms and Greek quotations with which it abounds show the familiarity of his readers with the Greek language and literature. Varro ascribes to him the *gracile genus dicendi*, the distinguishing features of which were *venustas* and *subtīlitas*. Hence it appears that his numerous archaisms were regarded as in no way inconsistent with grace and precision of diction. But it may be remembered that Varro was himself something of an archaizer, and also that the grammarians' quotations may bring this aspect of his language too much into prominence. It is to be feared that the disgusting coarseness of many of his lines did not lose them favor with the circle for whom he wrote. He shares with the comic poets the use of many plebeian expressions, the love for diminutives, abstract terms, and words of abuse; but occasionally he borrows from the more elevated style of Ennius forms like *simitu*, (= simul), *noenu* (= non), *facul* (= facile), and the genitive in *-ai*, and he ridicules the contemporary tragedians for their *zetematia*, their highflown diction and *sesquipedalia verba*, which make the characters talk "not like men but like portents, flying winged snakes." In his ninth book he discusses questions of grammar, and gives some interesting facts as to the tendencies of the language. For instance, when he ridicules a *praetor urbanus* for calling himself *pretor*, we see already the beginning of the confusion of *ae* and *e*, which afterwards became universal. He shows a great command of technical language, and (partly owing to the nature of the fragments) ἅπαξ λεγόμενα are very numerous.

Cato.

The treatise of Cato *De Re Rustica* would have afforded invaluable material, but it has unfortunately come down to us in a text greatly modernized. As it is, it is of interest from the point of view of literature rather than of language. We find in it instances of the accusative with *uti*, of the old imperative *praefamino*, and of the fut. subj. *servassis*, *prohibessis*; but there is nothing which can be added to what we learn from Plautus.

Growth of Latin prose.

It is unfortunately impossible to trace the growth of Latin prose diction through its several stages with the same clearness as in the case of poetry. The fragments of the earlier Latin prose writers are too scanty for us to be able to say with certainty when and how a formed prose style was created. But the impulse to it was undoubtedly given in the habitual practice of oratory. The earliest orators, like Cato, were distinguished for strong common sense, biting wit, and vigorous language, rather than for any graces of style; and probably personal *auctoritas* was of far more account than rhetoric both in the law courts and in the assemblies of the people. The first public speaker, according to Cicero, who aimed at a polished style, and elaborate periods, was M. Æmilius Lepidus Porcina, in the middle of the 2d century B.C.[1] On his model the Gracchi and Carbo fashioned themselves, and, if we may judge from the fragments of the orations of C. Gracchus which are preserved, there were few traces of archaism remaining. A more perfect example of the *urbanitas* at which good speakers aimed was supplied by a famous speech of C. Fannius against C. Gracchus, which Cicero considered the best of all orations of the time. No small part of the *urbanitas* consisted in a pronunciation equally removed from boorish roughness and from foreign affectations; and the standard of this was found in the language of the women of the upper classes, such as Lælia and Cornelia.

In the earliest continuous prose work which remains to us, the four books *de Rhetorica ad Herennium*, we find the language already almost indistinguishable from that of Cicero. There has been much discussion as to the authorship of this work, now commonly, without very convincing reasons, ascribed to Q. Cornificius; but, among the numerous arguments which prove that it cannot have been the work of Cicero, none has been adduced of any importance drawn from the character of the language. It is worth while noticing that not only is the style in itself perfectly finished, but the treatment of the subject of style, *elocutio* (iv. 12, 17), shows the pains which had already been given to the question. The writer lays down three chief requisites—(1) *elegantia*, (2) *compositio*, and (3) *dignitas*. Under the first come *Latinitas*, a due avoidance of solecisms and barbarisms, and *explanatio*, clearness, the employment of familiar and appropriate expressions. The second demands a proper arrangement, free from hiatus, alliteration, rhyme, the repetition or displacement of words, and too long sentences. Dignity depends upon the selection of language and of sentiments.

Characteristics of Latin prose.

Hence we see that by the time of Cicero Latin prose was fully developed. We may, therefore, pause here to notice the characteristic qualities of the language at its most perfect stage. The Latin critics were themselves fully conscious of the broad distinction in character between their own language and the Greek. Seneca dwells upon the stately and dignified movement of the Latin period, and uses for Cicero the happy epithet of *gradarius*. He allows to the Greeks *gratia*, but claims *potentia* for his own countrymen. Quintilian (xii. 10, 27 *sq.*) concedes to Greek more euphony and variety both of vocalization and of accent; he admits that Latin words are harsher in sound, and often less happily adapted to the expression of varying shades of meaning. But he too claims "power" as the distinguishing mark of his own language. Feeble thought may be carried off by the exquisite harmony and subtleness of Greek diction; his countrymen must aim at fulness and weight of ideas if they are not to be beaten off the field. The Greek authors are like lightly moving skiffs; the Romans spread wider sails and are wafted by stronger breezes; hence the deeper waters suit them. It is not that the Latin language fails to respond to the calls that are made upon it. Lucretius and Cicero concur, it is true, in complaints of the poverty of their native language; but this was only because they had had no predecessors in the task of adapting it to philosophic utterance; and the long life of Latin technical terms like *qualitas*, *species*, *genus*, *ratio*, shows how well the need was met when it arose. Mr. Munro has said admirably of this very period:

> "The living Latin for all the higher forms of composition, both prose and verse, was a far nobler language than the living Greek. During the long period of Grecian preeminence and literary glory, from Homer to Demosthenes, all the manifold forms of poetry and prose which were invented one after the other were brought to such exquisite perfection that their beauty of form and grace of language were never afterwards rivalled by Latin or any other people. But hardly had Demosthenes and Aristotle ceased to live when that Attic which had been gradually formed into such a noble instrument of thought in the hands of Aristophanes, Euripides, Plato, and the orators, and had superseded for general use all the other dialects, became at the same time the language of the civilized world and was stricken with a mortal decay. . . . . Epicurus, who was born in the same year as Menander, writes a harsh jargon that does not deserve to be called a style; and others of whose writings anything is left entire or in fragments, historians and philosophers alike, Polybius, Chrysippus, Philodemus, are little if any better. When Cicero deigns to translate any of their sentences, see what grace and life he instils into their clumsily expressed thoughts, how satisfying to the ear and taste are the periods of Livy when he is putting into Latin the heavy and uncouth clauses of Polybius! This may explain what Cicero means when at one time he gives to Greek the preference over Latin, at another to Latin over

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[1] Cicero also refers to certain *scripta dulcissima* of the son of Scipio Africanus Major, which must have possessed some merits of style.

Greek; in reading Sophocles or Plato he could acknowledge their unrivalled excellence; in translating Panætius or Philodemus he would feel his own immeasurable superiority."

Cicero and Cæsar.

The greater number of long syllables, combined with the paucity of diphthongs and consequent monotony of vocalization, and the uniformity of the accent, lent a weight and dignity of movement to the language which well suited the national *gravitas*. The precision of grammatical rules and the entire absence of dialectic forms from the written literature contributed to maintain the character of unity which marked the Roman republic as compared with the multiplicity of Greek states. It was remarked by Bacon that artistic and imaginative nations indulge freely in verbal compounds, practical nations in simple concrete terms. In this respect, too, Latin contrasts with Greek. The attempts made by some of the earlier poets to indulge in novel compounds was felt to be out of harmony with the genius of the language. Composition, though necessarily employed, was kept within narrow limits, and the words thus produced have a sharply defined meaning, wholly unlike the poetical vagueness of some of the Greek compounds. The vocabulary of the language, though receiving accessions from time to time in accordance with practical needs, was rarely enriched by the products of a spontaneous creativeness. In literature the taste of the educated town circles gave the law; and these, trained in the study of the Greek masters of style, required something which should reproduce for them the harmony of the Greek period. Happily the orators who gave form to the Latin prose were able to meet the demand without departing from the spirit of their own language, and the periods of Cicero and Livy, though very different in structure from those of Plato and Demosthenes, are not less satisfying to the ear, or less adequate to the full expression of thought. To Cicero especially the Romans owed the realization of what was possible to their language in the way of artistic finish of style. He represents a protest at one and the same time against the inroads of the *plebeius sermo*, vulgarized by the constant influx of non-Italian provincials into Rome, and the "jargon of spurious and partial culture" in vogue among the Roman pupils of the Asiatic rhetoricians. His essential service was to have caught the tone and style of the true Roman *urbanitas*, and to have fixed it in extensive and widely read speeches and treatises as the final model of classical prose. The influence of Cæsar was wholly in the same direction. His cardinal principle was that every new-fangled and affected expression, from whatever quarter it might come, should be avoided by the writer, as rocks by the mariner. His own style for straightforward simplicity and purity has never been surpassed; and it is not without full reason that Cicero and Cæsar are regarded as the models of classical prose. But, while they fixed the type of the best Latin, they did not and could not alter its essential character. In subtlety, in suggestiveness, in many-sided grace and versatility, it remained far inferior to the Greek. But for dignity and force, for cadence and rhythm, for clearness and precision, the best Latin prose remains unrivalled. These qualities make it pre-eminently the language of legislation and of commerce. There is no haziness about a Latin sentence; directness, concreteness, and lucidity stamp it as the utterance of men who knew precisely what they wished to say, and said it with all the force at their command.

It is needless to dwell upon the grammar or vocabulary of Cicero. His language is universally taken as the normal type of Latin; and, as hitherto the history of the language has been traced by marking differences from his usage, so the same method may be followed for what remains.

Varro

M. Terentius Varro, "the most learned of the ancients," a friend and contemporary of Cicero, seems to have rejected the periodic rhythmical style of Cicero, and to have fallen back upon a more archaic structure. Mommsen says of one passage, "the clauses of the sentence are arranged on the thread of the relative like thrushes on a string." But, in spite (some would say, because) of his old-fashioned tendencies, his language shows great vigor and spirit. In his Menippean satires he intentionally made free use of plebeian expressions, while rising at times to a real grace and showing often fresh humor. His treatise *De Re Rustica*, in the form of a dialogue, is the most agreeable of his works, and where the nature of his subject allows it there is much vivacity and dramatic picturesqueness, although the precepts are necessarily given in a terse and abrupt form. His sentences are as a rule co-ordinated, with but few connecting links; his diction contains many antiquated or unique words.

Sallust.

In Sallust, a younger contemporary of Cicero, we have the earliest complete specimen of historical narrative. It is probably due to his subject-matter, at least in part, that his style is marked by frequent archaisms; but something must be ascribed to intentional imitation of the earlier chroniclers, which led him to be called "priscorum Catonisque verborum ineruditissimus fur." His archaisms consist partly of words and phrases used in a sense for which we have only early authorities, *e.g.*, *cum animo habere*, etc., *animos tollere*, *bene factum*, *consultor*, *prosapia*, *dolus*, *venenum*, *obsequela*, *inquies*, *sallere*, *occipere*, *collibeo*, and the like, where we may notice especially the fondness for frequentatives, which he shares with the early comedy; partly in inflections which were growing obsolete, such as *senati*, *solui*, *comperior* (dep.) *neglegisset*, *vis* (acc. pl.), *nequitur*. In syntax his constructions are for the most part those of the contemporary writers.[1]

Lucretius.

In Lucretius and Catullus we have examples of the language of poetry of the same period. The former is undoubtedly largely archaic in his style. We find *im* for eum, *endo* for in, *illae*, *ullae*, *unae*, and *aliae* as genitives, *alid* for aliud, *rabies* as a genitive by the side of genitives in *-ai*, ablatives in *-i* like *colli*, *orbi*, *parti*, nominatives in *s* for *r*, like *colos*, *vapos*, *humos*. In verbs there are *scatit*, *fulgit*, *quaesit*, *confluxet* = confluxisset, *recesse* = recessisse, *induiacere* for inicere; simple forms like *figere*, *lacere*, *cedere*, *stinguere* for the more usual compounds, the infinitive passive in *-ier*, and archaic forms from *esse* like *siet*, *escit*, *fuat*. Sometimes he indulges in tmesis which reminds us of Ennius: *inque pediri*, *disque supata*, *ordia prima*. But this archaic tinge is adopted only for poetical purposes, and as a practical proof of his devotion to the earlier masters of his art; it does not affect the general substance of his style, which is of the freshest and most vigorous stamp. But the purity of his idiom is not gained by any slavish adherence to a recognized vocabulary: he coins words freely; Mr. Munro has noted more than a hundred ἅπαξ λεγόμενα, or words which he alone among good writers uses. Many of these are formed on familiar models, such as compounds and frequentatives; others are directly borrowed from the Greek apparently with a view to sweetness of rhythm (ii. 412; v. 334, 505); others again (forty or more in number) are compounds of a kind which the classical language refused to adopt, such as *silvifragus*, *terriloquus*, *perterricrepus*. He represents not so much a stage in the history of the language as a protest against the tendencies fashionable in his own time. But his influence was deep upon Virgil, and through him upon all subsequent Latin literature.

Catullus.

In Catullus we have the type of the language of the cultivated circles, lifted into poetry by the simple directness with which it is used to express emotion. In his heroic and elegiac poems he did not escape the influence of the Alexandrian school, and his genius is ill suited for long-continued flights; but in his lyrical poems his language is altogether perfect. As Macaulay says, "No Latin writer is so Greek. The simplicity, the pathos, the perfect grace, which I find in the great Athenian models are all in Catullus, and in him alone of the Romans." The language of these poems comes nearest perhaps to that of Cicero's more intimate letters. It is full of colloquial idioms and familiar language, of the diminutives of affection or of playfulness. Greek words are rare, especially in the lyrics, and those which are employed are only such as had come to be current coin. Archaisms are but sparingly introduced; but for metrical reasons he has four instances of the inf. pass. in *-ier*, and several contracted forms; we find also *alis* and *alid*, *uni* (gen.), and the antiquated *tetuli* and *recepso*. There are traces of the popular language in the shortened imperatives *cavě* and *maně*, in the analytic perfect *paratam habes*, and perhaps in the use of *unus* approaching that of the indefinite article.

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[1] The character of archaism has been denied to his style by Dean Merivale; and it is true that in the matter of orthography the forms which Sallust adopts, as Corssen has shown, were at least as common in his time as those which became afterwards the rule; but, when we compare his diction with that of Cicero, there is quite enough difference to justify the usual view; and the fact that some of his expressions are found in later writers only goes to show that they imitated him in this respect.

Horace.

The poets of the Augustan age mark the opening of a new chapter in the history of the Latin language. The influence of Horace was comparatively slight; he worked in a field of his own, and, although Statius imitated his lyrics, and Persius and Juvenal, especially the former, his satires, on the whole there are few traces of any deep marks left by him on the language of later writers. In his *Satires* and *Epistles* the diction is that of the contemporary *urbanitas*, differing hardly at all from that of Cicero in his epistles and dialogues. The occasional archaisms, such as the syncope in *erepsemus*, *evasse*, *surrexe*, the infinitives in *-ier*, and the genitives *deum*, *divum*, and *nummum* may be explained as still conversationally allowable, though ceasing to be current in literature; and a similar explanation may account for plebeian terms, *e.g.*, *balatro*, *blatero*, *garrio*, *mutto*, *vappa*, *caldus*, *soldus*, *surpite*, for the numerous diminutives, and for such pronouns, adverbs, conjunctions, and turns of expression as were common in prose, but not found, or found but rarely, in elevated poetry. Greek words are used sparingly, not with the license which he censures in Lucilius, and in his hexameters are inflected according to Latin rules. In the *Odes*, on the other hand, the language is much more precisely limited. There are practically no archaisms (*spargier* in Carm. iv. 11, 8 is a doubtful exception), or plebeian expressions; Greek inflections are employed, but not with the license of Catullus; there are no datives in *ĭ* or *sin* like *Tethyĭ* or *Dryasin;* Greek constructions are fairly numerous, *e.g.*, the genitive with verbs like *regnare*, *abstinere*, *desinere*, and with adjectives, as *integer vitae*, the so-called Greek accusative, the dative with verbs of contest, like *luctari*, *decertare*, the transitive use of many intransitive verbs in the past participle, as *regnatus*, *triumphatus;* and finally there is a "prolative" use of the infinitive after verbs and adjectives, where prose would have employed other constructions, which, though not limited to Horace, is more common with him than with other poets. Compounds are very sparingly employed, and apparently only when sanctioned by authority. His own innovations in vocabulary are not numerous. About eighty ἅπαξ λεγόμενα have been noted; but for the most part there is nothing very distinctive about their character, and perhaps we should find them almost entirely disappearing if the remains of contemporary literature were more extensive. Like Virgil, he shows his exquisite skill in the use of language rather in the selection from already existing stores than in the creation of new resources: *tantum series iuncturaque pollet.* But both his diction and his syntax left much less marked traces upon succeeding writers than did those of either Virgil or Ovid.

Virgil.

In Virgil the development of the Latin language reached its full maturity. What Cicero was to the period, Virgil was to the hexameter; indeed the changes that he wrought were still more marked, inasmuch as the language of verse admits of greater subtlety and finish than even the most artistic prose. For the straightforward idiomatic simplicity of Lucretius and Catullus he substituted a most exact and felicitous choice of diction, rich with the suggestion of the most varied sources of inspiration. Sometimes it is a phrase of Homer's "conveyed" literally with happy boldness, sometimes it is a line of Ennius, or again some artistic Sophoclean combination. Virgil was equally familiar with the great Greek models of style and with the earlier Latin poets. This learning, guided by an unerring sense of fitness and harmony, enabled him to give to his diction a music which recalls at once the fullest tones of the Greek lyre and the lofty strains of the most genuinely national song. His love of antiquarianism in language has often been noticed, but it never passes into pedantry. His vocabulary and constructions are often such as would have conveyed to his contemporaries a grateful flavor of the past, but they never would have been unintelligible. Forms like *iusso*, *olle*, or *admittier* can have delayed no one.

In the details of syntax it is difficult to notice any peculiarly Virgilian points, for the reason that his language, like that of Cicero, became the canon, departures from which were accounted irregularities. But we may notice as favorite constructions a free use of oblique cases in the place of the more definite construction with prepositions usual in prose, *e.g.*, *it clamor caelo*, *flet noctem*, *rivis currentia vina*, *bacchatam iugis Naxon*, and many similar phrases; the employment of some substantives as adjectives, like *venator canis*, and vice versa, as *plurimus volitans;* a proleptic use of adjectives, as *tristia torquebit*; idioms involving *ille*, *atque*, *deinde*, *haud*, *quin*, *vix*, and the frequent occurrence of passive verbs in their earlier reflexive sense, as *induor*, *velor*, *pascor* (comp. Dr. Kennedy's Appendix on "Virgilian Syntax").

Livy.

In Livy's singularly varied and beautiful style we have Latin prose in that rich maturity which seems to portend and almost to necessitate an early decline. To a training in the rhetorical schools, and perhaps professional experience as a teacher of rhetoric, he added a thorough familiarity with contemporary poetry and with the Greek language; and these attainments have all deeply colored his language. It is probable that the variety of style naturally suggested by the wide range of his subject-matter was increased by a half-unconscious adoption of the phrases and constructions of the different authorities whom he followed in different parts of his work; and the industry of German critics has gone far to demonstrate a conclusion likely enough in itself. Hence perhaps comes the fairly long list of archaisms, especially in formulæ, which scholars have collected (*cf.* Kühnast, *Liv. Synt.*, pp. 14-18). These are, however, purely isolated phenomena, which do not affect the general tone. It is different with the poetical constructions and Græcisms, which appear on every page. Of the latter we find numerous instances in the use of the cases, *e.g.*, in genitives like *ad Spei* (sc. *templum*), *pars altera regiae adulationis erat*, *oratores pacis petendae*, *ira praedae omissae*, *oppidum Antiochiae*, *aequum campi*, *qui captivorum*, in datives like *aeneum pectori tegumen*, *comitia collegae creando*, *quibusdam volentibus erat*, *promptus veniae dandae*;[1] in accusatives like *iurare calumniam*, *certare multam*, *distendere hostem;* an especially frequent use of transitive verbs absolutely; and the constant omission of the reflexive pronoun as the subject of an infinitive in reported speech. To the same source must be assigned a very frequent pregnant construction with propositions, an attraction of relatives, and a great extension of the employment of relative adverbs of place instead of relative pronouns, *e.g.*, *quo* = *in quem*. Among his poetical characteristics we may place the extensive list of words which are found for the first time in his works and in those of Virgil or Ovid, and perhaps his common use of concrete words for collective, *e.g.*, *eques* for *equitatus*, of abstract terms such as *remigium*, *servitia*, *robora*, and of frequentative verbs, to say nothing of poetical phrases like "haec ubi dicta dedit," "adversum montium," etc. Indications of the extended use of the subjunctive, which he shares with contemporary writers, especially poets, are found in the construction of *ante quam*, *post quam* with this mood, even when there is no underlying notion of purpose, of *donec*, and of *cum* meaning "whenever." On the other hand *forsitan* and *quamvis*, as in the poets, are used with the indicative in forgetfulness of their original force. Among his individual peculiarities may be noticed the large number of verbal nouns in *-tus* (for which Cicero prefers forms in *-tio*) and in *-tor*, and the extensive use of the past passive participle to replace an abstract substantive, *e.g.*, *ex dictatorio imperio concusso*. In the arrangement of words Livy is much more free than any previous prose writer, aiming, like the poets, at the most effective order rather than at that which is logically suggested. His periods are constructed with less regularity than those of Cicero, and gain at least as much in variety and energy as they lose in uniformity of rhythm and artistic finish. His style cannot be more fitly described than in the language of Quintilian, who speaks of his *mira iucunditas* and *lactea ubertas*.

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[1] Kühnast (p. 140) holds that of more than three hundred and twenty datives in book xxiii. about thirty show the influence of Greek constructions.

Propertius.

The language of Propertius is too distinctly his own to call for detailed examination here. It cannot be taken as a specimen of the great current of the Latin language; it is rather a tributary springing from a source apart, tinging to some slight extent the stream into which it pours itself, but soon ceasing to affect it in any perceptible fashion. "His obscurity, his indirectness, and his incoherence" (to adopt the words of Professor Postgate) were too much out of harmony with the Latin taste for him to be regarded as in any sense representative; sometimes he seems to be hardly writing Latin at all. Partly from his own strikingly independent genius, partly from his profound and not always judicious study of the Alexandrian writers, his poems abound in phrases and constructions which are without a parallel in Latin poetry. His archaisms and Græcisms, both in diction and in syntax, are very numerous; but frequently there is a freedom in the use of cases and prepositions which can only be due to bold and independent innovations. His style well deserves a careful study for its own sake (*cf.* Postgate's *Introduction*, pp. lvii.-cxxv.); but it is of comparatively little significance in the history of the language.

Ovid.

The brief and few poems of Tibullus supply only what is given much more fully in the works of Ovid. In these we have the language recognized as that best fitted for poetry by the fashionable circles in the later years of Augustus. The style of Ovid bears many traces of the imitation of Virgil, but it is not less deeply affected by the rhetoric of the schools. His never-failing fertility of fancy and command of diction often lead him into a diffuseness which mars the effect of his best works; according to Quintilian it was only in his (lost) tragedy of *Medea* that he showed what real excellence he might have reached if he had chosen to control his natural powers rather than to give them full rein. His influence on later poets was largely for evil: if he taught them smoothness of versification and polish of language, he also co-operated powerfully with the practice of recitation to lead them to aim at rhetorical point and striking turns of expression, instead of a firm grasp of a subject as a whole, and due subordination of the several parts to the general impression. Ovid's own influence on language was not great: he took the diction of poetry as he found it, formed by the labors of his predecessors; the conflict between the archaistic and the Græcizing schools was already settled in favor of the latter; and all that he did was to accept the generally accepted models as supplying the material in moulding which his luxuriant fancy could have free play. He is the pattern of the poet of society, never rising above that which was readily intelligible to the circle in which he moved, but achieving what all were attempting with consummate ease and grace. He has no deviations from classical syntax but those which were coming into fashion in his time (*e. g.*, *forsitan* and *quamvis* with the indic., the dative of the agent with passive verbs, the ablative for the accusative of time, the infinitive after adjectives like *certus*, *aptus*, etc.), and but few peculiarities in his vocabulary. It is only in the letters from the Pontus that laxities of construction are detected, which show that the purity of his Latin was impaired by his residence away from Rome, and perhaps by increasing carelessness of composition.

The Latin of daily life.

While the leading writers of the Ciceronian and Augustan eras enable us to trace the gradual development of the Latin language to its utmost finish as an instrument of literary expression, there are some less important authors who supply valuable evidence of the character of the *sermo plebeius*. Among them may be placed the authors of the *Bellum Africanum* and the *Bellum Hispaniense* appended to Cæsar's commentaries. These are not only far inferior to the exquisite *urbanitas* of Cæsar's own writings; they are much rougher in style even than the less polished *Bellum Alexandrinum* and *De Bello Gallico, Liber VIII.*, which are now with justice ascribed to Hirtius. There is sufficient difference between the two to justify us in assuming two different authors; but both freely employ words and constructions which are at once antiquated and vulgar. The writer of the *Bellum Alexandrinum* uses a larger number of diminutives within his short treatise than Cæsar in nearly ten times the space: *postquam* and *ubi* are used with the pluperfect subjunctive; there are numerous forms unknown to the best Latin, like *tristimonia*, *exporrigere*, *cruciabiliter*, and *convulnero*; *potior* is followed by the accusative, a simple relative by the subjunctive. There is also a very common use of the pluperfect for the imperfect, which seems a mark of this *plebeius sermo* (Nipperdey, *Quaest. Caes.*, pp. 13–30).

Another example of what we may call the Latin of business life is supplied by Vitruvius. Besides the obscurity of many of his technical expressions, there is a roughness and looseness in his language, far removed from a literary style; he shares the incorrect use of the pluperfect, and uses plebeian forms like *calefaciuntur*, *faciliter*, *expertiones*, and such careless phrases as "rogavit Archimedem uti in se sumeret sibi de eo cogitationem." At a somewhat later stage we have, not merely plebeian, but also provincial Latin represented in the *Satyricon* of Petronius. The narrative and the poems which are introduced into it are written in a style distinguished only by the ordinary peculiarities of silver Latinity; but in the numerous conversations the distinctions of language appropriate to the various speakers are accurately preserved; and we have in the talk of the slaves and provincials a perfect storehouse of words and constructions of the greatest linguistic value. Among the unclassical forms and constructions may be noticed masculines like *fatus*, *vinus*, *balneus*, *fericulus*, and *lactem* (for *lac*), *striga* for *strix*, *gaudimonium* and *tristimonium*, *sanguen*, *manducare*, *nutricare*, *molestare*, *nesapius* (*sapius* = Fr. *sage*), *rostrum* (= *os*), *ipsimus* (= master), *scordalias*, *baro*, and numerous diminutives like *camella*, *audaculus*, *potiuncula*, *savunculum*, *offla*, *peduclus*, *corcillum*, with constructions such as *maledicere* and *persuadere* with the accusative, and *adiutare* with the dative, and the deponent forms *pudeatur* and *ridetur*.

Of especial interest for the Romance languages are *astrum* (*désastre*), *berbex* (*brébis*), *botellus* (*boyau*), *improperare*, *muttus*, *naufragare*.

Suetonius (*Aug.* c. 87) gives an interesting selection of plebeian words employed in conversation by Augustus, who for the rest was something of a purist in his written utterances: "ponit assidue et pro stulto baceolum, et pro pullo pulleiaceum, et pro cerito vacerrosum, et vapide se habere pro male, et betizare pro languere, quod vulgo lachanizare dicitur."

The inscriptions, especially those of Pompeii, supply abundant evidence of the corruption both of forms and of pronunciation common among the vulgar. It is not easy always to determine whether a mutilated form is evidence of a letter omitted in pronunciation, or only in writing; but it is clear that there must have been a great tendency to drop final *m*, *s*, and *t*, to omit *n* before *s*, and to dull the vowel sounds, *e* and *i* being especially frequently interchanged, and *u* taking the place of *i* even in inflections. There are already signs of the confusion of *ae* and *e*, which later on became almost universal. The additions to our vocabulary are slight and unimportant (*cf.* *Corpus Inscr. Lat.*, vol. iv., with Zangemeister's *Indices*).

To return to the language of literature. In the dark days of Tiberius and the two succeeding emperors a paralysis seemed to have come upon prose and poetry alike. With the one exception of oratory, literature had long been the utterance of a narrow circle, not the expression of the energies of national life; and now, while all free speech in the popular assemblies was silenced, the nobles were living under a suspicious despotism, which, whatever the advantage which it brought to the poorer classes and to the provincials, was to them a reign of terror. It is no wonder that the fifty years after the accession of Tiberius are a blank as regards all higher literature. Velleius Paterculus, Valerius Maximus, Celsus, and Phædrus give specimens of the Latin of the time, but the style of no one of these, classical for the most part in vocabulary, but occasionally approaching the later usages in syntax, calls for special analysis. The elder Seneca, in his collection of *suasoriae* and *controversiae* supplies examples of the barren quibblings by which the young Romans were trained in the rhetorical schools. A course of instruction, which may have been of service when its end was efficiency in active public life, though even then not without its serious drawbacks, as is shown by Cicero in his treatise *De Oratore*, became seriously injurious when its object was merely idle display. Prose came to be overloaded with ornament, and borrowed too often the language, though not the genius, of poetry; while poetry in its turn, partly owing to the fashion of recitation, became a string of rhetorical points.

The age of Nero.

Seneca.

Persius.

Lucan.

In the writers of Nero's age, there are already plain indications of the evil effects of the rhetorical schools upon language as well as literature. The leading man of letters was undoubtedly Seneca the younger, "the Ovid of Prose;" and his style set the model of which it became the fashion to imitate. But striking and popular as it was, it could not commend itself to the judgment of sound critics like Quintilian, who held firmly to the great masters of an earlier time. He admits its brilliance, and the fertility of its pointed reflections, but charges the author justly with want of self-restraint, jerkiness, frequent repetitions, and tawdry tricks of rhetoric. He was the worst of models, and pleased by his very faults. In his tragedies the rhetorical elaboration of the style only serves to bring into prominence the frigidity and frequent bad taste of the matter. But his diction is on the whole fairly classical; he is, in the words of Muretus, "vetusti sermonis diligentior quam quidam inepte fastidiosi suspicantur." In Persius there is a constant straining after rhetorical effect, which fills his verses with harsh and obscure expressions. The careful choice of diction by which his master Horace makes every word tell is exaggerated into an endeavor to gain force and freshness by the most contorted phrases. The sin of allusiveness that besets so many young writers, is fostered by the fashion of the day for epigram, till his lines are barely intelligible after repeated reading. Conington happily suggested that this style was assumed only for satiric purposes, and pointed out that when not writing satire Persius is as simple and unaffected as Horace himself. This view, while it relieves Persius of much of the censure which has been directed against his want of judgment, makes him all the more typical a representative of this stage of silver Latinity. In his contemporary Lucan we have another example of the faults of a style especially attractive to the young, handled by a youth of brilliant but ill-disciplined powers. The *Pharsalia* abounds in spirited rhetoric, in striking epigram, in high-sounding declamation; but there are no flights of sustained imagination, no ripe wisdom, no self-control in avoiding the exaggerated or the repulsive, no mature philosophy of life or human destiny. Of all the Latin poets he is the least Virgilian, so that Merivale remarks "he had never studied, one is almost tempted to believe that he had never read, Virgil." It has been said of him that he corrupted the style of poetry, not less than Seneca that of prose. It may be doubted whether his influence was ever great enough to produce such an effect; it is safer to say that he is the earliest poet in whom the characteristics of the silver Latinity are clearly marked.

Pliny the Elder.

Quintilian.

Frontinus.

In the elder Pliny the same tendencies are seen occasionally breaking out in the midst of the prosaic and inartistic form in which he gives out the stores of his cumbrous erudition. Wherever he attempts a loftier tone than that of the mere compiler he falls into the tricks of Seneca. The nature of his encyclopædic subject-matter naturally makes his vocabulary very extensive; but in syntax and general tone of language he does not differ materially from contemporary writers. Quintilian is of interest especially for the sound judgment which led him to a true appreciation of the writers of Rome's golden age. He set himself strenuously to resist the tawdry rhetoric fashionable in his own time, and to hold up before his pupils purer and loftier models. His own criticisms are marked by excellent taste, and often by great happiness of expression, which is pointed without being unduly epigrammatic. But his own style did not escape, as indeed it hardly could, the influences of his time; and in many small points his language falls short of classical purity. There is more approach to the simplicity of the best models in Frontinus, who furnishes a striking proof that it was rather the corruption of literary taste than any serious change in the language of ordinary cultivated men to which the prevalent style was due. Writing on practical matters—the art of war, and the water-supply of Rome—he goes straight to the point without rhetorical flourishes; and the ornaments of style which he occasionally introduces serve to embellish but not to distort his thought.

The Flavian age.

Epic poets.

The epic poets of the Flavian age present a striking contrast to the writers of the Claudian period. As a strained originality was the cardinal fault of the one school, so a tame and slavish following of authority is the mark of the other. The general *correctness* of this period may perhaps be ascribed (with Merivale) partly to the political conditions, partly to the establishment of professional schools. Teachers like Quintilian must have done much to repress extravagance of thought and language; but they could not kindle the spark of genius. Valerius Flaccus, Silius Italicus, and Papinius Statius are all correct in diction and in rhythm, and abound in learning; but their inspiration is drawn from books and not from nature or the heart; details are elaborated to the injury of the impression of the whole; every line is labored, and over-

Juvenal.

Martial.

charged with epigrammatic rhetoric. Statius shows by far the greatest natural ability and freshness; but he attempts to fill a broad canvas with drawing and coloring suited only to a miniature. Juvenal exemplifies the tendencies of the language of his time as moulded by a singularly powerful mind. A careful study of the earlier poets, especially Virgil and Lucan, has kept his language up to a high standard of purity. His style is eminently rhetorical; but it is rhetoric of real power. The concise brevity by which it is marked seems to have been the result of a deliberate attempt to mould his natural diffuseness into the form recognised as most appropriate for satire. In his verses we notice a few metrical licenses common to his age, especially the shortening of the final *-o* in verbs, but as a rule they are as correct as they are sonorous. In Martial the tendency of this period to witty epigram finds its most perfect embodiment, combined with finished versification. The typical prose-writers of this time are Pliny the younger and Tacitus. A study of their diction and syntax will best disclose the characteristics of the silver Latinity. Some of the features of the style of Tacitus are peculiar to himself; but on the whole the following statement represents the tendencies shared in greater or less degree by all the writers of this period. The gains lie mainly in the direction of a more varied and occasionally more effective syntax; its most striking defect is a lack of harmony in the periods, of arrangement in words, of variety in particles arising from the loose connection of sentences. The vocabulary is extended, but there are losses as well as gains. Quintilian's remarks are fully borne out by the evidence of extant authorities; on the one hand, "quid quod nihil iam proprium placet, dum parum creditur disertum, quod et alius dixisset" (viii., prooem., 24); "a corruptissimo quoque poetarum figuras seu translationes mutuamur; tum demum ingeniosi scilicet, si ad intelligendos nos opus sit ingenio" (*ib.*, 25); "sordet omne quod natura dictavit" (*ib.*, 26); on the other hand, "nunc utique, cum haec exercitatio procul a veritate seiuncta laboret incredibili verborum fastidio, ac sibi magnam partem sermonis absciderit" (viii. 3, 23), "multa cotidie ab antiquis ficta moriuntur" (*ib.*, 6, 32). A writer like Suetonius therefore did good service in introducing into his writings terms and phrases borrowed, not from the rhetoricians, but from the usage of daily life.

Pliny the younger and Tacitus.

In the vocabulary of Tacitus there are to be noted:

1. Words borrowed (consciously or unconsciously) from the classical poets, especially Virgil, occurring for the most part also in contemporary prose. Of these Dräger gives a list of ninety-five (*Syntax und Stil des Tacitus*, p. 96).

2. Words occurring only, or for the first time in Tacitus. These according to the same authority number eighty-eight, for the most part new formations or compounds from stems already in use, especially verbal substantives in *-tor* and *-sor*, *-tus* and *-sus*, *-tura* and *-mentum*, with new frequentatives.

3. Words used with a meaning (*a*) not found in earlier prose, but sometimes (in more than eighty instances) borrowed from the poets, *e. g.*, *componere*, "to bury;" *scriptura*, "a writing;" *ferratus*, "armed with a sword;" (*b*) peculiar to later writers, *e. g.*, *numerosus*, "numerous;" *famosus*, "famous;" *decollare*, "to behead;" *imputare*, "to take credit for," etc.; (*c*) restricted to Tacitus himself, *e. g.*, *dispergere* = *divolgare*; of these Boetticher quotes one hundred and twenty-two.

Generally speaking, Tacitus likes to use a simple verb instead of a compound one, after the fashion of the poets, employs a pluperfect for a perfect, and (like Livy and sometimes Cæsar) aims at vividness and variety by employing the present and perfect conjunctive in indirect speech even after historical tenses. Collective words are followed by a plural far more commonly than in Cicero. The ellipse of a verb is more frequent. The use of the cases approximates to that of the poets, and is even more free. The accusative of limitation is common in Tacitus, though never found in Quintilian. Compound verbs are frequently followed by the accusative where the dative might have been expected; and the Virgilian construction of an accusative with middle and passive verbs is not unusual. The dative "absolute" is shared by Tacitus with Livy; the dative of purpose and the dative with a substantive in place of a genitive are more common with him than with any writer. The ablative of separation is used without a preposition, even with names of countries and with common nouns; the ablative of place is employed similarly without a preposition; the ablative of time has sometimes the force of duration; the instrumental ablative is employed even of persons. A large extension is given to the use of the quantitative genitive after neuter adjectives and pronouns, and even adverbs, and to the genitive with active participles; and the genitive of relation after adjectives is (probably by a Græcism) very freely employed. In regard to prepositions, there are special uses of *citra*, *erga*, *iuxta*, and *tenus* to be noted, and a frequent tendency to interchange the use of a preposition with that of a simple case in corresponding clauses. In subordinate sentences *quod* is used for "the fact that," and sometimes approaches the later use of "that;" the infinitive follows many verbs and adjectives that do not admit of this construction in classical prose; the accusative and infinitive are used after negative expressions of doubt, and even in modal and hypothetical clauses.

Like Livy, the writers of this time freely employ the conjunctive of repeated action with a relative, and extend its use to relative conjunctions, which he does not. In clauses of comparison and proportion there is frequently an ellipse of a verb (with *nihil aliud quam*, *ut*, *tanquam*); *tanquam*, *quasi*, and *velut* are used to imply not comparison but alleged reason; *quin* and *quominus* are interchanged at pleasure. *Quamquam* and *quamvis* are commonly followed by the subjunctive, even when denoting facts. The free use of the genitive and dative of the gerundive participle to denote purpose is common in Tacitus, the former being almost limited to him. Livy's practice in the use of participles is extended even beyond the limits to which he restricts it. It has been calculated that where Cæsar uses five participial clauses, Livy has sixteen, Tacitus twenty-four.

In his compressed brevity Tacitus may be said to be individual; but in the poetical coloring of his diction, in the rhetorical cast of his sentences, and in his love for picturesqueness and variety he is a true representative of his time.

The language of Suetonius is of interest as giving a specimen of silver Latinity almost entirely free from personal idiosyncrasies; his expressions are regular and straightforward, clear and business-like; and, while in grammar he does not attain to classical purity, he is comparatively free from rhetorical affectations.

The African Latinity.

Fronto.

Appuleius.

A new era commences with the accession of Hadrian (117 A.D.). As the preceding half century had been marked by the influence of Spanish Latinity (the Senecas, Lucan, Martial, Quintilian), so in this the African style was paramount. This is the period of affected archaisms and pedantic learning, combined at times with a reckless love of innovation and experiment, resulting in the creation of a large number of new formations and in the adoption of much of the plebeian dialect. Fronto and Appuleius mark a strong reaction against the culture of the preceding century, and for evil far more than for good the chain of literary tradition was broken. The language which had been unduly refined and elaborated now relapsed into a tasteless and confused patchwork, without either harmony or brilliance of coloring. In the case of the former the subject-matter is no set-off against the inferiority of the style. His latest editor is quite pathetic in lamenting the worthlessness of his author, and says that it would have conduced to his reputation if his works had never been unearthed. He deliberately attempts to go back to the obsolete diction of writers like Cato and Ennius. We find compounds like *altipendulus*, *nudiustertianus*, *tolutiloquentia*, diminutives such as *matercula*, *anulla*, *passercula*, *studiolum*, forms like *congarrire*, *disconcinnus*, *pedetemptius*, *desiderantissimus* (passive), *conticinium*; *gaudeo*, *oboedio*, and *perfungor* are used with an accusative, *modestus* with a genitive; and, if our MS. is to be trusted, the interchange of *b* and *v* has already begun. On the other hand he actually attempts to revive the form *asa* for *ara*. In Appuleius the archaic element is only one element in the queer mixture which constitutes his style, and it probably was not intended to give the tone to the whole. Poetical and prosaic phrases, Græcisms, solecisms, jingling assonances, quotations, and coinages, apparently on the spur of the moment, all appear in this wonderful medley. There are found such extraordinary genitives as *sitire beatitudinis*, *cenae pignerarer*, *incoram omnium*, *foras corporis*, sometimes heaped one upon another, as *fluxos vestium Arsacidas et frugum pauperes Ityraeos et odorum divites Arabas*. Diminutives are coined with reckless freedom, *e. g.*, *diutule*, *longule*, *mundule amicta et altiuscule sub ipsas papillas succinctula*. He confesses himself that he is writing in a language not familiar to him:—"In urbe Latia advena studiorum Quiritium indigenam sermonem aerumnabili labore, nullo magistro praeeunte, aggressus excolui;" and the general impression of his style fully bears out his confession. Melanchthon is hardly too severe when he says that Appuleius brays like his own ass. **Gellius.** The language of Aulus Gellius is much superior in purity; but still it abounds in rare and archaic words, *e. g.*, *edulcare*, *recentari*, *aeruscator*, and in meaningless frequentatives like *solitavisse*. He has some admirable remarks on the pedantry of those who delighted in obsolete expressions (xi. 7) such as *apluda*, *flocus*, and *bovinator*; but his practice falls far short of his theory.

The lawyers. The style of the eminent lawyers of this period, foremost among whom is Gaius, deserves especial notice as showing well one of the characteristic excellences of the Latin language. It is for the most part dry and unadorned, and in syntax departs occasionally from classical usages, but it is clear, terse, and exact. Technical terms may cause difficulty to the ordinary reader, but their meaning is always precisely defined; new compounds are employed whenever the subject requires them, but the capacities of the language rise to the demands made upon it; and the conceptions of jurisprudence have never been more adequately expressed than by the great Roman jurists.

Decay of literary Latin. It is needless to trace in detail the gradual impoverishment and disorganization of literary Latin. After the time of Gellius, there is no writer who deserves in any sense to be called classical. The true literary tradition was lost; and even the poets who aimed at imitating the best models, by far the best of whom was Claudian, were led into many faults by the defective taste of their time. The sense of quantity was lost, and the practice of regarding accent as the ruling principle in metre, which had doubtless never been extinct in popular songs,[1] and which has left plain traces in a poem quoted by Gellius (xix. 11), became gradually predominant. Its effects are sometimes to be observed even in the poems of Ausonius (flor. 350 A.D.), and are plain in those of Sedulius in the next century.

In Gaul the rhetorical schools, which flourished greatly in the 4th century, maintained a tradition of learning, which preserved some classical tinge of language, but it sank by degrees into bombastic extravagance, and the style of Sidonius Apollinaris displays, with a profusion of erudition, an entire absence of correctness. Latin was to him no living language; his natural medium of expression was the *sermo rusticus*, and this has left its mark on every page.

Ecclesiastical Latin. The influence of the Christian church in the development of the Latin language was mainly in two directions. In the first place the new conceptions introduced brought about a large extension of the vocabulary. As the most important of the early Latin fathers belonged to Africa (Tertullian, Cyprian, Arnobius, Augustine), this extension was made under the influence of the African Latinity; the newly-coined terms took an awkward and almost barbarous form; and the tendency of the time to abstract expressions and clumsy compounds was heightened by the needs of the writers. Secondly, the Christian teachers, as several of them expressly say, thought little of the grammatical exactness of their language, provided they could make themselves readily intelligible to the common people; *e. g.*, Augustine confesses "Melius est reprehendant vos grammatici quam non intelligant populi," and again, "Saepe enim et verba non Latina dico, ut vos intelligatis." Hence in the writings of the early fathers we find a large element of plebeian Latinity introduced into the clumsy and affected rhetoric and the bold linguistic experiments of the African schools. Perhaps it is Tertullian who represents this stage of the language in its most extravagant form. He has genitives like *imbrium utilia*, accusatives like *Campania erepta Pompeios*, adverbs used for adjectives, metaphorical terms employed in the boldest fashion (*e. g.*, *adulter*, *assium*, *conus*, *contentiosus funis*, *communicare*, etc.), numerous abstract words, often in the plural, like *corpulentiae*, *dissentiae*, *inexperientiae*, and finally the most extraordinary compounds, such as *interibilis*, *elementicius*, *concupiscentivum*, *ethnicalis*, *extructorius*, *famulatorius*, etc.

The language of the *Vetus Itala* (a version of the Bible, made in Africa) and of the Vulgate has been made the subject of an admirable study by Hermann Rönsch (*Itala und Vulgata*, 2d ed., Marburg, 1875), from whom the following sketch of its leading characteristics has been mainly derived (comp. also Bernhardy, *Röm. Lit.*, pp. 334, 335). Many of the phenomena are common to the plebeian language generally, and have been already noticed as appearing occasionally in earlier writings.

1. In the formation of substantives there appears a preference for full-sounding forms, constructed by a free use of the suffixes *-mentum*, *-monium*, *-arium*, *-orium*, *-culum*, *-bulum*, *-eneum*, *-ivum*, *-ura*, *-udo*, *-tela*, *-ties*: *e. g.*, *augumentum* for *sagus*, *sessimonium*, *sessibulum*, or *sessorium* for *sedes*, [illegible] for *vale*, *poenitudo* for *poena*, *dulcitas* for *dulce*.

2. Plebeian terms take the place of their classical equivalents: *e.g.*, *caballus* (= *cheval*), *mansio* (= *maison*), *bucca* (= *bouche*), *testa* (= *tête*), *in gyrum* (= *environ*).

3. Substantives in *-tor* and *-io* receive large additions (Rönsch gives more than one hundred and eighty of the first kind, and more than two hundred and seventy of the second kind, found either new for the first time, or previously only in writers like Plautus and Petronius).

4. Adjectives are turned into substantives. From this class are formed many Romance words: *e. g.*, *montana* (= *montagne*), *hibernum* (= *hiver*), *diurnum* (= *giorno*), *volatilia* (= *volatili*, *volaille*), *matutinum* (= *mattino*, *matin*), *murale* (= *muraille*).

5. Adjectives in *-alis* and *-bilis*, *-urnus*, *-bundus*, *-lentus*, and *-osus* are largely introduced, often replacing simpler forms: *e. g.*, *placibilis* = *placens*, *aeternalis* = *aeternus*, *longiturnus*, *amarulentus*, *meticulosus*, *dignitosus*; and verbals in *-or* give rise to participial forms like *expudoratus*, *intimoratus*, *doloratus*.

6. The terminations *-im* and *-iter* largely replace *-e* in adverbs: *e. g.*, *inordinatim*, *pressim*, *avariter*, *improbiter*.

7. Verbs of secondary derivation take the place of simple verbs, thus meeting the love for fuller forms, as *mensurare*, *amaricare*, *taediare*, *potionare*, *deteriorare*; an intensive force is given by composition with *ad*, *de*, *con*, *ex*, *in*, and *ob*; *e. g.*, *adminari*, *coinquinare*, *confortare*, *deplanare*, *elonginquare*, *incrassare*, *obdulcare*; and sometimes, in imitation of the Greek, there is a double prefix, as in *adincrescere*, *perconterrere*, *obrelinquere*, *discooperire* (= *découvrir*).

8. Intensive and frequentative verbs are especially common, and have given rise to many Romance words; *e. g.*, *compressare*, *proiectare*, *recollectare*.

9. In composition there is great freedom, and the use of the negative *in-* is very common, *e. g.*, *imbonitas*, *disconvenientia*, *indicto-audientia*, *quaterducatus* (= *tetrarch*), *admanuductor*. Hybrid forms are common, like *thelodiose*, *acidia* (for ἀκηδία), *cataplectatio* (καταπληγμός), *aporiari* (ἀπορεῖσθαι). Especially noteworthy is the use of two prepositions or an adverb with a preposition, as *de mane* (= *demain*), *de foris* (= *dehors*), *de intus*, and *ab intus* (*dans* = *de ab intus*), *de retro* (= *derrière*), *de sursum* (= *dessus*), *ab ante* (= *avant*).

10. In inflection there are many irregularities, largely due to the reappearance of forms which had long been obsolete in the literary language, but partly produced by the love of fuller forms, often resulting in heteroclite words. To the first class belong *u*-stems inflected according to the second declension, *e. g.*, *fructi*, *victi*, *strepiti*, etc.; masculine for neuters, *e. g.*, *fama*, *foenus*, *lignus*, etc., and, on the other hand, *nasum*, *populum*, etc.; numerous pronominal forms, such as *alis*, *ipsud*, *alie* and *ille* (dat.), etc. To the second class belong *ossum* for *os* (comp. August., *Doct. Christ.*, iii. 3: *mallem quippe cum barbarismo dici "non est absconditum a te ossum meum," quam ut ideo esset minus apertum, quia magis Latinum est*), *principens* for *princeps*, *praesepium* for *praesepe*, *lampada* for *lampas*, *retia* for *rete*, etc. Comparatives and superlatives are largely invented, often with the aid of *magis* and *plus*, sometimes used pleonastically, as *plus lucidiores*. In verbs analogy has often replaced the classical forms by others which seemed more regular: *odio* is inflected throughout like *audio*; verbs are transferred from one con-

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[1] Mr. Munro (Cambridge Philosophical Society, 1860) has discussed an inscription in accented hexameters, from Cirta, dating from the 4th century of our era.

jugation to another, *e. g.*, *floriet*, *fugiit*, *linies*, *extergunt*; compare perfects like *conterui*, *porregi*, *collexi*, *prandiderunt*, futures like *augeam*, *persuadeam*, *metuebitis*, *peries*, *scibo*, *sepelibo*. Many deponents appear with active forms, as so commonly in archaic Latin, and less frequently *vice versa*.

11. In the meaning of words there are many changes, especially in the way of giving a concrete force to abstract and figurative forms. Some of these preserve their acquired force in the Romance languages: *e. g.*, *cortina* (curtain), *focus* (*fuoco*, *feu*), *exhibitio* (= maintenance), *papilio* (*pavillon*), *sella* (*selle*), *spatula* (*épaule*), *substantia* (= property), *venatio* (*venaison*), *gentes* (*gens*), *exterminare* (exterminate), *instaurare* (store), *involare* (*embler*), *rememorari* (remember), *renuntiare* (renounce), *traducere* (traduce), *recuperari* (recover), *stare* (*être*). *Ad* and *apud* are treated as equivalent; *de* is constantly used with an instrumental force, and as equal to *ex*: it replaces the partitive genitive (*de colentibus multitudo magna*; *tantum de chartis*), and sometimes forms with its case a substantive used as a nominative (*ampulla in qua de oleo* [*de l'huile*] *continebatur*).

12. In syntax there is everywhere visible a negligent simplicity of structure, careless of grammatical rule, but aiming at directness and ready intelligibility. Hence the tendency to analytic rather than synthetic construction, observable in earlier stages, is extended. Prepositions are constantly used instead of the simple cases, often with entire neglect of their classical construction: *e. g.*, *ab*, *cum*, *de*, *ex*, *in*, and *sub* (of rest), *prae*, *pro*, *sine*, with acc.; *in* and *sub* (of motion), *intra*, *post*, etc., with abl). Verbs are construed *κατὰ σύνεσιν*, instead of according to classical usage: *e. g.*, *egere* c. acc., *misereri* and *impedire* c. dat. *Ille*, *hic*, and *is* are used for the definite article, *unus* for the indefinite. *Quod*, *quia*, and *quoniam* are constantly used for the accusative with the infinitive; the indicative follows *ut* and indirect interrogatives. Sometimes (as at times in modern German) the subjunctive is used in expressing astonishment. The infinitive follows a preposition, as *quomodo potest hic nobis dare carnem ad manducare* (*à manger*); *non habuit unde reddere* (comp. *de quoi vivre*). The pluperfect conjunctive frequently replaces the imperfect (comp. *que je punisse*), and the perfect infinitive the imperfect, especially with *possum* and *debeo*. The ablative gerund often takes the place of a participle, and the gerundive of a future infinitive.

Of Graecisms, which are very numerous in the literal versions of the Bible, the only one requiring notice here is the frequent use of *habeo* with the infinitive (not unknown even to Cicero), which has given rise to the Romance future.

The changes of pronunciation which had been effected by this time consisted partly in the wider extension given to tendencies previously existing in the popular speech, partly in that gradual disintegration and weakening of sounds always observable in the history of a language. Our knowledge of them has to be derived almost wholly from inscriptions; for, although the conclusions derived from these may sometimes be usefully supplemented by the evidence of manuscripts, there is usually a doubt possible in the latter case whether the forms occurring bear witness to the pronunciation of the author or to that of the copyist in a later age. Interesting evidence is sometimes furnished by the rhymes found in the poets who discarded the classical forms of verse for rhyming metres. For instance, the tendency to drop a final consonant, shown in inscriptions of every period, comes out plainly in the verses of Sedulius, who has the following rhymes: *pectoris—dei*, *impie—times*, *viderant—praeviam*, *personat—pignora*, *millia—victimam*, *fundere—originem*, *torridi—obstruit*. The following table (mainly from Schuchardt, *Vokalismus des Vulgärlatein*, i. 104–5) gives the principal facts of the popular pronunciation, with an indication of the periods at which the change can be proved to have taken place. It will be understood that it is always possible that the more correct pronunciation may have been retained side by side with the corruption long after the latter makes its first appearance.

I. 100–50 B.C.	*o* = *au* (*plostrum* for *plaustrum*). *e* = *ae* (see above). *m* obscured before labials (*Decebris*, *C. I. L.*, i. 930). *n* obscured before dentals and gutturals (*paretes*). *m*, *s*, *t* dropped when final.
II. 100–150 A.D.	Surds changed to sonants (*bublicae*, *grassus*, etc. Aspiration neglected (often even in the Augustan age, and common in Pompeian inscriptions). *i* for *ĕ*. *u* for *ō*. *v* for *b* (very common in 3d century). *s* for *x* (rare before 4th century). *tt* or *t* for *ct* (*autor* for *auctor*, later *prefetto* for *praefecto*).
III. 300–350 A.D.	*l* and *r* interchanged (only under special circumstances before the next period). Assibilation of *ti* and *ci*, and of *di* and *j*. *g* for *j* before *e* and *i* (comp. *Giove*, *congiunto*). *i* prefixed to *s* followed by a consonant (*iscala* = *escalier*, *ispiritus* = *esprit*). *tt* for *pt*. *ss* for *sc*.
IV. 500–550 A.D.	*g* assibilated before *e* and *i*. *ss* for *st*. *mm* for *gm*. *p* inserted between *m* and *n*.
V.	*c* assibilated before *e* and *i*. *ie* for *ĕ*. *uo* for *ŏ*.

The assibilation of *ci* commenced in Africa, not before the time of Alexander Severus (222–235 A.D.), and was late in extending to Italy; in Gaul it was common in the 7th century; that of *ti* was generally adopted even by the educated in the 5th century. In the 6th and 7th century *g* was dropped after vowels before *e* or *i* (*vinti* = *viginti*) in Africa. This phenomenon had been common in Umbrian and Oscan.

The exact date of some of these changes is open to question; but it would be impossible to attempt to determine it without a fuller discussion of the evidence than is here possible. On the whole, it may be asserted with confidence that all these changes had been fully established before the end of the 6th century after Christ. The question of the relation of the Latin language to the various Romance tongues which have been derived from it is one which can be discussed in detail only under the head of the several languages. The general character of the relation is all that can be touched upon here. But it is of importance to notice that the metaphor which is embodied in the phrase "mother and daughter languages" holds good only for literature. From this point of view M. Littré writes with justice: "Latin alters without doubt towards the end of the empire and after the arrival of the barbarians, and the style of Gregory of Tours is very far removed from the purity of Livy; but after all it is Latin, and not one of the Neo-Latin languages. Then all at once it disappears, and we see arising, as if from under the ground, the various idioms to which it has given birth. It dies suddenly and without transformation, so that these secondary languages cannot be considered as the metamorphosis or expansion of it. We have no right to say that Latin is continued in the new languages; it died without developing itself, but it died leaving children and heirs." Such a breach of continuity is wholly inconceivable as an historical procedure. From the popular Latin various dialects were gradually formed, assuming forms differing with the various influences which were brought to bear upon them. It is true that there is much in the derived languages which cannot be shown to have existed in the popular Latin; but if we set aside what is evidently due to the action of foreign, especially Teutonic idioms—and this is to be found far more in the vocabulary than in the syntax—there is nothing which may not fairly be ascribed to the operation of tendencies already existing in the plebeian speech. By degrees the custom grew up of confining the name *Latina* to the literary language, while the popular speech was known as *lingua Romana*. As early as 660 A.D. St. Mummolinus was elected bishop of Noyon, "quia praevalebat, non tantum in Teutonica, sed etiam in Romana lingua." In the middle of the next century the *Acta Sanctorum*, speaking of St. Adalhard, abbot of Corbey, brings out the distinction still more clearly: "qui si vulgari, id est, Romana lingua loqueretur, omnium aliarum putaretur inscius; si vero Teutonica, enitebat perfectius, si Latina, in nulla omnine absolutius." The famous "glosses of Reichenau" of the same date explain some words of the Latin vulgate in the popular language: *e. g.*, *caementarii* = *macioni* (*maçons*). In the beginning of the 9th century the church ordered the priest to preach, not in literary Latin, but in the popular tongue. The oath of Strasburg (842 A.D.), happily preserved in a contemporary record, gives us what may be called with equal justice the latest specimen of the Latin or the earliest example of the French language.

Pro Deo amur et pro christian poblo et nostro
(Latin) *Pro Dei amore et pro christiano populo et nostro*
(French) *Pour l'amour de Dieu, et pour le salut du peuple chrétien et de notre*

Commun salvament, d'ist di en avant, in quant Deus
Communi salvamento de isto die in ab-ante in quantum Deus

Commun salut ae ce jour en avant, autant que Dieu

Savir et podir me dunat, si salvarai eo cist meon fradre
Sapere et posse mihi donabit, si salvare habeo ego ecc'istum meum fratrem
Me donne savoir et pouvoir, je sauverai mon frère

Karlo et in adjudha et in cadhuna cosa, si cum om per
Carolum et in adjutu et in quaque una causa, sic quomodo homo per
Charles et en aide et en chaque chose, ainsi qu'on doit

Dreit son fradra salvar dist, in o quid il mi altresi
Directum suum fratrem salvare debitus est, in eo quod ille mihi alterum sic
Selon la justice sauver son frère, à condition qu'il en fasse autant

Fazet; et ab Ludher nul plaid numquam prindrai
Faciet, et ab Lothario nullum placitum numquam prehendere habeo
Pour moi, et je ne ferai avec Lothaire aucun accord

Qui meon vol cist meon fradre Karle in damno sit.
Quod mea voluntate ecc'isto meo fratri Carolo in damno sit.
Qui par ma volonté porte préjudice, à mon frère Charles ici présent.

Leading phonetic changes in the Romance languages.

The details of the changes which the popular Latin experienced in passing into the Romance languages cannot be given in this connection; but a few of the leading features may be not improperly noticed. It is to be remarked at the outset, however, that these concern only those portions of the vocabulary which have come by direct descent from the Latin; in all the Romance languages there is a large element which is due to borrowing at a later stage by the learned; for this portion the tendencies to be mentioned do not come into play. The Italian *cagione*, Spanish *velar*, French *frêle*, are examples of the first class; Ital. *occasione*, Span. *vigilar*, French, *fragile*, are instances of the second. We notice then that (1) the accented vowel, "the soul of the word," as it is called by Diez, is always retained, subject to phonetic changes: comp. *rábiem* = *rage*, *crêtam* = *craie*. (2) An unaccented vowel in the immediate neighborhood of an accented one is usually lost: comp. *auricula* = *oreille* = *orecchio*, or changed for another, especially *a*, almost arbitrarily, *e.g.*, *silvaticus* = *salvaggio* = *sauvage*. (3) Diphthongs are rarely retained; the tendency noticed already in Latin to change them into simple vowels continued to operate; and the numerous diphthongs in the Romance languages are usually of later origin, arising either from contraction, or from the modification of simple vowels. (4) A mute between two vowels is commonly lost: comp. *frigidus* = *froid* = *freddo*; *laudare* = *louer*. Hiatus thus caused is usually removed by contraction. (5) When two mutes are brought into contact, by the loss of the intermediate vowel, the former is generally sacrificed: *manducare* = *mangiare*, *manger*; *berbicarius* = *berger*. (6) C before *a*, *o*, and *u*, before a consonant, or at the end of a word, commonly remains, but occasionally is softened; it is only in French that as a rule *ca* becomes *cha* or *che*, as in *caballus* = *cheval*, *cambiare* = *changer*, while *co*, *cu* are retained, as in *collum* = *cou*, *cuneus* = *coin*. When medial, it is softened usually in Spanish, and frequently in Italian; in French it passes into *y* or *i*, as in *doyen* = *decanus*, *braie* = *braca*, or is lost, as in *mie* = *mica*, *prier* = *precari*. C before *e*, *i*, *ae*, *oe*, is almost invariably assibilated, in accordance with a linguistic law, examples of which might be adduced from the most diverse quarters. G has passed through precisely analogous changes. (7) The liquids *l* and *r* freely interchange; and, while in Latin itself *l* rarely if ever becomes *r*, except under the influence of dissimilation, in the Romance languages this change is apparently quite as common as the reverse: *e.g.*, *lusciniola* = *rosignuolo* = *rossignol*. L regularly becomes *i* after *c* (*ch*) *f* in Italian, and *al* before a mute becomes *au* in French. Both *r* and *l* are especially liable to metathesis, as also in Latin and English: *e.g*, Span. *blago* from *baculus*, Ital. *frugare* from *furca*. N frequently becomes *r*, as in *pampre* for *pampinus*; but the reverse rarely happens. (8) Before *sp*, *st*, *sc*, Spanish always, French and Provençal usually, but Italian never prefixes *e*: comp. *spiritus*; Span. *espiritu*, French *esprit*, Prov. *esperit*, Ital. *spirito*.

It is needless to add that assimilation, syncope, and the avoidance of a harsh concurrence of consonants, either by the rejection of one or more of them, or by the insertion of a vowel, have all played a great part in the consonantal system of the Romance languages. A table of the chief changes of consonants in combination will be found in Diez, *Grammaire des Langues Romanes*, vol. i. p. 282.

Changes of inflection.

In nouns the inflections denoting cases were generally lost and their functions supplied in the genitive, dative, and ablative by the use of prepositions, and this in two ways. On the one hand French and Provençal, following a tendency common in popular Latin, took the accusative as the typical oblique case, and used forms thence derived for the objective case, while forms derived from the nominative constituted the subjective case: *e.g.*, sing. subj. *murs* (= *murus*), obj. *mur* (= *murum*), plur. subj. *mur* (= *muri*), obj. *murs* (= *muros*). But by the 14th century this distinction, no longer corresponding to any facts in the pronunciation of the French language, fell into disuse, and the objective form alone was used, the last trace of inflection thus disappearing. On the other hand, Italian and Spanish seem never to have passed through the former stage, but to have adopted from the first the accusative form as the basis of their own subjective as well as objective case, although in the plural (*corone*, *anni*) a desire to avoid confusion has led the Italian to adopt forms pointing rather to the nominative. Again, the neuter gender is lost entirely in the Romance languages; neuter words have become masculine as a rule, not, however, without many exceptions, due in some cases to false analogy, in others to the corruptions of the popular Latin. We may notice also the development of the article out of the popular use of *ille* and *unus* found in all the Romance languages.

The comparison of adjectives shows the steady growth of the preference for analytic over synthetic forms, which is a a characteristic of Romance grammar generally. The use of *magis* and *plus*, comparatively rare, especially the latter, in Latin, has become quite normal, the former in Spanish, Portuguese, and Roumanian, the latter in the other language, while the suffixed forms *-ior* and *-issimus* have left but few traces, and the definite article has been generally employed to form the superlative on quite a new principle.

In the case of pronouns some of the most common (*e.g.*, *hic*, *is*, *uter*) are lost altogether, and many new ones are created by composition.

In the conjugation of verbs, the principal changes are due to the disintegration of the old forms, leading to their replacement by compound forms. In popular Latin there was already a strong tendency to analytic forms, such as *habeo compertum*, *habeo dicere*, which supplied the model for numerous similar expressions. Thus the passive inflections have been entirely replaced by the use of auxiliary verbs; the perfect is formed with the aid of *habere* (for which Spanish and Portuguese often employ *tenere* [*tener*, *ter*]), the future is compounded with *habeo* (*j'aimer-ai*, etc.); a new mood, the conditional, is formed by a termination borrowed from the past imperfect; and supines and gerunds are entirely lost. In regard to the inflection of particular verbs, it is of special importance to notice the distinction between strong and weak forms, the accent in the former falling on the root (*créscere*), and in the latter on the termination (*amáre*); comp. *tiens* = *téneo*, but *tenons* = *tenémus*.

In adverbs, prepositions, and conjunctions, the chief point to notice is the extent to which, as in pronouns, simple forms have been replaced by compound forms, either as a result of the indistinguishable shape assumed by the latter in course of time, or with a view to a more complete expression of meaning. The former cause has led, for example, to the loss of adverbs distinguished from adjectives merely by a termination, worn away by the lapse of time; the latter to compounds like *désormais* (= *de ex hora magis*), *beaucoup* (= *bellum colaphum*, "a fine stroke").

Changes of vocabulary.

In derivation the Romance languages are especially rich, the loss of numerous simple Latin words, which either were too short to bear the abbreviating effects of time, or would have assumed an inconvenient form under the influence of the necessary phonetic changes, being compensated by new creations. Thus in the place of *res*, *vis*, *ius*, *os*, *rus*, *sus*, *crus*, *mus*, we find derivatives from *causa*, *fortia*, *directum*, *bucca*, *campania*, *troia*, *gamba*, *sorex*; and diminutives very frequently replace their primitives. We may notice finally how frequently it was necessary to adopt new forms in order to avoid homonyms, thus *bellum* was driven out by *bellus*, *aequus* by *equus*, *puer* by *purus*, *sol*. by *solum*. Frequently words of non-Latin origin were employed for this purpose.

Continued use of Latin.

But the formation of the Romance languages, and their occasional employment in popular songs and stories, at first hardly affected at all the use of Latin as the language of literature. Its adoption as the means of utterance of the Christian church lent to it, in the days of its most marked decay, a new though a strangely transformed life. So appropriated, it became familiar to all who had even the elements of education throughout western Europe; it was universally retained in the services of the church, if not in the discourses with which these services were sometimes, but by no means always, accompanied; all philosophy and theology to which the new and unformed popular idioms could give no expression was necessarily expressed in its terminology; and it remained, as it is at the present day, the official language of the ecclesiastical authorities. In France it is not until the 10th century that we find any considerable remains of the vernacular in the form of charters and other muniments, and literary prose does not begin until the 12th century, when French versions of the chronicles, originally written in Latin, are fairly common. In Italy, as was perhaps natural, the use of Latin for literature was retained still more tenaciously, and the development of the national language in its new form was extremely slow. It was not before the 13th century that there was any serious attempt at writing in Italian; the earliest prose work, the *Composizione del Mundo*, dating from the middle of that century, quite in accordance with the spirit of Italian thought at the time, was a scientific treatise. Numerous *novelle* are preserved to us from about the same period; but the use of Italian as an organ of literary expression was still so little established that Dante found it natural to write, not only his political treatise *De Monarchia*, but also his defence of the vulgar tongue *De Vulgaria Eloquio* in Latin.[1] Even in the sixteenth century sermons addressed to a mixed audience in Italy were frequently delivered in Latin. The fact that so large a proportion of the chronicles of the Middle Ages proceeded from the monasteries serves to explain the continued use of a language familiar to the writers alike in their religious exercises and in their theological studies; and in our own English chronicles we have perhaps a unique instance of the history of a nation recorded for centuries in its own vernacular. Further, as the clergy supplied the secretaries and often the ministers of state in every court in western Europe, Latin continued to be the language of diplomacy and public business, and, as all science and learning was confined to them or to their pupils, works appealing to a learned audience were of necessity clothed in the same garb. Of the vast mass of Latin poetry produced in the cloisters of the Middle Ages, perhaps it is enough to say, with a scholar whose studies made him exceptionally familiar with it, "It offers no one exception to the eternal irrepealable law, that no great poet is inspired but in his native language." Even the Latin hymns, some of which have taken their place among the perennial treasures of the church, owe their charm almost wholly to the intensity of their religious emotions, and to the lofty or plaintive music to which they were wedded, and not to any power in wielding the resources of the language, or happy artistic skill. It is perhaps in the *De Imitatione Christi* that ecclesiastical Latin is seen in its most perfect form. The style is of course wholly unlike that of the classical writers; but the Hebraic individualism, which in the Latin fathers often seems to clash inharmoniously with the general tone of the diction, has here proved strong enough to absorb the whole into its own key. Its terse and pregnant vigor, its direct simplicity, its profound thought, and its intense passion of self-devotion give it a place in the history of literature hardly inferior to that which it has always held among works of religious edification. It was one of the happy effects of a universal language that such a book, embodying as none other did the whole spirit of mediæval Christianity, should at once be accessible to the whole of Christendom.

Literary Latin.

During the long period for which Latin continued to be the language of learning and science, we find the writers who used it dividing themselves broadly into two great classes, according as they were accustomed to employ the current language of the cloister and the court, or aimed at a reproduction of the rhythm and diction of classical times. Of course the line cannot be drawn sharply, and all degrees of purity in idiom and syntax are represented, from the barbarous expressions which teem in many of the chroniclers to the purism of the Ciceronians. But it is not hard, as a rule, to determine in the case of any particular writer whether his style is merely derived from the traditional teachings of the schools, or drawn from a fresh study of the great models; and, while it is impossible to trace in detail the fluctuations in the greater or less badness of the former group, it may not be improper to sketch in outline the origin, the development, and it is to be feared that we must add the decline, of the art of using the Latin language with purity and grace. The attempt to return to something like the classical standard may perhaps have originated in the schools of Charles the Great, but it was least unsuccessful where, as in England, Latin was never a living language, and all knowledge of it had to be obtained from regular grammatical instruction. In the 9th and 10th centuries reference is very rarely made to the classical writers; it was only in the 11th century, under the influence of the schools of Lanfranc and Anselm, that a purer taste and a wider knowledge begin to show themselves. If the impulse came from Italy, the scholars of England and France soon surpassed their masters, and there is probably no Italian scholar who can be placed by the side of John of Salisbury, or (in the next century) of Abelard and Bernard of Clairvaux. But the influence of the mendicant friars, and the corruption of the monastic houses, led to a decline at least as marked as the revival; and the Latin of the 13th century was not less barbarous, as a rule, than that of the 10th. A far more enduring movement for reform is connected with the name of Petrarch (1304–1374). According to his own account, the sweetness and sonorousness of the periods of Cicero charmed his ears, when a boy, and made all other Latin seem to him harsh and discordant. Of course he was unable to escape altogether the influences of his time, and the more accurate scholars of a later age, aided by the vast improvement in the *subsidia* of learning such as dictionaries and grammars, find much to censure in his diction. But at least he set the example of that enthusiastic study of the great ancient models which is the only possible road to a finished and harmonious Latin style; and the lesson that he taught was not destined to be forgotten until it had borne its due fruits. His favorite pupil, John of Ravenna, was himself the teacher of the best scholars of the next generation; and to one of these, Gasparino of Barziza (died 1431), has commonly been assigned the distinction of being the father of the pure and elegant Latinity of the Renaissance. His devotion to the study of Cicero is shown by the plan which he formed to fill up, by conjectural links, the numerous deficiencies in the MSS. of the *De Oratore* then known to scholars, a design happily superseded by the discovery of the famous *Codex Laudianus*. Additional material was furnished by the recovery of not a few authors or portions of authors of the best period by the unwearied diligence of Poggio Bracciolini; and from henceforward the study of the Latin classics was pursued with the happiest results. Throughout the 15th century no literary acquirement was more valued than a good Latin style; the patronage extended to scholarship by the learned Pope Nicholas V. and the grammatical teaching of scholars like Laurentius Valla combined to encourage its pursuit with energy and success. Towards the latter part of the century Politian at Florence, and Hermolaus Barbarus at Venice, showed a mastery over the Latin language which won for them the enthusiastic admiration of their contemporaries; and, though the learning of these eminent scholars proved not unfrequently injurious to their style by inducing an affectation of obsolete or unfamiliar words, there is no reason to deny that on the whole this admiration was well deserved. In Germany they had a worthy rival, by some even ranked before them, in Agricola; in France and England there was as yet no one who, in the judgment afterwards expressed by Erasmus, could be said to write Latin at all. As far as purity of style went, the highest pitch of excellence was doubtless reached by the Italians towards the beginning of the 16th century. Sadolet, Bembo, Paulus Manutius, and, we must in justice add, Longolius in France, wrote Latin with a grace and finish which place their works in respect of style almost on a level with those of their great model, Cicero. But it cannot be denied that their fastidiousness of language often led them to sacrifice the fruits to the flowers of learning, and justly drew down upon them the witty and biting censures of Erasmus in his *Ciceronianus*. In the controversy between the men of learning and the men of taste, the best tendencies of the age were decidedly on the side of the former; and the Italian scholars whose object, as Hallam well expresses it, was "to write pure Latin, to glean little morsels of Roman literature, to talk a heathenish philosophy in private, and to leave the world to its own abuses," had little influence on the next generation in comparison with the wider culture and loftier aims of scholars like Erasmus and Melanchthon. The rapid extension of a knowledge of Greek literature, especially in England, France, and Germany, had its effects in the same direction. Men threw themselves into the new world of thought thus revealed with an eager avidity which left little leisure for that elaborate polishing of periods which had been the delight of the Ciceronianists. The 16th century saw enormous advances in the knowledge of antiquity; but the most learned scholars were by no means always equally famous for their skill in the use of the Latin language. Even in Italy itself the most eminent writers on classical subjects approach rather to the German than the Ciceronian type, and are more distinguished for the width of their erudition and the abundance of their quotations than for elegance or purity of style. On this side of the Alps the prevalence of the same type was, as might have been expected, all but universal. Muretus alone perhaps maintained in this generation the best traditions of style, and was pronounced, even by the judgment of the censorious Scaliger, to have written better Latin than any one since Cicero; in Italy, however, he had a formidable rival in the last of the Ciceronians, Paulus Manutius. It shows how little Latin was now a living language, that the latter, like all his school, refused to speak in Latin, for fear that the necessities of daily conversation should make him familiar with barbarous phrases, which would hardly fail to taint his written style. Others for a similar reason always recited the breviary in Greek, just as in later days some have refused to read the New Testament in the original language for fear of spoiling the purity of their Attic prose. In Germany especially the influence of Lipsius founded a new school of Latinists, based on the imitation of the silver Latinity of Tacitus and Seneca, and conspicuous for some of the merits, and more than all the faults, which have been noticed above as marking those authors. In Britain the only scholar whose style merits especial notice is George Buchanan, whose prose is hardly less admirable than his famous poetical version of the Psalms. On the whole it must be said that, while the improvement in works of reference, and in methods of education generally (especially through the activity of the Jesuits), raises the average of correctness and purity, there is less grace and power than may be found among the best of the writers of an earlier time. As yet the use of Latin as a means of literary expression and of public business showed no signs of decline, except perhaps in Germany, where the version of the Bible by Luther and his popular works in the vernacular had given a model for literary German, and in England, where some of the great works of controversial theology, notably Hooker's *Ecclesiastical Polity*, were already published in English, doing thereby incalculable service to the dignity and the enrichment of the native tongue. But during the 17th century, as a consequence of the steady development of the various national literatures, Latin came to be more and more merely the language of the learned. Some of the most eminent scholars belong to this period; and among them Heinsius, Grotius, Salmasius, and his more illustrious antagonist Milton, are all famous for the elegance of their diction; while Scioppius and Vossius contributed largely to the scientific knowledge of grammar. But towards the end of the century complaints as to the general decay of learning frequently occur. In Germany it was almost extinct. In France the Jesuit colleges maintained the traditions of a pure Latinity with some success, and were noted for the polished though sometimes too rhetorical style in which their exercises were conducted. In England the decay of Latin was never so complete as that of Greek; and the great name of Bentley shines out conspicuous, set off, it must be admitted, by the schoolboy darkness of most of his rivals. Even he did not escape the ferule of the schoolmaster, Richard Johnson of Nottingham, who claims in his *Anti-Aristarchus* to have pointed out more than ninety errors in the great scholar's Latinity. In the 18th century we still find Latin used for works on science and philosophy, which appealed to the learned in all countries; to say nothing of Newton's *Principia* (1689), Burnet's *Theoria Telluris Sacra* (1694), and Ray's *Synopsis Methodica* (1693), and subsequent botanical works, we find even Linnæus in 1760 issuing his *Systema Naturae* in Latin. But as an organ of general literature it may be said to have expired in the course of the 17th century. The last great philosopher who habitually employed Latin for his works was Leibnitz (1646–1716); perhaps the last important work in English theology written in Latin was Bull's *Defensio Fidei Nicenae* (1685).

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[1] The history of Walter Spinelli is, however, enough to show that Italian was already assuming precise and definite shape, to say nothing of the Sicilian and early Florentine poets.

The use of Latin in diplomacy died out towards the end of the 17th century. The Spanish embassy sent to the court of James I. in 1605 used sometimes Latin and sometimes French; the Latin state-papers written by Milton during the Commonwealth are well known; and in the negotiations at Münster (1644) even the French representative, M. d'Avaux, prided himself on his skill in writing Latin. But at Nymegen (1677) the Danish ambassador's claim that the Latin language should be used between the French representative and himself was rejected as an impertinence; and he was obliged to agree that, while he might employ Latin himself, the French should use their own language. At Ryswick, Temple opened the proceedings in French; he was answered by the bishop of Gurk in Latin; but the French envoys pleaded that they had forgotten their Latin, and the subsequent proceedings were conducted in French (*cf.* Bernard's *Lectures on Diplomacy*, pp. 153–155). Long after this date the German empire insisted that all negotiations with it should be conducted in Latin; and, although Joseph II. attempted to make German the official language of Hungary in its place, he was compelled to give way, and it was only in 1825 that Latin was for the first time displaced by Magyar in the debates of the diet (*cf.* vol. xii. p. 371). It is now the universal practice that written communications from any European power should be made in the language of that power, but oral intercourse is carried on in French, with rare exceptions.

Authorities.—For the earliest stage of the Latin language the *Corpus Inscriptionum Latinarum*, vol. i., or Garrucci's *Sylloge Inscriptionum Latinarum*, is indispensable. Wordsworth's *Fragments and Specimens of Early Latin* is very useful. Hübner's *Grundriss zu Vorlesungen über die Lateinische Grammatik* (Berlin, 1880, p. 104) contains a very complete list of all works of value upon the language. Corssen's *Aussprache Vokalismus und Betonung der Lateinischen Sprache* (2 vols., Leipsic, 1870) contains a valuable collection of the evidence as to the history of the pronunciation. Neue's *Formenlehre*) 2 vols., Berlin, 1877) is a complete storehouse of the inflectional forms. Dräger's *Historische Syntax* (2 vols., Leipsic, 1880) is extremely valuable, especially for the classical writers. Kühner's *Ausführliche Grammatik der Lateinischen Sprache* (2 vols., Hanover, 1877–78) is the most complete of recent grammars. In English the best grammars are those of Madvig, Dr. Kennedy, and Mr. Roby The first is excellent in the syntax, and well represents the most complete knowledge of the Latin language in its classical form to be gained without the aid of comparative philology; the second in respect of etymology too frequently adopts not only the facts but the less trustworthy theories of Corssen, while in syntax the full collection of examples is sometimes incumbered by an awkward terminology; the last is equally admirable for the clearness and fulness of its discussion of phonetics, the careful historical treatment of inflections, and the freshness and precision of its syntax. For later Latin and its connection with the Romance languages, Schuchardt's *Vokalismus des vulgärlateins*, Rönsch's *Itala und Vulgata*, and Diez's *Grammaire des Langues Romanes* are the chief text-books. The diction of the most important writers can best be studied in the numerous German treatises and programmes devoted to them severally, most of which will be found mentioned in Dräger's *Syntax* and in Professor Mayor's edition of Hübner's *Guide to Latin Literature*. Bernhardy's *Grundriss der Römischen Litteratur* and Teuffel's *History of Roman Literature* have many useful hints as to the growth of the language. (A. S. W.)

LATIN LITERATURE. See ROME.

LATITUDE. See ASTRONOMY, GEODESY, and GEOGRAPHY (MATHEMATICAL).

LATIUM, in ancient geography, was the name given to the portion of Central Italy which adjoined the Tyrrhenian Sea on the west, and was situated between Etruria and Campania. The name was, however, applied in a very different sense at different times, and the extent of country comprised under this appellation varied materially. Latium originally means the land of the Latini, and in this sense, which is that alone in use historically, it was a tract of comparatively limited extent; but after the overthrow of the Latin confederacy, when the neighboring tribes of the Hernicans, Volscians, and Auruncans, as well as the Latins properly so called, were reduced to the condition of subjects and citizens of Rome, the name of Latium was extended so as to comprise them all, and include the whole country from the Tiber to the Liris. The change thus introduced was not formally established till the reign of Augustus; but it is already recognized by Strabo (v. p. 228), as well as by Pliny, who terms the additional territory thus incorporated Latium Adjectum, while he designates the original Latium, extending from the Tiber to Circeii, as Latium Antiquum. We shall confine ourselves in the first instance to the description of Latium in this limited sense, in which it figures in Roman history from the foundation of the city to the days of Cicero.

I. LATIUM ANTIQUUM. In this original sense Latium was a country of but small extent, and consisted principally of an extensive plain, now known as the Campagna di Roma, bounded towards the interior by the lofty range of the Apennines, which rise very abruptly from the plains at their foot to a height of between 4000 and 5000 feet. Several of the Latin cities, including Tibur and Præneste, were, however, situated on the terrace-like underfalls of these mountains, while Cora, Norba, and Setia were placed in like manner on the slopes of the Volscian mountains or Monti Lepini, a rugged and lofty range, which branches off from the Apennines near Præneste, and forms a continuous mountain barrier from thence to Terracina. In the midst of the plain thus limited rises a group of volcanic mountains, of about 30 miles in circuit, and attaining to a height of over 3000 feet, now commonly known as the Alban hills, though the designation of Albani Montes is not found in any ancient writer. But the highest summit, now called Monte Cavo, on which stood the temple of Jupiter Latiaris, was known as Mons Albanus; while the northeast summit, which almost equalled it in height, bore the name of Mount Algidus, celebrated in all ages for the dark forests of ilex with which it was covered. No volcanic eruptions are known to have taken place in these mountains within the historic period, but the remains of a crater are distinctly seen near the summit of the Mons Albanus, forming the basin known as the Campo di Annibale, while the cup-shaped lakes known as the Alban Lake and the Lake of Nemi unquestionably occupy the basins of similar craters at a lower level on the southern slope of the mountain, and the adjacent Lacus Aricinus, now drained, was another vent of a similar character.

But, besides this distinctly volcanic group, by far the greater part of the plain now called the Campagna di Roma was formed by volcanic deposits, consisting for the most part of the rock called *tufa*, an aggregate of volcanic sand, pebbles, and cinders or scoriæ, varying greatly in hardness and consistency, from a compact rock well adapted for building stone to a loose disintegrating sand known by the local name of *puzzolano*. In a few places only beds of lava are found, the most distinct of which is a continuous stream extending from the foot of the Alban hills to within 2 miles from Rome, along which the line of the Appian Way was carried. These deposits have been formed upon previously existing beds of Tertiary formation, which here and there rise to the surface, and in the Monte Mario, a few miles north of Rome, attain to the height of 400 feet. The surface is by no means an uniform plain, like that of the Terra di Lavoro (the ancient Campania), but is a broad undulating tract, furrowed throughout by numerous depressions, with precipitous banks, serving as water-courses, though rarely traversed by any considerable stream. As the general level of the plain rises gradually, though almost imperceptibly, to the foot of the Apennines, these channels by degrees assume the character of ravines of a formidable description.

Between the volcanic tract of the Campagna and the sea there intervenes a broad strip of sandy plain, evidently formed merely by the accumulation of sand from the sea, and constituting a barren tract, still covered, as it was in ancient times, almost entirely with wood. This long belt of sandy shore extends without a break for a distance of above 30 miles from the mouth of the Tiber to the promontory of Antium (Porto d'Anzo), which is formed by a low but rocky headland, projecting out into the sea, and giving rise to the only considerable angle in this line of coast. Thence again a low sandy shore of similar character extends for about 24 miles to the foot of the Monte Circello, an isolated mountain mass of limestone of about 9 miles in circumference, and rising to a height of 2000 feet. From the almost insulated character of the remarkable promontory, which is united to the Apennines at Terracina by a similar strip of sandy coast, between the Pontine Marshes and the sea, there can be no doubt that it was once an island, which has been gradually united to the mainland by alluvial deposits. But it is certain that these deposits must have commenced long before the historical period, and the assertion strangely ascribed by Pliny to Theophrastus, that the Circeian promontory was in the days of that philosopher still an island, is certainly erroneous. The region of the Pontine Marshes, which occupies almost the whole tract between the sandy belt on the sea-shore and the Volscian mountains, extending from the southern foot of the Alban hills below Velletri to the sea near Terracina, a distance of about 30 miles, is a perfectly level plain, rendered pestilential by the stagnation of numerous streams that descend from the neighboring mountains, and are unable to find their way through this extremely low and level tract, while their outlet to the sea is barred by the sands of the coast between Monte Circello and Terracina.

At the earliest period of which we have any historical record the whole of the country that we have thus described, or Latium in the proper sense of the term, was inhabited by the people known to the Romans as Latini. Of their origin or ethnical affinities we have very little information, except that they belonged to the same branch of the Italian race with the Umbrians, Oscans, and Sabellians (see ITALY). At the same time they constituted, according to the general testimony of ancient writers, a distinct people from their neighbors the Sabines and the Volscians, who held the mountain districts adjoining their territory, as well as (in a much higher degree) from the Etruscans on the other side of the Tiber. There was once, however, a people called the Rutuli, who occupied a small portion of the Latin territory adjoining the sea-coast, and are described as a separate people under their own king,—a tradition familiar to all modern readers from its having been adopted by Virgil. But the name of the Rutuli, as that of an independent people, disappears from history at a very early period, and their capital city of Ardea was certainly one of the thirty cities that in historical times constituted the Latin league. The list of these cities given us by Dionysius of Halicarnassus, which has every appearance of being derived from an authentic document (see Niebuhr's *Roman History*, vol. ii. p. 23), enumerates them as follows;—Ardea, Aricia, Bovillæ, Bubentum, Corniculum, Carventum, Circeii, Corioli, Corbio, Cora, Fortinei (?), Gabii, Laurentum, Lavinium, Labicum, Lanuvium, Nomentum, Norba, Præneste, Pedum, Querquetulum, Satricum, Scaptia, Setia, Tellenæ, Tibur, Tusculum, Toleria, Tricrinum (?), Velitræ.

The list thus given by Dionysius is arranged in an order approximately alphabetical. Omitting the two names which are probably corrupt, and a few of which the site cannot be determined with any certainty, the others may be described according to their geographical arrangement. Laurentum and Lavinium, names so conspicuous in the legendary history of Æneas, were situated in the sandy strip near the sea-coast,—the former only 8 miles east of Ostia, which was from the first merely the port of Rome, and never figured as an independent city. Farther eastward again lay Ardea, the ancient capital of Rutuli, and some distance beyond that Antium, situated on the sea-coast, which, though not in the list of Dionysius, was certainly a Latin city. On the southern underfalls of the Alban mountains, commanding the plain at the foot, stood Lanuvium and Velitræ; Aricia rose on a neighboring hill, and Corioli was probably situated in the plain beneath. The more important city of Tusculum occupied one of the northern summits of the same group; while opposite to it, in a commanding situation on a lofty offshoot of the Apennines, rose Præneste, now Palestrina. Bola and Pedum were in the same neighborhood, Labicum on the slope of the Alban hills below Tusculum, and Corbio on a rocky summit east of the same city. Tibur (Tivoli) occupied a height commanding the outlet of the river Anio. Corniculum, farther west, stood on the summit of one of three conical hills that rise abruptly out of the plain at the distance of a few miles from Monte Gennaro, the nearest of the Apennines, and which were thence known as the Montes Corniculani.

Nomentum was a few miles farther north, between the Apennines and the Tiber, and close to the Sabine frontier. The boundary between the two nations was indeed in this part very fluctuating. Nearly in the centre of the plain of the Campagna stood Gabii; Bovillæ was also in the plain, but close to the Appian Way, where it begins to ascend the Alban hills. Several other cities—Tellenæ, Scaptia, and Querquetulum—mentioned in the list of Dionysius were probably situated in the Campagna, but their site cannot be determined. Satricum, on the other hand, was south of the Alban hills, apparently between Velitræ and Antium; while Cora, Norba, and Setia (all of which retain their ancient names with little modification) crowned the rocky heights which form advanced posts from the Volscian mountains towards the Pontine Marshes.

It must be borne in mind that the list given by Dionysius belonged to a date about 490 B.C., and a considerable number of the Latin cities had before that time either been utterly destroyed or reduced to subjection by Rome, and had thus lost their independent existence. Such were Antemnæ and Cœnina, both of them situated within a few miles of Rome, and the conquest of which was ascribed to Romulus; Fidenæ, about 5 miles north of the city, and close to the Tiber; and Crustumerium, in the hilly tract farther north towards the Sabine frontier. Pometia also, on the borders of the Pontine Marshes, to which it was said to have given name, was a city of importance, the destruction of which was ascribed to Tarquinius Superbus. But by far the most important of these extinct cities was Alba, on the lake to which it gave its name, which was, according to the tradition universally received, the parent of Rome, as well as of numerous other cities within the limits of Latium, including Gabii, Fidenæ, Collatia, Nomentum, and other well-known towns. Whether or not this tradition deserves to rank as historical, it appears certain that at an early period there existed a confederacy of thirty towns, of which Alba was the supreme head. A list of these is given us by Pliny (iii. 5, 968) under the name of "populi Albenses," which includes only six of those found in the list of Dionysius; and these for the most part among the more obscure and least known of the names there given; while the more powerful cities of Aricia, Lanuvium, and Tusculum, though situated immediately on the Alban hills, are not included, and appear to have maintained a wholly independent position. This earlier league was doubtless broken up by the fall of Alba; it was probably the increasing power of the Volsci and Æqui that led to the formation of the later league, including all the more powerful cities of Latium, as well as to the alliance concluded by them with the Romans in the consulship of Sp. Cassius (493 B. C.).

The cities of the Latin league continued to hold general meetings or assemblies from time to time at the Grove of Ferentina, a sanctuary at the foot of the Alban hills in a valley below Marino, while they had also a common place of worship on the summit of the Alban Mount (the Monte Cavo), where stood the celebrated temple of Jupiter Latiaris. The participation in the annual sacrifices at this sanctuary was regarded as typical of a Latin city; and they continued to be celebrated long after the Latins had lost their independence and been incorporated in the Roman state. This change took place in 338 B. C. During the centuries that followed down to the end of the Roman republic many of the Latin towns sank into a very decayed condition. Cicero speaks of Gabii, Labicum, and Bovillæ as places that had fallen into abject poverty, while Horace refers to Gabii and Fidenæ as mere "deserted villages." Many of the smaller places mentioned in the list of Dionysius, or the early wars of the Romans, had altogether ceased to exist, but the statement of Pliny that fifty-three communities (*populi*) had thus perished within the boundaries of Old Latium is certainly exaggerated, and his list of the "illustrious cities" (*clara oppida*) that had thus disappeared is very confused and unintelligible. Still more erroneous is his statement that there were once twenty-four cities on the site occupied in his time by the Pontine Marshes,—an assertion not confirmed by any other authority, and utterly at variance with the physical conditions of the tract in question.

II. LATIUM NOVUM or ADJECTUM, as it is termed by Pliny, comprised the territories occupied in earlier times by the Volscians, Hernicans, and Auruncans. It was for the most part a rugged and mountainous country, extending at the back of Latium proper, from the frontier of the Sabines to the sea-coast between Terracina and Sinuessa. But it was not separated from the adjacent territories by any natural frontier or physical boundaries, and it is only by the enumeration of the towns in Pliny according to the division of Italy by Augustus that we can determine its limits. It included the upper valley of the Anio, with the towns of Sublaqueum and Treba; the Hernican cities of Anagnia, Ferentinum, Alatrium, and Verulæ—a group of mountain strongholds on the north side of the valley of the Trerus or Sacco, together with the Volscian cities on the south of the same valley, and in that of Liris, the whole of which, with the exception of its extreme upper end, was included in the Volscian territory. Here were situated Signia, Frusino, Fabrateria, Fregellæ, Sora, Arpinum, Atina, Aquinum, Casinum, and Interamna; Anxur, or Tarracina, was the only seaport that properly belonged to the Volscians, the coast from thence to the mouth of the Liris being included in the territory of the Auruncans, or Ausonians as they were termed by Greek writers, who possessed the maritime towns of Fundi, Formiæ, Caieta, and Minturnæ, together with Suessa in the interior, which had replaced their more ancient capital of Aurunca. Sinuessa, on the sea-coast between the Liris (Garigliano) and the Vulturnus, was the last town in Latium according to the official use of the term.

Though the Apennines comprised within the boundaries of Latium do not rise to a height approaching that of the loftiest summits of the central range, they attain to a considerable altitude, and form steep and rugged mountain masses from 4000 to 5000 feet high. They are traversed by three principal valleys:—(1) that of the Anio, now called Teverone, which descends from above Subiaco to Tivoli, where it enters the plain of the Campagna; (2) that of the Trerus or Sacco, which has its source below Palestrina (Præneste), and flows through a comparatively broad valley that separates the main mass of the Apennines from the Volscian mountains or Monti Lepini, till it joins the Liris below Ceprano; (3) that of the Liris or Garigliano, which enters the confines of New Latium about 20 miles from its source, flows under the walls of Sora, and has a very tortuous course from thence to the sea at Minturnæ; its lower valley is for the most part of considerable width, and forms a fertile tract of considerable extent, bordered on both sides by hills covered with vines, olives, and fruit trees, and thickly studded with towns and villages.

It may be observed that, long after the Latins ceased to exist as a separate people, we meet in Roman writers with the phrase of "nomen Latinum," used not in an ethnical but a purely political sense, to designate the inhabitants of all those cities on which the Romans had conferred "Latin rights" (*jus Latinum*),—an inferior form of the Roman franchise, which had been granted in the first instance to certain cities of the Latins, when they became subjects of Rome, and was afterwards bestowed upon many other cities of Italy, especially the so-called Latin colonies. At a later period the same privileges were extended to places in other countries also,—as for instance to most of the cities in Sicily and Spain. All persons enjoying these rights were termed in legal phraseology "Latini" or "Latinæ conditionis."

For the topography of Latium, and the local history of its more important cities, the reader may consult Sir W. Gell's *Topography of Rome and its Vicinity*, 2 vols. 8vo., Lond., 1834, 2d ed., 1 vol., 1846, with a valuable map; Nibby, *Analisi Storico-Topografico-Antiquaria della Carta dei Dintorni di Roma*, 3 vols. 8vo, 1837, 2d ed. 1848; Westphal, *Die Römische Kampagne*, 4to, Berlin, 1829; Bormann, *Alt-Latinische Chorographie und Städte-Geschichte*, 8vo, Halle, 1852; Burn's *Rome and the Campagna*, 4to, Lond., 1871; Hare's *Walks around Rome*, 2 vols. 8vo, Lond., 1873. An elaborate antiquarian map of Old Latium has been long in preparation by the Cavaliere De Rossi, but has not yet made its appearance. (E. H. B.)

LATONA is the Latin name of the Greek Leto, mother of Apollo and Artemis. In Greece she belongs rather to the sphere of mythology than that of religion; she forms part of the surroundings of these two great deities, but is not usually a goddess to whom worship is paid or temples built. Different forms of the Latona legend are found in the various seats of Apolline religion. Of these seats the chief are Delos and Delphi, and the tradition which has obtained the widest literary currency is a union of the legends of these two places, formed doubtless under the unifying influence of the Delphic oracle. Latona, pregnant by Zeus, long seeks in vain for a place of refuge to be delivered. She wanders from Crete over Athens, the coasts of Thrace and Asia Minor, and the islands; at last the barren desolate isle of Delos offers itself. Pindar and later poets tell that Delos was a wandering rock borne about by the waves, till it was fixed to the bottom of the sea to serve for the birth of Apollo. Hence arose the belief that Delos could not be shaken by earthquakes,—a belief that was disproved by several shocks in historical times (Herod., vi. 98; Plin., iv. 66). In the oldest forms of the legend Hera is not mentioned; but afterwards the wanderings of Leto are ascribed to the jealousy of Hera, enraged at her amour with Zeus. In the legend the foundation of Delphi follows immediately on the birth of the god; and on the sacred way between Tempe and Delphi the giant Tityus offers violence to Leto, and is immediately slain by the arrows of Apollo and Artemis. Such are the main facts of the Leto legend in its common literary form, which is due especially to the two Homeric hymns to Apollo. We must turn from mythology to actual religion in order to discover the true character of the myth. Then we shall find that Leto is a real goddess, and not a mere mythological figure. The honor paid to her in Delphi and Delos might be explained as part of the cultus of her son Apollo; but temples to her existed in Argos, in Mantinea, and in Xanthus of Lycia; her sacred grove was on the coast of Crete. In Lycia graves are frequently placed under her protection (see *Corpus Inscr. Græc.*, No. 4259, 4300, 4303, etc.); and she is also known as a goddess of fertility and as κουροτρόφος. In these attributes we recognise the earth-goddess. Now, although in the common legends Apollo and Artemis are called the twin children of Leto, yet she appears far more conspicuously in the Apolline myths than in those which grew round the great centres of Artemis worship; moreover, in the older forms of the Apolline myths Artemis is hardly mentioned except as an after-thought, and the Homeric hymn makes them born in different places (τὴν μὲν ἐν Ὀρτυγίῃ, τὸν δὲ κραναῇ ἐνὶ Δήλῳ). Facts such as these will be readily explained if one recognizes that the idea of Apollo and Artemis as twins is one of later growth on Greek soil, and that the two religions come from different origins in Asia Minor. Again Lycia, one of the chief homes of the Apolline religion, is precisely the country where most frequent traces are found of the worship of Leto as the great goddess. Etymological considerations point in the same direction. The Greeks always connected the word Leto with the root seen in λανθάνω, λήθη, etc.; but it is more probable that the resemblance is delusive, and that the origin is to be found in words which are not so distinctively Greek. Leto and Leda are both probably forms of the Lycian word *Lada*, which means woman or lady; and the island of Lade or Late (Plin., v. 35), the town Lete, the rivers Ladon and Lethæus, were all named from the goddess.

It is clear then that Latona or Leto was the great goddess of a religion which found its way into Greece, where its mythology was harmonized to a certain extent with that of the other religious systems of the country. Everything points to Lycia as the earlier home of this religion. Zeus, by whatever name he was called, and Leto are heaven and earth; their offspring is Apollo, the ever young god of light and of the sun, born afresh every spring. The myth is the same that occurs over and over again with different names in every district of Greece and Asia Minor. But in Greece Hera was recognized as the supreme consort of Zeus, and Latona could only rank with many other goddesses of antique religions as his concubine; though even in Greece the oldest forms of the tradition recognize her as the goddess-consort, κυδρὴ παρακοιτίς, of Zeus. Sappho calls her and Niobe "loving companions." The father of Leto, Cœus, must be a god in the almost forgotten religion to which she belongs.

In Greek art Leto appears usually in company with her children; in vase paintings especially she is often represented with Apollo and Artemis. The statue of Leto in the Letoon at Argos was the work of Praxiteles.

See *Matth. Inst. Ath.*, i. 168; Hesiod, *Theog.*, 134; Conze, *Reisen auf den Griech. Inseln*, p. 91.

LATREILLE, PIERRE-ANDRÉ (1762–1833), French naturalist, was born in humble circumstances at Brives-la-Gaillarde, now in the department of Corrèze, France, on November 29, 1762. His abilities attracted the attention of the Baron d'Espagnac, who in 1778 placed him at the Collége Lemoine at Paris, where the Abbé Haüy was at that time a teacher. Having chosen the ecclesiastical career, he was admitted to priestly orders in 1786, and in the same year retired to Brives, devoting all the leisure which the discharge of his professional duties allowed to the study of entomology. In 1788 he returned to Paris and found means of making himself known to the leading naturalists there,—Fabricius, Olivier, Bosc, Lamarck; his first important contribution to his special science, a "Mémoire sur les Mutilles découvertes en France," contributed to the *Proceedings of the Society of Natural History in Paris*, procured for him the honor of admission to that body, and of being made a corresponding member of the Linnean Society of London. At the Revolution he was compelled to quit Paris, and as a priest of conservative sympathies suffered considerable hardship; he lay for some time in prison at Bordeaux, and gained his liberty at last only through the intervention of the naturalists Bory de Saint-Vincent and Dargelas. His *Précis des Caractères génériques des insectes, disposés dans un ordre naturel*, appeared at Brives in 1796. In 1798 he became a corresponding member of the Institute, and at the same time was intrusted with the task of arranging the entomological collection at the recently organized "Muséum d'Histoire Naturelle" (Jardin des Plantes); in 1814 he succeeded Olivier as member of the Académie des Sciences, and in 1821 he was made a chevalier of the Legion of Honor. For some time he acted as professor of zoology in the veterinary school at Alfort near Paris, and in 1830, when the chair of zoology of invertebrates at the Muséum was divided after the death of Lamarck, Latreille was appointed professor of zoology of crustaceans, arachnids, and insects, that of molluscs, worms, and zoophytes being assigned to De Blainville. "On me donne du pain quand je n'ai plus de dents," said Latreille, who was then in his sixty-eighth year. He died on February 6, 1833.

In addition to the works already mentioned, the numerous works of Latreille include—*Histoire naturelle générale et particulière des Crustacés et Insectes* (14 vols., 1802–5), forming part of Sonnini's edition of Buffon; *Genera Crustaceorum et Insectorum, secundum ordinem naturalem in familias disposita*, 4 vols.,1806–7: *Considérations générales sur l'ordre naturel des animaux composant les classes des Crustacés, des Arachnides, et des Insectes*, 1810; *Familles naturelles du règne animal, exposées succinctement et dans un ordre analytique*, 1825; *Cours d'Entomologie* (of which only the first volume appeared, 1831); the whole of the section "Crustacés, Arachnides, Insectes," in Cuvier's *Règne Animal;* besides many papers in the *Annales du Muséum*, the *Encyclopédie Methodique*, the *Dictionnaire Classique d'Histoire Naturelle*, and elsewhere.

LAUBAN, chief town of a circle of the same name in the government of Liegnitz and province of Prussian Silesia, is situated in a picturesque valley, at the immetion of the lines of railway from Görlitz and Sorau, 39 miles west-southwest from Liegnitz, in 51° 7′ N. lat., 15° 17′ E. long. Lauban is the seat of a chamber of commerce, and has a Roman Catholic and three Lutheran churches, a conventual house of the order of S. Magadelene, dating from the 14th century, a municipal library and museum, two hospitals, an orphanage, a gymnasium, and a collegiate institute for girls. The industrial establishments comprise tobacco, yarn, thread, and linen and woollen cloth manufactories, bleaching, calendering, and dyeing works, a bell-foundry, tile-kilns, breweries, and oil and flour mills. In 1880 the population was 10,779.

Lauban was founded in the 10th and fortified in the 13th century; in 1427 and 1431 it was devastated by the Hussites, and in 1640 by the Swedes. In 1761 it was the headquarters of Frederick the Great. In 1815 it was the last Saxon town that made its submission to Prussia.

LAUD, William (1573–1644), archbishop of Canterbury, was born at Reading on October 7, 1573. In 1590 he became a scholar of St. John's, Oxford, and a fellow in 1593. In 1601 he entered the ministry of the church. In 1605 he married the earl of Devonshire to the divorced Lady Rich, an act which he never ceased to regret. In 1611 he became president of St. John's. His career at Oxford brought him into collision with the authorities of the university. He was one of those who were revolted by the Calvinistic Puritanism which prevailed, and he upheld, in a sharp irritating way, the doctrines on the divine right of Episcopacy, and of the permanent existence of the church during the Middle Ages, which was regarded as rank heresy by the Puritans. In 1616 he was appointed to the deanery of Gloucester, and, with the king's approbation, removed the communion table in the cathedral to the east end. In 1621 James made him bishop of St. David's, though, if a commonly received story is to be believed, he entertained grave doubts whether Laud would exercise the episcopal authority with wisdom. In 1622 the new bishop took part in a controversy with Fisher the Jesuit, on the claims of the Papal Church. His argument, which was afterwards published, was not only a serious contribution to controversial literature, but marks a distinct advance in the direction which was afterwards taken by Chillingworth.

The controversy with Fisher had been entered on in order to save Buckingham's mother from conversion to the Church of Rome. It failed in this object, but it gained for Laud considerable influence over Buckingham himself, and through Buckingham over Prince Charles, who when he became king in 1625 was attracted to an ecclesiastical adviser whose opinions so closely resembled his own, and whose firmness of character supplied a contrast to the irresoluteness of which he could scarcely be unconscious. During the first years of the reign Laud was frequently consulted in matters relating to the church. He is found favoring the promotion of anti-Puritan divines, approving Montague's *Appello Cæsarem*, and generally throwing his weight into the scale against the assumption of the House of Commons to lay down the law in politics and religion.

In 1628 Laud was made bishop of London, and when the ecclesiastical controversy came to a head in the session of 1629, his biography became identified, till the meeting of the Long Parliament, with the history of the Church of England.

Intellectually Laud's position was that of a man opposed to the dogmatism of the Calvinists. "The wisdom of the church," he wrote, "hath been in all ages, or the most, to require consent to articles in general as much as may be, because that is the way of unity, and the church in high points requiring assent to particulars hath been rent." Laud's love of peace unhappily led him to shrink from the free exuberance of spiritual life. Perhaps it could hardly be expected, in an age when each ecclesiastical party was longing to persecute all others, that any man placed in authority should think it possible to allow the struggling parties to grow up side by side, in what must have seemed the vain hope that liberty would bring a larger harmony. Laud, at least, had no conception of the kind. He was by nature a lover of order and discipline, devoid of the higher spiritual enthusiasm or breadth of judgment which characterizes the highest order of intellect. He spoke of Aristotle, the philosopher who lays such stress on the formation of habits, as his great master *in humanis*. All Laud's work in life was to attempt to form habits, to make men learn to be decent by acting decently, and to be religious by acting religiously. "Since I came to this place," he said of himself, "I labored nothing more than that the external public worship of God—too much slighted in most parts of this kingdom—might be preserved, and that with as much decency and uniformity as might be, being still of opinion that unity cannot long continue in the church when uniformity is shut out at the church doors. And I evidently saw that the public neglect of God's service in the outward face of it, and the nasty lying of many places dedicated to that service, had almost cast a damp upon the true and inward worship of God,—which, while we live in the body, needs external helps, and all little enough to keep it in any vigor."

Upon these principles he acted, more especially after his promotion in 1633 to the archbishopric of Canterbury. His metropolitical visitation of the province enforced his system of uniformity in every parish contained in it. He had no sympathy with the special doctrines of the Papal Church, still less with its ceremonial; but he held that conformity to the prayer book was to be the universal rule. He gave great offence to the Puritans by insisting upon the removal of the communion table to the east end of the church, while the communicants were to receive the sacrament on their knees. For this and for the enforcement of other observances he was stigmatized as an innovator, but he repelled the charge in the speech which he delivered at the trial in the Star Chamber of Prynne, Bastwick, and Burton in 1637, declaring that the Puritan usages were themselves innovations on the practice inculcated at the Reformation.

Nor did Laud confine himself to imposing ceremonies upon the clergy. The church courts undertook in those days to reform the morals of the laity, and Laud excited much ill-feeling by insisting that the powerful and the wealthy should submit to punishment as well as the poor. As a privy councillor he took part in affairs of state, and upon the death of Portland in 1635 he became a commissioner of the treasury till he procured for Bishop Juxon the appointment of lord treasurer in 1637. The advice which he gave to the king with respect to the introduction of a new prayer book into Scotland proved ultimately fatal to him. Of this prayer book, in the amendment of which he had had a considerable share, he was not unnaturally regarded as the author; and, when in 1640 the Scots triumphantly occupied the northern counties, and sent commissioners to London to negotiate a peace, they called for the punishment of the archbishop as the great incendiary. One of the first acts of the Commons after the meeting of the Long Parliament was to impeach him. For some time he remained in prison, apparently overlooked. But in 1643 there was fresh need of conciliating the Scots, and his impeachment was proceeded with. He made an able and in many respects a satisfactory defence, but his condemnation was a foregone conclusion, and he was executed on January 10, 1644, at the age of seventy-two.

The best source of the biography of Laud is to be found in his own *Works*, edited by Dr. Bliss, in the Anglo-Catholic Library. The adverse view of his character will be found in Prynne's *Canterbury's Doom*. (S. R. G.)

LAUDANUM. See Opium.

LAUDER, SIR THOMAS DICK, BART. (1784–1848), was the only son of Sir Andrew Lauder, the sixth baronet, and was born at Edinburgh in 1784. He succeeded to the baronetcy in 1820. In early life he published two romances, *Lochandhu* and the *Wolf of Badenoch*; and such were the merits of his style that his first contribution to *Blackwood's Magazine*, in 1817, entitled "Simon Roy, Gardener at Dunphail," was by some ascribed to the author of *Waverley*. He was afterwards a frequent contributor to *Blackwood* and also to *Tait's Magazine*, and in 1830 he published the book by which his name is now best known, *An Account of the Great Floods of August*, 1829, *in the Province of Moray and adjoining Districts*. Subsequent works were *Highland Rambles, with Long Tales to shorten the Way* (2 vols. 8vo., 1837), *Legendary Tales of the Highlands* (3 vols. 12mo., 1841), *Tour Round the Coasts of Scotland*, and *Memorial of the Royal Progress in Scotland* (1843). Lauder's paper on "The Parallel Roads of Glenroy," printed in vol. ix. of the *Transactions of the Royal Society of Edinburgh*, first drew attention to the phenomenon in question. Vol. i. of a *Miscellany of Natural History*, published in 1833, was also partly prepared by Lauder. He died on May 29, 1848. An unfinished series of papers, written for *Tait's Magazine* shortly before his death, was published under the title *Scottish Rivers*, with a preface by John Brown, M.D., in 1874.

LAUENBURG, formerly a duchy belonging with Holstein to Denmark, but from 1865 to Prussia, was in July, 1876, incorporated as a circle in the Prussian province of Schleswig-Holstein. It lies on the right bank of the Elbe, between 53° 21′ and 53° 48′ N. lat., 10° 13′ and 11° 3′ E. long., is bounded by the territories of Hamburg, Lübeck, and Mecklenburg, the province of Hanover, and the circle of Oldesloe, and comprises an area of 453 square miles. The surface of the country is a slightly undulating plain. The soil, chiefly alluvial, though in some places arenaceous, is generally fertile and well cultivated, but a great portion is covered with forests, and interspersed with lakes. By means of the Stecknitz Canal, the Elbe, the principal river, is connected with the Trave. The chief agricultural products of the circle are timber, fruit, grain, hemp, flax, and vegetables. Cattle-breeding affords employment for many of the inhabitants. The railroad from Hamburg to Berlin traverses the country. The judicial administration is divided among five courts of law, over which is a superior court for the whole circle, the supreme court of appeal being at Berlin. The capital is Ratzeburg, and there are two other towns, Mölln and Lauenburg. In 1880 the population amounted to 49,185, Low Saxons by descent, and with few exceptions Lutherans by confession.

The earlier inhabitants of Lauenburg were a Slavic tribe known by the name of Polabes (*i.e.*, dwellers on the Elbe; Slavic, *Leba*). They were gradually replaced by colonists from Lower Saxony, and about the middle of the 12th century the country was conquered by Henry the Lion, and thus came under the yoke of the dukes of Saxony. Lauenburg subsequently passed into the hands of Valdemar II. of Denmark, but, having in 1227 reverted to the Saxons, it remained in their possession for over four hundred years,—from 1260, however, in the separate line of Saxe-Lauenburg. After the death of Duke Julius Francis in 1689, the line of succession having become extinct, the emperor ordered the sequestration of the duchy, but Duke George William of Brunswick-Luneburg-Celle forcibly occupied it, paid a money indemnity to Saxony, and was recognized by the inhabitants (15th September, 1702). Upon his death, in 1705, Lauenburg fell to his nephew, George I., elector of Hanover, and afterwards king of England, whose claim was eventually recognized, in 1728, by imperial decree. In 1806 Lauenburg was occupied by the French, and in 1810 it was incorporated with the department of Bouches de l'Elbe. After the battle of Leipsic, in 1813, it reverted to Hanover, and on the 29th May, 1815, was ceded to Prussia, which on the 4th of June transferred it to Denmark. After the death of Frederick VII. of Denmark (1863) there were various claimants to the duchy, but at the peace of Vienna (30th October, 1864) it was ceded by Christian IX. of Denmark to Austria and Prussia. By the convention of Gastein (14th August, 1865) Austria surrendered her claims to Prussia upon the payment of 2,500,000 Danish thalers (about £280,000). On the 15th of September William I. of Prussia took formal possession of the duchy, but it still retained its constitution and special privileges, and was not consolidated and incorporated with the kingdom of Prussia until the 1st of July, 1876.

LAUNCESTON, a municipal and parliamentary borough and market-town of England, in the eastern division of the county of Cornwall, is situated on a branch railway line from Plymouth, on an eminence near the Kinsey, an affluent of the Tamar, 213 miles west-southwest from London. The streets are narrow and irregular, but of late years have been considerably improved. The parish church, dedicated to St. Mary Magdalene, and built of curiously carved blocks of granite, was erected in the beginning of the 16th century, but possesses a detached tower of the date 1380. There are important remains of the old castle, which was the ancient seat of the earls of Cornwall, and was frequently besieged during the wars of Charles I. For the grammar school originally established in the reign of Edward VI. a new building was erected in 1862. The trade of the town is chiefly in agricultural produce. The population of the municipal borough (area 1504 acres) increased between 1871 and 1881 from 2935 to 3217, and that of the parliamentary borough (area 14,707 acres) from 5468 to 5675.

The ancient name of Launceston was *Dunnecheved*, the swelling hill. The name Launceston, originally *Lanstephen*, is derived from an old monastery dedicated to St. Stephen. From the time of the Conqueror the place has belonged to the earls of Cornwall. It was made a free borough in the reign of Henry III., and received a charter of incorporation from Queen Mary in 1555. From 1294 it returned two members to parliament until 1832, when it was deprived of one of its members, and the disfranchised borough of Newport, comprising the parish of St. Stephens, was included in its boundaries. The assizes of the county were transferred to Bodmin in 1838.

LAUNCESTON, the second town of Tasmania, is situated in the north of the island, at the point where the North and South Esk unite to form the river Tamar. It is the northern terminus of the railway from Hobart Town (120 miles distant), and has regular communication by steamer with Melbourne. Among the places of note are the Government buildings, the town-hall, a theatre, two hospitals, a public library, and a convent of the Presentation Order. The population was 10,100 in 1847, 10,668 in 1870, and 12,753 in 1881. Launceston began to be an important settlement not long after the first colonization of Tasmania. St. John's Church (Episcopal) dates from 1824. The town was incorporated in 1858.

LAUREATE. See ROYAL HOUSEHOLD.

LAUREL. There are at least four shrubs or small trees which are called by this name in Great Britain, viz., the common or cherry laurel (*Cerasus Laurocerasus*, Lois.), the Portugal laurel (*C. lusitanica*, Lois.), the bay or sweet laurel (*Laurus nobilis*, L.), and the spurge laurel (*Daphne Laureola*, L.). The first two belong to the rose family (*Rosaceæ*), and are regarded by Bentham and Hooker as a subgenus of *Prunus*, L. (*Genera Plantarum*, i. p. 610), to which genus Linnæus referred them.

The common laurel is a native of the woody and subalpine regions of the Caucasus, of the mountains of Northern Persia, of Northwestern Asia Minor, and of the Crimea. It was received into Europe in 1576 (De Candolle, *Prod.*, ii. p. 540), and flowered for the first time in 1583. Ray in 1688 relates that it was first brought from Trebizonde to Constantinople, thence to Italy, France, Germany, and England. Parkinson in his *Paradisus* records it as growing in a garden at Highgate in 1629; and in Johnson's edition of Gerard's *Herbal*, published in 1633, it is recorded that the plant "is now got into many of our choice English gardens, where it is well respected for the beauty of the leaues and their lasting or continuall greennesse" (see Loudon's *Arboretum*, ii. p. 717). The leaves of this plant are rather large, broadly lance-shaped, and of a leathery consistence, the margin being somewhat serrated. They are remarkable for their poisonous properties, giving off the odor of bitter almonds when bruised; the vapor thus issuing is sufficient to kill small insects. Cherry laurel water is a solution of the volatile oil. The leaves when cut up finely and distilled yield the oil of bitter almonds and hydrocyanic (prussic) acid. Sweetmeats, custards, cream, etc., are often flavored with laurel-leaf water, as it imparts the same flavor as bitter almonds; but it should be used sparingly, as it is a dangerous poison, having several times proved fatal. The first case occurred in 1731, which induced a careful investigation to be made of its nature, which was discovered by Schrader in 1802 to be hydrocyanic acid. The effects of the distilled laurel-leaf water on living vegetables is to destroy them like ordinary prussic acid; while a few drops act on animals as a powerful poison. It was introduced into the British pharmacopœia in 1839, but is more generally superseded by the use of hydrocyanic acid. The following varieties of the common laurel are in cultivation:—the Caucasian (*Prunus Laurocerasus caucasica*), which is hardier and bears very rich dark-green glossy foliage; the Versailles laurel (*P. L. latifolia*), which has larger leaves; the Colchican (*P. L. colchica*), which is a dwarf-spreading bush with narrow sharply serrated pale green leaves. There is also the variety *rotundifolia* with short broad leaves, the Grecian with narrow leaves, and the Alexandrian with very small leaves. See Hemsley's *Handbook of Hardy Trees*, etc., p. 141.

The Portugal laurel is believed to be a native of Portugal and Madeira. This tree, together with a variety called *Hixa*, Ser., which bears larger leaves and has the flowers more loosely disposed, were found growing together in 1827 on the Serra de Gerez in Portugal, the former being 20 feet high while the latter attained to 70 feet. It was introduced into England about the year 1648, when it was cultivated in the Oxford Botanic Gardens. During the first half of the 18th century this plant, the common laurel, and the holly were almost the only hardy evergreen shrubs procurable in British nurseries. They are all three tender about Paris, and consequently much less seen in the neighborhood of that city than in England, where they stand the ordinary winters but not very severe ones. There is a variety (*myrtifolia*) of compact habit with smaller narrow leaves, a variegated variety, and one of recent introduction (*azorica*), probably not so hardy as the Continental form. See *Handbook of Hardy Trees*, etc., p. 141.

The evergreen glossy foliage of the common and Portugal laurels render them well adapted for shrubberies, while the racemes of white flowers are not devoid of beauty. The former often ripens its insipid drupes, but the Portugal rarely does so. It appears to be less able to accommodate itself to the English climate, as the wood does not usually "ripen" so satisfactorily. Hence it is rather more liable to be cut by the frost. According to Prof. A. Gray neither the common nor the Portugal laurel stands either the summer or the winter climate of the United States.

The bay or sweet laurel (*Laurus nobilis*, L.), belongs to the family *Lauraceæ*, which contains sassafras, benzoin, camphor, and other trees remarkable for their aromatic properties. It is a large evergreen shrub, sometimes reaching the height of 60 feet, but rarely assuming a truly tree-like character. The leaves are smaller than those of the preceding laurels, possessing an aromatic and slightly bitter flavor, and are quite devoid of the poisonous properties of the cherry laurel. The small yellowish-green flowers are produced in axillary clusters, and consist of a calyx only, which incloses nine stamens in the male, the anthers of which dehisce by valves which lift upwards as in the common barberry, and carry glandular processes at the base of the filament. The fruit consists of a succulent berry surrounded by the persistent base of the calyx. The bay laurel is a native of Italy, Greece, and North Africa, and is abundantly grown in the British Isles as an evergreen shrub, as it stands most winters. The date of its introduction is unknown, but must have been previous to 1562, as it is mentioned in Turner's *Herbal*, published in that year. A full description also occurs in Gerard's *Herbal*, 1597, p. 1222. It was used for strewing the floors of houses of distinguished persons in the reign of Elizabeth. Several varieties have been cultivated, differing in the character of their foliage, as the *undulata* or wave-leafed, *salicifolia* or willow-leafed, the variegated, the broad-leafed, and the curled; there is also the double-flowered variety. The bay laurel was carried to North America by the early colonists, but, like the others, apparently does not thrive there.

This laurel is generally held to be the *Daphne* of the ancients, though at least Dr. Lindley, following Gerard (*Herbal*, 1795, p. 761), asserts that the Greek *Daphne* was *Ruscus racemosus*. Among the Greeks the laurel was sacred to Apollo, especially in connection with Tempe, in whose laurel groves the god himself obtained purification from the blood of the Python. This legend was dramatically represented at the Pythian festival once in eight years, a boy fleeing from Delphi to Tempe, and after a time being led back with song, crowned and adorned with laurel. Similar *δαφνηφορίαι* were known elsewhere in Greece. Apollo, himself purified, was the author of purification and atonement to other penitents, and the laurel was the symbol of this power, which came to be generally associated with his person and sanctuaries. The relation of Apollo to the laurel was expressed in the legend of DAPHNE (*q. v.*). The victors in the Pythian games were crowned with the laurels of Apollo, and thus the laurel became the symbol of triumph in Rome as well as in Greece. As Apollo was the god of poets, the *Laurea Apollinaris* naturally belonged to poetic merit, and so we still have a poet-laureate. The various prerogatives of the laurel among the ancients are collected by Pliny (*Hist. Nat.*, xv. 30). It was a sign of truce, like the olive branch; letters announcing victory and the arms of the victorious soldiery were garnished with it; it was thought that lightning could not strike it, and the emperor Tiberius always wore a laurel wreath during thunder-storms.[1] From its association with the divine power of purification and protection, it was often set before the door of Greek houses, and among the Romans it was the guardian of the gates of the Cæsars (Ovid, *Met.*, i. 562 *sq.*). The laurel worn by Augustus and his successors had a miraculous history: the laurel grove at the imperial villa by the ninth milestone on the Flaminian way sprang from a shoot sent from heaven to Livia Drusilla (Sueton., *Galba*, i.). Like the olive, the laurel was forbidden to profane use. It was employed in divination; the crackling of its leaves in the sacred flame was a good omen (Tibull., ii. 5, 81), and their silence unlucky (Propert., ii. 21); and the leaves when chewed excited a prophetic afflatus (*δαφνηφάγοι*, comp. Tibull., *ut supra*, line 63). There is a poem enumerating the ancient virtues of the laurel by J. Passeratius, 1594.

The last of the plants mentioned above under the name of laurel is the so-called spurge laurel (*Daphne Laureola*, L.). This and one other species (*D. Mezereum*, L.), the mezereon, are the sole representatives of the family *Thymelaceæ* in Great Britain. The spurge laurel is a small evergreen shrub, with alternate somewhat lanceolate leaves with entire margins. The green flowers are produced in early spring, and form drooping clusters at the base of the leaves. The calyx is four-cleft, and carries eight stamens in two circles of four each within the tube. The pistil forms a berry, green at first, but finally black. DeCandolle says they are poisonous to all animals except singing birds. The mezereon differs from it in blossoming before the leaves are produced, while the flowers are lilac instead of green. The bark furnishes the drug *Cortex Mezerei*, for which that of the spurge laurel is often substituted.

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[1] A similar superstition still exists among the peasants of the Pyrenées.

Both are powerfully acrid, but the latter is less so than the bark of mezereon. It is now only used as an ingredient of the compound decoction of sarsaparilla (*Pharmacographia*, p. 487). Of other species in cultivation there are *D. Fortunei* from China, which has lilac flowers; *D. pontica*, a native of Asia Minor; *D. alpina*, from the Italian alps; *D. collina*, South European; and *D. Cneorum*, the garland flower or trailing daphne, the handsomest of the hardy species. See Hamsley's *Handbook of Hardy Trees*, etc., p. 394; Loudon's *Arboretum*, iii. p. 1307 *sq.* (G. H.)

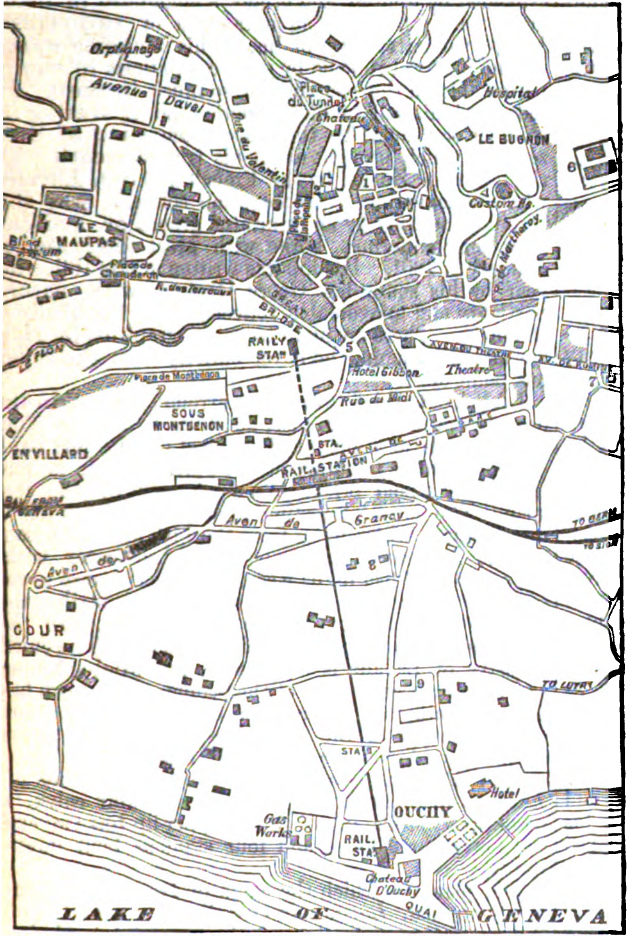
LAURENS, HENRY (1724–1792), American statesman, was born at Charleston, South Carolina, in 1724, of Huguenot ancestry. After receiving a good education, he entered a counting-house in London by way of preparation for commercial pursuits, in which he engaged, after his return to Charleston, with such success as to amass rapidly a large fortune. He accepted ardently the advanced views of individual rights then prevalent in the colony, and was several times engaged in stubborn contests with the crown judges, in which he resisted their alleged arbitrary and oppressive rulings, not only by all legal means at his command, but in occasional pamphlets, the vigor and legal acumen of which attracted much attention. He retired from active business in 1771, and spent the next three years in Europe in travel, and in superintending the education of his sons in England. In 1774 he united with thirty-seven other Americans in a petition to parliament against the passing of the Boston Port Bill, in the hope of averting war. Becoming convinced that a peaceful settlement was impracticable, he returned to Charleston at the close of 1774, to take part with his fellow colonists in the impending struggle. He was soon made president of the South Carolina council of safety, and in 1776 a delegate from that colony to the general continental congress at Philadelphia, of which body he was president during 1777–78. Throughout these years he was a steadfast and influential promoter of the colonial cause, and a trusted friend of Washington. In 1778 he undertook a mission as minister plenipotentiary to Holland, in furtherance of secret negotiations for a commercial treaty which had been for some time in progress; but, while on the way, he was captured by a British frigate, and taken to London. On the evidence of his papers, which he had vainly attempted to destroy, war was declared upon Holland by Great Britain, and Laurens was closely imprisoned in the Tower. During his imprisonment of nearly fifteen months, his health became greatly enfeebled, yet he steadily refused opportunities for procuring release by abandoning his patriotic principles. Having been set free late in 1781, he was appointed by congress one of the commissioners for negotiating the peace; and, proceeding to Paris with Franklin and Jay, he signed with them, on November 30, 1782, the preliminaries of the treaty. Failing health obliged him to return to Charleston, South Carolina, where he passed his remaining years in retirement, much respected and beloved by his countrymen. He died in December, 1792, and, in accordance with the directions of his will, his body was burned, and the bones and ashes were carefully collected and buried. The most valuable of his papers and pamphlets have been published by the South Carolina Historical Society.

LAURENS, JOHN (1756–1782), an American revolutionary officer of distinguished bravery, son of Henry Laurens noticed above, was born at Charleston, South Carolina, in 1756. He was educated in England, and on his return to America in 1777, in the height of the revolutionary struggle, he joined Washington's staff. He soon gained his commander's confidence, which he reciprocated with the most devoted attachment, and was intrusted with the delicate duties of a confidential secretary, which he performed with much tact and skill. He was present in all Washington's battles, from that of the Brandywine to Yorktown, and his gallantry on every occasion has gained him the title of "the Bayard of the Revolution." Laurens displayed bravery even to rashness in the storming of the Chew mansion at Germantown; at Monmouth, where he saved Washington's life by rushing between him and danger, and was himself severely wounded; and at Coosahatchie, where, with a handful of men, he defended a pass against a large English force under General Provost, and where he was again wounded. In command of a body of light infantry at the storming of Savannah, he was among the first to penetrate the English lines, and again distinguished himself at the siege of Charleston in 1780. After the capture of Charleston by the English, he rejoined Washington, and was selected by him as a special envoy to appeal to the king of France for supplies for the relief of the American armies, which had been brought by prolonged service and scanty pay to the verge of dissolution. The more active co-operation of the French fleets with the land forces in Virginia, which was one result of his mission, brought about the unexpected overwhelming of Cornwallis at Yorktown. Laurens lost no time in rejoining the army, and at Yorktown was at the head of the American storming party which captured the first redoubt, and received the sword of Colonel Campbell, its commander. Laurens was designated with Count de Noailles to arrange the terms of a surrender, which occurred October 19, 1781, and virtually ended the war, although desultory skirmishing, especially in the south, attended the months of delay before peace was formally concluded. In one of these trifling affairs in July, 1782, on the Combahee Ferry, Laurens exposed himself needlessly and was killed. Washington lamented deeply the death of Laurens, then in his twenty-seventh year, saying of him, "He had not a fault that I could discover, unless it were intrepidity bordering upon rashness."

LAURIA, or **LORIA**, a city in Italy in the province of Potenza, 13 miles south of Lagonegro, consisting of a walled town on the steep side of a hill and another portion in the plain below. The castle was the birthplace of Ruggiero di Loria, the great Italian admiral of the 13th century. The population was 10,609 in 1871.

LAURVIK, or **LAURVIG**, a seaport town of south-eastern Norway, in the amt of Jarlsberg, is situated at the head of a short fjord, near where the Lougen or Laagen Elv falls into the sea. A considerable trade in timber and fish is carried on; and formerly the best Norway iron was produced in the immediate neighborhood, at Fritzö; but the works are now used as a saw-mill. About a mile to the south is Frederiksværn, formerly a station of the Norwegian fleet, and the seat of a naval academy. The population of Laurvik in 1875 was 7681.

LAUSANNE, the chief town of the canton of Vaud in Switzerland, lies about 27 miles N. E. of Geneva and 1 mile to the N. of the lake, which used not unfrequently to be called the Lake of Lausanne instead of the Lake of Geneva. It is the junction of the railways to Geneva from Bern and the Rhone valley, and has direct communications with Paris *via* Pontarlier. A railway worked by a cable connects the town proper with the village and port of Ouchy on the lake. Built on the lower slopes of Mont Jorat, partly on the crests and declivities of three hills and partly in the intervening valleys, Lausanne presents a fine appearance from the water, and in turn enjoys a wide outlook over the Alps of Savoy on the farther side. Modern improvements have largely modified the original characteristics of the site. The Great Bridge, designed by Pichard (1790–1841) and opened to traffic in Oct., 1844, crosses the Flon, and unites the quarters of St. Francis and St. Lawrence; and a roadway with easy gradients due to the same engineer tunnels beneath the castle and passes round the city. The Place de Riponne, the most spacious of the public squares and the site of the great corn-market and the Arlaud museum, is an artificial level secured by massive substructions ove the channel of the Louve. Lausanne is rapidly tending in all directions, and especially towards the uth and west. The principal building is the cathe- al of Notre Dame, which occupies a terrace on the ghest hill. It is a good example of plain and massive othic, the ground plan a Latin cross, and the interior markably simple. The erection is assigned to 1235–275, and the dedication was performed by Gregory X. presence of the emperor Rudolph of Hapsburg. To e north of the cathedral on the highest point in the city stands the castle, a structure of the 15th century. The academy, founded by the Bernese authorities in 1589, has numbered among its teachers Theodore Beza, Conrad Gessner, De Crousaz, Vinet, and Juste Olivier. The Arlaud museum founded in 1846, the blind asylum established by a wealthy Englishman, Mr. Haldiman, the penitentiary designed by Pichard, the great cantonal hospital, the theatre, and the cantonal library (80,000 volumes) are among the more noteworthy of the remaining institutions. Besides the well-known Society of Naturalists (established 1841) there are in the town a medical and an historical society (1837). Since the days of Gibbon, whose praises of the town have been often repeated, Lausanne has become a favorite place of residence for foreigners, and an international centre of education. The population was 26,520 (22,610 Protestants, 3517 Roman Catholics) in 1870, and 30,179 in 1880. At the end of the 18th century it was only 9000.



Plan of Lausanne.

1. Academy.
2. Corn Exchange.
3. Arlaud Museum.
4. Hôtel de Ville.
5. Post Office.
6. Penitentiary.
7. Scotch Church.
8. English Church.
9. Ouchy Church.

Though Lausanne (Latin, *Lausonium; Lausanna* in *Tab. Peut.*) undoubtedly existed at an early date, it was when Bishop Marius of Aventicum (c. 593) chose one of its hills as the new seat of his bishopric that its history practically began. The little episcopal city had a rival in an independent German community on the neighboring hill, but after long struggles the bishop was recognized as official head of the united community, on condition that every year in May he convoked the three estates to the *plaid général*. This state of matters lasted till the beginning of the 16th century. In 1536 the Bernese deprived the bishops of their temporal authority, transferred most of the goods of the church to the secular domain, and appointed intendants of their own to guide the action of the local magistracy. In this state of pupilage to Bern the city remained till the Revolution, and in 1798 it was made the chief town of the newly constituted canton of Vaud. In 1875 it was chosen as the seat of the supreme court of the Swiss confederation. Among the eminent men born in Lausanne are Benjamin Constant and the Secretans.

See Ludovicus, *Chronicon breve Episcoporum Laus.*, published by Gremaud in 1856; Schmitt, *Hist. du diocèse de Lausanne* · Bridel, *Matériaux pour une hist. litt. de l'Acad. de Lausanne;* the *Mémoires* of the Soc. d'hist. de la Suisse romande; Rodolphe Rey, *Genève et les rives du Leman*, 1875. The *Gazette de Lausanne* dates from 1798, though its present name was adopted only in 1804.

LAVA. See GEOLOGY.

LAVAGNA, a market-town of Italy, in the province of Genoa, situated on the sea-coast about a mile east of Chiavari, on the railway between Genoa and Pisa. It has a little shipbuilding, and exports (to France, Portugal, Constantinople, etc.) large quantities of excellent slate quarried in the vicinity. Among its buildings are two fine churches, and palaces belonging to the Rivarola, the Pallavicini, and Fransoni families. The population in 1871 was 5055 for the town and 6066 for the commune.

In the 10th century Lavagna was the seat of the independent counts Fieschi, who, after a severe struggle (1166–1198), were obliged to recognize the supremacy of Genoa. Among the members of the family born at Lavagna are Sinibaldo (Pope Innocent IV.) and Giovanni Luigi, the famous conspirator against the Doria party in Genoa. Filippo of Lavagna was the first printer in Milan (1460).

LAVAL, capital of the department of Mayenne, France, is situated on the Mayenne, 186 miles by railway west from Paris. On the right bank of the river stands the old feudal city, with its ancient castle, and its irregularly built houses, whose slate roofs and pointed gables peep from the groves of trees which clothe the hill. On the left bank the regularly built new town extends far into the plain. The river, here 80 yards broad, is crossed by the handsome railway viaduct, a beautiful stone bridge called "Pont Neuf," and the Mayenne bridge of three pointed arches, built in the 16th century. There is communication by steamer as far as to Angers. Laval may justly claim to be one of loveliest of French towns. Its most curious and interesting monument is the sombre-looking old castle of the counts, now transformed into a prison. The new castle dating from the Renaissance, is now the court house. Laval possesses several churches of different periods: in that of the Trinity, which serves as the cathedral, the transept is of the 12th century while the choir is of the 16th; the chapel of the Carmelites is an imitation of the Sainte Chapelle at Paris; Notre Dame des Cordeliers, which dates from the end of the 14th century or beginning of the 15th, has some fine marble altars. Half a mile below the Mayenne bridge is the beautiful 12th century church of Avenières, with an ornamental spire of 1534 and a handsome modern pulpit. The finest remaining relic of the ancient fortifications is the Beucheresse gate near the cathedral. There is a scientific museum, and a library containing 25,000 volumes. The town is embellished by fine promenades, at the entrance of one of which, facing the mairie, stands the statue of the celebrated surgeon Ambrose Paré. On the Place de Cheverus is a statue to the cardinal of that name, archbishop of Bordeaux. The principal industry of the town is the linen manufacture, introduced from Flanders in the 14th century. A large cloth hall (Halle-aux-toiles), built in the last century is used now for industrial, artistic, and agricultural exhibitions. At present tickings are chiefly made. This industry occupies ten thousand workmen, who are not gathered together in great factories, but scattered all over the town. Cotton spinning is also carried on, and there are tanneries, flour-mills, foundries, paper-works, and dye-works. Here also the marbles of the neighborhood are sawn, the greater part being converted into lime. Laval is the seat of a bishop, and has a lyceum. Population 27,000.

The history of Laval goes back only to the beginning of the 11th century, but from an early date in the feudal period the barons of Laval were distinguished by their valor and power, and by their alliances. One of them followed William the Conqueror into England. After having assumed the cross they allied themselves with the Montmorencys and Montforts, and their barony passed on later to the Colignys and the La Trémoilles. Laval was taken by Talbot in 1428. It changed hands several times during the wars of the League and the war of La Vendée in 1793.

LAVATER, Johann Kaspar (1741-1801), is a remarkable instance of a man who has obtained celebrity by following a bypath apart from the proper work of his life. As a preacher, theological writer, and spiritual director he occupied during his lifetime a position not very dissimilar to that held by Keble in our own day, but he survives for posterity chiefly as the author of a work on physiognomy. He was born at Zürich, November 15, 1741. Consistent with himself from the first, he manifested little application to study, but great depth of feeling, especially on religious themes, and a remarkable fluency of fervent and persuasive discourse. When barely one and twenty he greatly distinguished himself by denouncing, in conjunction with his friend the painter Fuseli, an iniquitous magistrate, who was compelled to make restitution of his own ill-gotten gains. In 1769 Lavater took orders, and officiated till his death as deacon or pastor in various churches in his native city. The advantages of his manner and address, as well as his oratorical fervor and genuine depth of conviction, gave him great personal influence, especially with women; he was extensively consulted as a casuist, and was welcomed with demonstrative enthusiasm in his numerous journeys through Germany. His mystical writings were also widely popular. Scarcely a trace however, of this influence has remained, and Lavater's name would be forgotten but for his work on physiognomy, *Physiognomische Fragmente zur Beförderung der Menschenkenntnis und Menschenliebe*, Leipsic, 1775-78, republished in French with extensive additions by the author. The fame even of this universally known book rests to a great extent upon the handsome style of publication and the accompanying illustrations. It is not to be compared with the subsequent labors of Caius for scientific value, and leaves the study of physiognomy as desultory and unsystematic as it found it. The author's remarks, nevertheless, frequently display remarkable acuteness and insight into character, and the illustrations render it very valuable to artists. Next to his physiognomy, Lavater is perhaps chiefly remembered for his acquaintance with Goethe, and the lively portrait of him in *Wahrheit und Dichtung*. The impression he produced upon one so dissimilar to himself shows that the man was greater than his works. At a later period Goethe became estranged from him, somewhat abruptly accusing him of superstitition and hypocrisy. Of the former charge he cannot be acquitted, seeing that he had manifested a tendency to run after Cagliostro; but he seems to have been no more open to the latter than every man whose ideal of creed and conduct is too exalted to be maintained with unvarying consistency. A more cogent reason for Lavater's discredit with Goethe was his intellectual intolerance. No man was more bigoted upon paper, while in truth his heart was open to all. He was continually propounding the alternative of his own form of Christianity or atheism; and it is indeed true that, if passages in his own writings are to be taken literally, he was himself incapable of conceiving a Deity apart from the person of the Redeemer. Much that he has written might be expressed in the language of Feuerbach but with slight alteration. He had a mystic's indifference to historical Christianity, and, although esteemed by himself and others a champion of orthodoxy, was in fact only an antagonist of rationalism. During the latter years of his life his influence waned, and he incurred ridicule by some exhibitions of vanity, pardonable in the recipient of so much incense. He redeemed himself by his patriotic conduct during the troubles occasioned by the French occupation of Switzerland, which brought about his tragical death. On the taking of Zürich by the French in 1799, Lavater, while endeavoring to appease the soldiery, was shot through the body by an infuriated grenadier, and died after long sufferings, borne with great fortitude, on January 2, 1801. His life was written in the following year by his son-in-law Georg Gessner, with natural partiality and unavoidable reticences, but faithfully in the main. There are more recent biographies by Hagner and Bodemann, the latter entirely from the religious point of view.

LAVAUR, chief town of an arrondissement in the department of Tarn, France, 25 miles E.N.E. of Toulouse, stands at a height of 460 feet on the left bank of the Agout (a tributary of the Tarn), which is here crossed by a bold bridge of a single arch of 160 feet span. The most interesting monument of Lavaur is its cathedral, which dates from the 14th and 15th centuries. In front of it is an octagonal bell-tower, without a spire, 131 feet high; a second smaller square tower contains a *jaquemart* (a metal statue which strikes the hours with a hammer) of the 16th century. In the bishop's garden is the statue of Las Casas. The chief industry of Lavaur is sericulture, but wool-spinning and tanning occupy some of the people. The town has 7560 inhabitants. It was taken by Simon de Montfort during the war of the Albigenses, and several times during the religious wars of the 16th century.

LAVENDER, botanically *Lavandula*, a genus of *Labiatæ* distinguished by an ovate tubular calyx, a two-lipped corolla, of which the upper lip has two and the lower three lobes, and four stamens bent downwards.

The plant to which the name of Lavender is commonly applied, *Lavandula vera*, D.C., is a native of the mountainous districts of the countries bordering on the western half of the Mediterannean, extending from the eastern coast of Spain to Calabria and northern Africa, growing in some places at a height of 4500 feet above the sea-level, and preferring stony declivities in open sunny situations. It is cultivated in the open air as far north as Norway and Livonia. Lavender forms an evergreen undershrub about 2 feet high, with grayish-green hoary linear leaves, rolled under at the edges when young; the branches are erect, and give a bushy appearance to the plant. The flowers are borne on a terminal spike at the summit of a long naked stalk, the spike being composed of 6-10 verticillasters or dense cymes in the axils of small, brownish, rhomboidal, tapering, opposite bracts, the verticillasters being more widely separated towards the base of the spike. The calyx is tubular, contracted towards the mouth, marked with 13 ribs and 5-toothed, the posterior tooth being the largest. The corolla is of a pale violet color, but darker on its inner surface, tubular, two-lipped, the upper lip with two and the lower with three lobes. Both corolla and calyx are covered with stellate hairs, amongst which are imbedded shining oil glands, to which the fragrance of the plant is due. The leaves and flowers of lavender are said to have been used by the ancients to perfume their baths; hence the name

Lavandula is supposed to have been derived from *lavare*, to wash. But, although *S. Stœchas* was well known to the ancients, no allusion unquestionably referring to *L. vera* has been found in the writings of classical authors, the earliest mention of the latter plant being in the 12th century by the abbess Hildegard, who lived near Bingen on the Rhine. Under the name of llafant or llafantly it was known to the Welsh physicians as a medicine in the 13th century. In England lavender is cultivated chiefly for the distillation of its essential oil, of which it yields on an average 1½ per cent. when freed from the stalks, but in the south of Europe the flowers form an object of trade, being exported to the Barbary states, Turkey, and America.

In Great Britain lavender is grown in the parishes of Mitcham, Carshalton, and Beddington in Surrey, where about 300 acres are under cultivation, and in Hertfordshire, in the parish of Hitchin, to the extent of 50 acres. The most suitable soil seems to be a sandy loam with a calcareous substratum, and the most favorable position a sunny slope in localities elevated above the level of fogs, where the plant is not in danger of early frost and is freely exposed to air and light. At Hitchin lavender is said to have been grown as early as 1568, but as a commercial speculation its cultivation dates back only to 1823. The plants at present in cultivation do not produce seed, and the propagation is always made by slips or by dividing the roots. The latter plan has only been followed since 1860, when a large number of lavender plants were killed by a severe frost. Since that date the plants have been subject to the attack of a fungus, in consequence of which the price of the oil has been considerably enhanced, and the disease is likely, if it continues, to affect seriously the cultivation of the herb. At Market Deeping in Lincolnshire, where lavender was formerly grown, its cultivation has been discontinued on this account.

The flowers are collected in the beginning of August, and taken direct to the still. The yield of oil depends in great measure upon the weather. After a wet and dull June and July the yield is sometimes only half as much as when the weather has been bright and sunshiny. From 12 to 30 ℔ of oil per acre is the average amount obtained. The oil contained in the stem has a more rank odor and is less volatile than that of the flowers; consequently the portion that distils over after the first hour and a half is collected separately.

The finest oil is obtained by the distillation of the flowers without the stalks, but the labor spent upon this adds about 10s. per ℔ to the expense of the oil, and the same end is practically attained by the fractional distillation. The oil mellows by keeping three years, after which it deteriorates unless mixed with alcohol; it is also improved by redistillation. Oil of lavender is distilled from the wild plants in Piedmont and the South of France, especially in the villages about Mont Ventoux near Avignon, and in those some leagues west of Montpelier. The best French oil realizes scarcely one-sixth of the price of the English oil. Cheaper varieties are made by distilling the entire plant.

Oil of Lavender is a mobile liquid having a specific gravity from 0.78 to 0.96 (Zeller). It appears to be a mixture in variable proportions of oxygenated oils and a stearoptene, the latter being identical, according to Dumas, with common camphor. Its adulteration with alcohol may be detected by chloride of calcium dissolving in it and forming a separate layer of liquid at the bottom of the vessel. Glycerine acts in the same way. If it contain turpentine it will not dissolve in three volumes of alcohol, in which quantity the pure oil is perfectly soluble.

Lavender flowers were formerly considered good for "all disorders of the head and nerves;" a spirit prepared with them was known under the name of palsy drops. At the present day a compound spirit of lavender, official in the British pharmacopœia, is sometimes given in conjunction with other stimulants to nervous and hysterical persons suffering from depression of spirits, or is used to give a color and flavor to medicine.

Lavender water consists of a solution of the volatile oil in spirit of wine with the addition of the essence of musk, rose, bergamot, and ambergris, but it is very rarely prepared by distillation of the flowers with spirit.

In the climate of New York lavender is scarcely hardy, but in the vicinity of Philadelphia considerable quantities are grown for the market, the dried flowers being used for satchels or scent bags and for perfuming linen, etc. In American gardens sweet basil (*Ocimum basilicum*) is frequently called lavender.

Lavandula Spica (D.C.), a species which differs from *L. Vera* chiefly in its smaller size, more crowded leaves, and linear bracts, is also used for the distillation of an essential oil, which is known in England as oil of spike and in France under the name of essence d'aspic. It is used in painting on porcelain and in veterinary medicine. The oil as met with in commerce is less fragrant than that of *L. Vera*,—probably because the whole plant is distilled, for the flowers of the two species are scarcely distinguishable in fragrance. *L. spica* does not extend so far north, nor ascend the mountains beyond 2000 feet. It cannot be cultivated in Britain except in sheltered situations. A nearly allied species *L. lanata* (Boiss.), a native of Spain, with broader leaves, is also very fragrant, but does not appear to be distilled for oil.

Lavandula Stœchas (L.), a species extending from the Canaries to Asia Minor, is distinguished from the above plants by its blackish purple flowers, and shortly-stalked spikes crowned by conspicuous purplish sterile bracts. The flowers were officinal in the London pharmacopœia as late as 1746. They are still used by the Arabs as an expectorant and antispasmodic. The Stœchades (now called the isles of Hyères near Toulon) owed their names to the abundance of the plant growing there.

Several other species of lavender (twenty in all) are known, some of which extend as far east as to India. A few which differ from the above in having divided leaves, as *L. dentata*, *L. abrotanoides*, *L. multifolia*, *L. pinnata* and *L. viridis*, have been cultivated in greenhouses, etc., in England.

Sea lavender is a name applied in England to several species of *Statice*, a genus of littoral Plumbaginaceous plants. Lavender cotton is a species of the genus *Santolina*, small, yellow-flowered, evergreen undershrubs of the Composite order.

See *Pharmacographia* p. 476; De Candolle, *Prodromus*, xii. p. 145; *Pharm. Journal*, (1) xi. p. 88; (1) viii. p. 276; (2) i. p. 278; (3) iii. p. 326; (3) iv. p. 161; (3) v. p. 182; (3) viii. p. 301; (3) x. p. 686; Guigin's *Histoire des Lavandes*, 1826. (E. M. H.)

LAVOISIER, Antoine Laurent (1743–1794), one of the founders of modern chemistry, was born in Paris, August 26, 1743. His father, a wealthy tradesman, gave him an excellent education at the Collége Mazarin, and encouraged his desire to adopt the career of science. On quitting college, he devoted himself to study with extraordinary ardor. He followed the astronomical and mathematical course of Lacaille, worked in the laboratory of Rouelle, and took lessons in botany from Jussieu. He renounced all frivolous society, and even restricted himself to a diet of milk in order to repair the damage to his constitution caused by excessive application. His first public distinction was gained on the occasion of a prize offered by the Academy of Sciences for an essay on the best mode of lighting the streets of Paris. To increase the sensitiveness of his eyes, he immersed himself for six weeks in a room hung with black, from which all light was excluded except that of the lamps experimented upon. His zeal was a pledge of success, and was rewarded with a gold medal, April 9, 1776. A multitude of subjects now engaged his attention. He presented to the Academy a masterly analysis of gypsum; travelled through France with Guettard, who was occupied in constructing the first geological map of the country, and composed a work, of which a fragment entitled *Mémoire sur les couches des montagnes* found a place in the Academy collection for 1789; refuted the prevalent error as to the conversion of water into silica by repeated distillation, and studied the phenomena of thunder and auroræ, of crystallization and congelation. He became an associate of the Academy in 1768, and in 1769 obtained the lucrative post of farmer-general of the revenue, with a view to increase the resources at his command for the advancement of science.

It was about the year 1770 that the vast possibilities of the new field opened to the researches of chemists by the pneumatic discoveries of Black, Cavendish, and Priestly were recognized by Lavoisier, and the perception gave to his genius the definitive impulse hitherto wanting to it. He repeated and verified experiments which became, in his hands, the means of invalidating their authors' conclusions, and prepared to import the clear-cut precision of his own ideas into a science as yet illogical in form and incoherent in expression. His wealth and position, as well as his enthusiasm, eminently qualified him to lead a successful reform. He lived in the midst of the most stimulating society of his time. Between him and such men as Laplace, Monge, Berthollet, and Fourcroy the constant interchange of ideas established a community of opinion in physical matters so close that the separate intellectual property of each was all but completely merged in the general stock.[1] On one day in each week Lavoisier threw open his laboratory to a select few of his friends, communicated the results of his labors, and invited their criticism and advice. By this consultative system his work gained in solidity, and lost nothing in originality. On the 1st of November, 1772, Lavoisier, eager to secure the credit of priority, deposited at the Academy a sealed packet containing the record of his earliest conclusions on the crucial point of metallic oxidation. The discovery by Priestly in 1774 of "dephlogisticated air" materially assisted the development of the innovating doctrine, which took the form of a fully fledged theory when Lavoisier in 1778 assigned to the new substance, with the name of "oxygen," the important functions of the universal "acidifying principle." His analysis of water in 1784, and synthesis of "fixed air" (called by him "carbonic acid," *Academy Memoirs*, 1781), opened the way for an extended view of the composition of organic as well as inorganic substances, and the antiphlogistic chemistry was completed by the publication, in 1787, of the *Méthode de nomenclature chimique.* The reform of language effected by Lavoisier in conjunction with Guyton de Morveau, Berthollet, and Fourcroy was an indispensable prelude to the reform of thought. With the current alchemistic jargon science, properly so-called, could have no fellowship. The new terminology prevailed without change for fifty years, and has been fitted, by trifling modifications, to meet the exigencies of recent progress. The acceptance of the "oxygen theory" was enormously facilitated by the defined and logical form given to it in Lavoisier's *Traité élémentaire de chimie* (Paris, 1789). Indeed, the history of science scarcely presents a second instance of a change so fundamental accomplished with such ease. The partisans of phlogiston did not, it is true, abandon the field without a struggle. In Berlin they met Lavoisier's demonstrations by burning him in effigy, and in Paris Lamétherie conducted, in the *Journal de Physique*, a fierce polemic against the party of innovation. The controversy was, however, brief, and its issue visibly certain. Before the end of the century the reformed chemistry was everywhere in a position of uncontested triumph.

The enlightened activity of Lavoisier was no less conspicuous in his administrative than in his scientific capacity. A prominent member of the body of farmers-general during twenty-one years, he obtained the abolition of certain taxes equally onerous and unproductive, and earned the gratitude of the Jews of Metz by relieving them from an oppressive impost. Appointed director of the powder-works by Turgot in 1776, he not only suppressed the vexatious searches for saltpetre in the cellars of private houses, but succeeded in quadrupling the produce of the commodity. He, moreover, improved the manufacture of gunpowder so as to add one-third to its explosive force, thereby reversing the previous superiority of English over French ordnance. His philanthropic zeal was displayed in the provincial assembly of the Orléanais in 1787. In the year following he was attached to the Caisse d'escompte, and presented a report of its operations, November 21, 1789, to the Constituent Assembly. In 1790 he sat on the commission of weights and measures. In 1791 he became commissary to the treasury, where he established a system of accounts of unexampled punctuality. Requested by the National Assembly to set forth a new scheme of taxation, he composed a treatise *De la richesse territoriale de la France*, of which an extract, printed at the public expense, shows him to have been possessed of sound and liberal views on political economy. In short to quote the words of Lalande, "Lavoisier was to be found everywhere." But those were times when to be conspicuous was to be in peril. On the 2d of May, 1794, Dupin, a member of the Convention, presented a frivolous accusation against the whole of the ex-farmers-general, whose wealth constituted in itself an inexpiable crime. Lavoisier found a hiding-place for a day or two in the deserted apartments of the Academy, but hearing that his absence was likely to prejudice the cause of his colleagues, he voluntarily gave himself up. He thought it impossible that his life could be taken, but expected the confiscation of his property, when, as he told Lalande, he proposed to earn his bread as an apothecary. Half measures, however, were not in favor with the revolutionary tribunal. On the 6th of May, he, with twenty-seven others of the same profession, was condemned to the guillotine, and, two days later, the sentence was carried into execution. "Il ne leur a fallu," Lagrange remarked, "qu'un moment pour faire tomber cette tête, et cent années peut-être ne suffiront pas pour en reproduire une semblable." It is said that a petition presented in his favor met with the brutal reply: "The republic has no need of *savants.*" He was preceded on the scaffold by M. Paulze, whose gifted daughter he had married in 1771. He left no posterity.

To the gift of a transcendent intellect Lavoisier joined the charms of a noble person and winning manners. He was faithful to his friends, charitable to the poor, a model husband, and a patriotic public servant. His fame as the reformer of chemistry rests on no single discovery, but is involved in the first principles of the science (see CHEMISTRY, p. 401). It was his great merit to have made the balance the *ultima ratio* of the laboratory. Quantitative analysis thus became for the first time possible, and a chemical reaction took in his hands the rigid form of an algebraical equation.[2] His latest studies were of a physiological character, and M. Dumas[3] found among his papers a piece showing that he had arrived at a remarkable anticipation of modern views concerning the relations of organic to inorganic nature. He was probably the first to devote systematic attention to agricultural chemistry, and obtained the practical success of doubling the produce of a large farm owned by him near Blois. A striking proof of his disinterested humanity is afforded by a long and painful investigation of putrefying substances carried out solely with a view to averting accidents in sewers. Not the least notable of his achievements is that of having first formed a clear idea as to the nature of gases, and of matter generally in its relation to heat. He held that bodies exist in the solid, liquid, or gaseous states according as the attractive force of their particles is superior, equal, or inferior to the repulsive action of an universally-diffused, imponderable fluid which he called "caloric." Differences of specific heat he attributed to differences of inter-molecular space. The theory, put forward by him with due reserve, formed a useful if not indispensable preliminary to further progress. He was the inventor of the gasometer, and, jointly with Laplace, his coadjutor in a series of experiments on specific heat, of the calorimeter.

A complete edition of the writings of Lavoisier was issued in four vols. 4to, by the Government of Napoleon III., under the title *Œuvres de Lavoisier publiées par les soins de son Excellence le Ministre de l'Instruction publique*, Paris, 1864-68. This publication comprises, besides the works already mentioned, *Opuscules physiques et chimiques* (1774), a large number of memoirs from the Academy volumes (during the twenty years 1770-90 he contributed no less than fifty-eight), and numerous letters, notes, and reports relating to the various affairs in which he was engaged. At the time of his death he was preparing an edition of his collected works, and the portions ready for the press were published by his widow in 1805, in two 8vo vols. entitled *Mémoires de Chimie.* The plates in the *Traité élémentaire* were drawn and engraved by Madame Lavoisier. Biographical notices of Lavoisier are given in Fourcroy's *Notice*, and by Lalande in Scherer's *Nachträge*, Jena, 1796. For an account of his discoveries see Dumas, *Leçons sur la Philosophie Chimique*, and Béchamp, *Lettres Historiques sur la Chimie.* (A. M. C.)

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[1] *Œuvres de Lavoisier*, tom. i. p. 13.

[2] *Œuvres*, tom. i. p. 108.

[3] *Leçons de Chimie*, [illegible].

LAW.

THE present article will be limited to the consideration of the phenomena presented for study by ositive laws. The objects which laws ought to sub- erve, the principles of legislation, the sphere of law, he province of government, and other topics of a sim- ar nature which are generally to be found in writings rofessing to treat of law in the abstract have been iscussed under the heading GOVERNMENT and else- here. It will be convenient, and it will be following he lines of a very remarkable development of English hought, to take actual laws as positive facts, without eference to their goodness or badness, and examine, far as it can be done within the limits at our com- and, the character which they present when looked from different points of view. This conception of e science of law, which is closely related to the scien- fic ideas of the time, has been developed by the efforts the modern school of English jurists. In former mes the science of law meant anything but science we have been taught to conceive it by physical phi- sophers. It meant if anything a philosophy of legal rinciples not necessarily related to any system of actual w. A philosophy of laws actually existing in fact is hat we in England at least should now consider the ience of law to be. By universal consent the some- hat shifting term jurisprudence has been limited to is meaning. Jurisprudence is the science of posi- ve laws. The present article will attempt to present mply the leading principles and conclusions of juris- udence.

The human race may be conceived as parcelled out to a number of distinct groups or societies, differing eatly in size and circumstances, in physical and moral aracteristics of all kinds. But they all resemble each her in this, that they reveal on examination certain les of conduct in accordance with which the relations the members *inter se* are governed. Such rules we ay for the present, without anticipating a somewhat ficult discussion, term laws. Each society has its n system of laws, and all the systems, so far as they e known, constitute the appropriate subject matter jurisprudence. The jurist may deal with it in the llowing ways. He may first of all examine the lead- conceptions common to all the systems, or in other rds define the leading terms common to them all. ich are the terms *law* itself, *right*, *duty*, *property*, *me*, and so forth, which, or their equivalents, may, twithstanding delicate differences of connotation, be garded as common terms in all systems. That kind inquiry is what is known in England as analytical risprudence. It regards the conceptions with which deals as fixed or stationary, and aims at expressing em distinctly and exhibiting their logical relations th each other. What is really meant by a right and a duty, and what is the true connection between a ht and a duty, are types of the questions proper to s inquiry. Shifting our point of view, but still regard- systems of law in the mass, we may consider them, as stationary, but as changeable and changing, we y ask what general features are exhibited by the rec- of the change. This, somewhat crudely put, may ve to indicate the field of historical jurisprudence. its ideal condition it would require an accurate rec- of the history of all legal systems as its material. yet the record is exceedingly incomplete, and the ults are proportionately limited. But whether the terial be abundant or scanty, the method is the ne. It seeks the explanation of institutions and al principles in the facts of history. Its aim is to ow how a given rule came to be what it is. The islative source—the emanation of the rule from a ereign authority—is of no importance here; what important is the moral source—the connection of the rule with the ideas prevalent during contemporary periods. This method, it is evident, involves not only a comparison of successive stages in the history of the same system, but a comparison of different systems, of the Roman with the English, of the Hindu with the Irish, and so on. The historical method as applied to law may be regarded as a special example of the method of comparison. The comparative method is really employed in all generalizations about law; for, although the analysis of legal terms might be conducted with exclusive reference to one system, the advantage of testing the result by reference to other systems is obvious. But, besides the use of comparison for purposes of analysis and in tracing the phenomena of the growth of laws, it is evident that for the purposes of practical legislation the comparison of different systems may yield important results. Laws are contrivances for bringing about certain definite ends, the larger of which are identical in all systems. The comparison of these contrivances not only serves to bring their real object, often obscured as it is in details, into clearer view, but enables legislators to see where the contrivances are deficient, and how they may be improved.

The "science of law," as the expression is generally used, means the examination of laws in general in one or other of the ways just indicated. It means an investigation of laws which exist or have existed in some given society in fact—in other words, positive laws; and it means an examination not limited to the exposition of particular systems. Analytical jurisprudence is in England associated chiefly with the name of JOHN AUSTIN (*q. v.*), whose *Province of Jurisprudence Determined* systematized and completed the work begun in England by Hobbes, and continued at a later date and from a different point of view by Bentham. The best view of the subject will be obtained by taking Austin's principal positions in outline, and considering the criticisms which later jurists have bestowed upon them.

Austin's first position is to distinguish between laws properly so-called and laws improperly so called. In any of the older writers on law, we find the various senses in which the word is used grouped together as variations of one common meaning. Thus Blackstone advances to his proper subject, municipal laws, through (1) the laws of inanimate matter, (2) the laws of animal nutrition, digestion, etc., (3) the laws of nature, which are rules imposed by God on men and discoverable by reason alone, and (4) the revealed or Divine law, which is part of the law of nature directly expounded by God. All of these are connected by this common element that they are "rules of action dictated by some superior being." And some such generalization as this is to be found at the basis of most treatises on jurisprudence which have not been composed under the influence of the analytical school. Austin disposes of it by the distinction that some of those laws are commands, while others are not commands. The so-called laws of nature are not commands; they are uniformities which resemble commands only in so far as they may be supposed to have been ordered by some intelligent being. But they are not commands in the only proper sense of that word,—they are not addressed to reasonable beings, who may or may not will obedience to them. Laws of nature are not addressed to anybody, and there is no possible question of obedience or disobedience to them. Austin accordingly pronounces them laws improperly so called, and confines his attention to laws properly so called, which are commands addressed by a human superior to a human inferior.

This distinction seems so simple and obvious that the energy and even bitterness with which Austin insists upon it now seems superfluous. But the indiscriminate identification of everything to which common speech gives the name of a law was, and still is, a fruitful source of confusion. Blackstone's statement that when God "put matter into motion He established certain laws of motion, to which all movable matter must conform," and that in those creatures that have neither the power to think nor to will such laws must be invariably obeyed, so long as the creature itself subsists, for its existence depends on that obedience, imputes to the law of gravitation in respect of both its origin and its execution the qualities of an Act of Parliament. On the other hand the qualities of the law of gravitation are imputed to certain legal principles which, under the name of the law of nature, are asserted to be binding all over the globe, so that "no human laws are of any validity if contrary to this." Nonsense like this so exasperated Austin that he never fails to stigmatize the use of "natural laws" in the sense of scientific facts as improper, or as metaphorical. A later writer has pointed out that law in the scientific sense has acquired a position of its own, from which it is impossible to dislodge it, and which involves none of the ambiguities and confusions against which Austin protested. It would be as reasonable for the man of science as for the jurist to set up his own conception of law as the only legitimate one. There is perhaps only one field of inquiry where the two opposed conceptions of law are still to be found entangled. The "laws of political economy" still hover in the minds of many between the jural and the scientific conception. Certain economical principles appear to have acquired a double character,—that of scientific generalizations, and that of rules which may be disobeyed. Measures are pronounced to be a violation of the laws of political economy, with a vague implication that these being laws of nature any violation of them must be particularly heinous.

Having eliminated metaphorical or figurative laws, we restrict ourselves to those laws which are commands. This word is the key to the analysis of law, and accordingly a large portion of Austin's work is occupied with the determination of its meaning. A command is an order issued by a superior to an inferior. It is a signification of desire distinguished by this peculiarity that "the party to whom it is directed is liable to evil from the other, in case he comply not with the desire." "If you are able and willing to harm me in case I comply not with your wish, the expression of your wish amounts to a command." Being liable to evil in case I comply not with the wish which you signify, I am *bound* or obliged by it, or I lie under a *duty* to obey it. The evil is called a *sanction*, and the command or duty is said to be *sanctioned* by the chance of incurring the evil. The three terms *command*, *duty*, and *sanction* are thus inseparably connected. As Austin expresses it in the language of formal logic, "each of the three terms signifies the same notion, but each *denotes* a different part of that notion, and *connotes* the residue."

All commands, however, are not laws. That term is reserved for those commands which oblige generally to the performance of acts of a class. A command to your servant to rise at such an hour on such a morning is a particular command, but not a law or rule; a command to rise always at that hour is a law or rule. Of this distinction it is sufficient to say in the meantime that it involves, when we come to deal with positive laws, the rejection of particular enactments to which by inveterate usage the term law would certainly be applied. On the other hand it is not, according to Austin, necessary that a true law should bind persons as a class. Obligations imposed on the grantee of an office specially created by parliament would imply a law; a general order to go into mourning addressed to the whole nation for a particular occasion would not be a law.

So far we have arrived at a definition of laws properly so called. Austin holds superiority and inferiority to be necessarily implied in command, and such statements as that "laws emanate from superiors" to be the merest tautology and trifling. Elsewhere he sums up the characteristics of true laws as ascertained by the analysis thus:—(1) laws being commands, emanate from a determinate source; (2) every sanction is an evil annexed to a command; and (3) every duty implies a command, and chiefly means obnoxiousness to the evils annexed to commands.

Of true laws, those only are the subject of jurisprudence which are laws strictly so called, or positive laws. Austin accordingly proceeds to distinguish positive from other true laws, which are either laws set by God to men or laws set by men to men, not, however, as political superiors nor in pursuance of a legal right. The discussion of the first of these true but not positive laws leads Austin to his celebrated discussion of the Utilitarian theory. The laws set by God are either revealed or unrevealed, *i. e.*, either expressed in direct command, or made known to men in one or other of the ways denoted by such phrases as the "light of nature," "natural reason," "dictates of nature," and so forth. Austin maintains that the principle of general utility, based ultimately on the assumed benevolence of God, is the true index to such of His commands as He has not chosen to reveal. His exposition of the meaning of the principle is a most valuable contribution to moral science, though he rests his claims ultimately on a basis which many of its supporters would disavow. And the whole discussion is now generally condemned as lying outside the proper scope of the treatise, although the reason for so condemning it is not always correctly stated. It is found in such assumptions of fact as that there is a God, that He has issued commands to men in what Austin calls the "truths of revelation," that He designs the happiness of all His creatures, that there is a predominance of good in the order of the world—which do not now command universal assent. It is impossible to place these propositions on the same scientific footing as the assumptions of fact with reference to human society on which jurisprudence rests. If the "Divine laws" were facts like Acts of Parliament, it is conceived that the discussion of their characteristics would not be out of place in a scheme of jurisprudence.

The second set of laws properly so called, which are not positive laws, consists of three classes:—(1) those which are set by men living in a state of nature; (2) those which are set by sovereigns but not as political superiors, *e. g.*, when one sovereign commands another to act according to a principle of international law; and (3) those set by subjects but not in pursuance of legal rights. This group, to which Austin gives the name of positive morality, helps to explain his conception of positive law. Men are living in a state of nature, or a state of anarchy, when they are not living in a state of government or as members of a political society. "Political society" thus becomes the central fact of the theory, and some of the objections that have been urged against it arise from its being applied to conditions of life in which Austin would not have admitted the existence of a political society. Again, the third set in the group is intimately connected with positive laws on the one hand and rules of positive morality which are not even laws properly so called on the other. Thus laws set by subjects in consequence of a legal right are clothed with legal sanctions, and are laws positive. A law set by guardian to ward, in pursuance of a right which the guardian is bound to exercise, is a positive law pure and simple; a law set by master to slave, in pursuance of a legal right which he is not bound to exercise, is, in Austin's phraseology, to be regarded both as a positive moral rule and as a positive law.[1] On the other hand the rules set by a club or society, and enforced upon its members by exclusion from the society, but not in pursuance of any legal right, are laws, but not positive laws. They are imperative and proceed from a determinate source, but they have no legal or political sanction. Closely connected with this positive morality, consisting of true but not positive laws, is the positive morality whose rules are not laws properly so called at all, though they are generally denominated laws. Such are the laws of honor, the laws of fashion, and, most important of all, international law.

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[1] This appears to be an unnecessary complication. The sovereign has authorized the master to set the law, although not compelling him to do so, and enforces the law when set. There seems no good reason why the law should be called a rule of positive morality at all.

Nowhere does Austin's phraseology come more bluntly into conflict with common usage than in pronouncing the law of nations (which in substance is a compact body of well-defined rules resembling nothing so much as the ordinary rules of law) to be not laws at all, even in the wider sense of the term. That the rules of a private club should be law properly so called, while the whole mass of international jurisprudence is mere opinion, shocks our sense of the proprieties of expression. Yet no man was more careful than Austin to observe these proprieties. He recognizes fully the futility of definitions which involve a painful struggle with the current of ordinary speech. But in the present instance the apparent paralogism cannot be avoided if we accept the limitation of laws properly so called to commands proceeding from a determinate source. And that limitation is so generally present in our conception of law that to ignore it would be a worse anomaly than this. No one finds fault with the statement that the so-called code of honor or the dictates of fashion are not, properly speaking, laws. We repel the same statement applied to the law of nature, because it resembles in so many of its most striking features—in the certainty of a large portion of it, in its terminology, in its substantial principles—the most universal elements of actual systems of law, and because, moreover, the assumption that brought it into existence was nothing else than this, that it consisted of those abiding portions of legal systems which prevail everywhere by their own authority. But, though "positive morality" may not be the best phrase to describe such a code of rules, the distinction insisted on by Austin is unimpeachable.

The elimination of those laws properly and improperly so called which are not positive laws brings us to the definition of positive law, which is the keystone of the system. Every positive law is "set by a sovereign person, or sovereign body of persons, to a member or members of the independent political society wherein that person or body is sovereign or superior." Though possibly sprung directly from another source, it is a positive law, by the institution of that present sovereign in the character of a political superior. The question is not as to the historical origin of the principle, but as to its present authority. "The legislator is he, not by whose authority the law was first made, but by whose authority it continues to be law." This definition involves the analysis of the connected expressions *sovereignty*, *subjection*, and *independent political society*, and of *determinate body*,—which last analysis Austin performs in connection with that of commands. These are all excellent examples of the logical method of which he was so great a master. The broad results alone need be noticed here. In order that a given society may form a society political and independent, the *generality* or *bulk* of its members must be in a *habit* of obedience to a certain and common superior; whilst that certain person or body of persons must not be *habitually* obedient to a certain person or body. All the italicized words point to circumstances under which it might be difficult to say whether a given society is political and independent or not. Several of these Austin has discussed,—*e. g.*, the state of things in which a political society yields obedience which may or may not be called habitual to some external power, and the state of things in which a political society is divided between contending claimants for sovereign power, and it is uncertain which shall prevail, and over how much of the society. So long as that uncertainty remains we have a state of *anarchy*. Further, an independent society to be political must not fall below a number which can only be called considerable. Neither then in a state of anarchy, nor in inconsiderable communities, nor among men living in a state of nature, have we the proper phenomena of a political society. The last limitation goes some way to meet the most serious criticism to which Austin's system has been exposed, and it ought to be stated in his own words. He supposes a society which may be styled independent, which is considerable in numbers, and which is in a savage or extremely barbarous condition. In such a society, "the bulk of its members is not in the habit of obedience to one and the same superior. For the purpose of attacking an external enemy, or for the purpose of repelling an attack, the bulk of its members who are capable of bearing arms submits to one leader or one body of leaders. But as soon as that emergency passes the transient submission ceases, and the society reverts to the state which may be deemed its ordinary state. The bulk of each of the families which compose the given society renders habitual obedience to its own peculiar chief, but those domestic societies are themselves independent societies, or are not united and compacted into one political society by habitual and general obedience to one common superior, and there is no law (simply or strictly so styled) which can be called the law of that society. The so-called laws which are common to the bulk of the community are purely and properly customary laws —that is to say, laws which are set or imposed by the general opinion of the community, but are not enforced by legal or political sanctions." Such, he says, are the savage societies of hunters and fishers in North America, and such were the Germans as described by Tacitus. He takes no account of societies in an intermediate stage between this and the condition which constitutes political society.

We need not follow the analysis in detail. Much ingenuity is displayed in grouping the various kinds of government, in detecting the sovereign authority under the disguises which it wears in the complicated State system of the United States or under the fictions of English law, in elucidating the precise meaning of abstract political terms. Incidentally the source of many celebrated fallacies in political thought is laid bare. That the question who is sovereign in a given state is a question of fact and not of law or morals or religion, that the sovereign is incapable of legal limitation, that law is such by the sovereign's command, that no real or assumed compact can limit his action—are positions which Austin has been accused of enforcing with needless iteration. He has cleared them, however, from the air of paradox with which they had been previously encumbered, and his influence was in no direction more widely felt than in making them the commonplaces of educated opinion in this generation.

Passing from these, we may now consider what has been said against the theory, which may be summed up in the following terms. Laws, no matter in what form they be expressed, are in the last resort reducible to commands set by the person or body of persons who are in fact sovereigns in any independent political society. The sovereign is the person or persons whose commands are habitually obeyed by the great bulk of the community; and by an independent society we mean that such sovereign head is not himself habitually obedient to any other determinate body of persons. The society must be sufficiently numerous to be considerable before we can speak of it as a political society. From command, with its inseparable incident of sanction, come the duties and rights in terms of which laws are for the most part expressed. Duty means that the person of whom it is predicated is liable to the sanction in case he fails to obey the command. Right means that the person of whom it is predicated may set the sanction in operation in case the command be disobeyed.

Before noticing the considerable body of hostile criticism with which in the main we are unable to agree, we may here interpolate a doubt whether the condition of independence on the part of the head of a community is essential to the legal analysis. It seems to us that we have all the elements of a true law present when we point to a community habitually obedient to the authority of a person or determinate body of persons, no matter what the relations of that superior may be to any external or superior power. Provided that in fact the commands of the lawgiver are those beyond which the community never looks, it seems immaterial to inquire whether this lawgiver in turn takes his orders from somebody else or is habitually obedient to such orders when given. One may imagine a community governed by a dependent legislatorial body or person, while the supreme sovereign whose representative and nominee such body or person may be never directly addresses the community at all. We do not see that in such a case anything is gained in clearness by representing the law of the community as set by the suzerain, rather than the dependent legislator. Nor is the ascertainment of the ultimate seat of power necessary to define political societies. That we get when we suppose a community to be in the habit of obedience to a single person or to a determinate combination of persons.

The use of the word "command" is not unlikely to lead to a misconception of Austin's meaning. When we say that a law is a command of the sovereign, we are apt to think of the sovereign as enunciating the rule in question for the first time. Many laws are not traceable to the sovereign at all in this sense. Some are based upon immemorial practices, some can be traced to the influence of private citizens, whether practising lawyers or writers on law, and in most countries a vast body of law owes its existence as such to the fact that it has been observed as law in some other society. The great bulk of modern law owes its existence and its shape ultimately to the labors of the Roman lawyers of the empire. Austin's definition has nothing to do with this, the historical origin of laws. Most books dealing with law in the abstract generalize the modes in which laws may be originated under the name of the "sources" of law, and one of these is legislation, or the direct command of the sovereign body. The connection of laws with each other as principles is properly the subject matter of historical jurisprudence, the ideal perfection of which would be the establishment of the general laws governing the evolution of law in the technical sense. Austin's definition looks, not to the authorship of the law as a principle, not to its inventor or originator, but to the person or persons who in the last resort cause it to be obeyed. If a given rule is enforced by the sovereign it is a law.

It may be convenient to notice here what is usually said about the sources of law, as the expression sometimes proves a stumbling-block to the appreciation of Austin's system. In the *corpus juris* of any given country only a portion of the laws is traceable to the direct expression of his commands by the sovereign. Legislation is one, but only one, of the sources of law. Other portions of the law may be traceable to other sources, which may vary in effect in different systems. The list given in the *Institutes* of Justinian of the ways in which law may be made—*lex, plebiscitum, principis placita, edicta magistratuum*, and so on—is a list of sources. Among the sources of law other than legislation which are most commonly exemplified are the laws made by judges in the course of judicial decisions, and law originating as custom. The source of the law in the one case is the judicial decision, in the other the custom. In consequence of the decision and in consequence of the custom the rule has prevailed. English law is largely made up of principles derived in each of those ways, while it is deficient in principles derived from the writings of independent teachers, such as have in other systems exercised a powerful influence on the development of law. The *responsa prudentum*, the opinions of learned men, published as such, did undoubtedly originate an immense portion of Roman law. No such influence has affected English law to any appreciable extent—a result owing to the activity of the courts of the legislature. This difference has profoundly affected the form of English law as compared with that of systems which have been developed by the play of free discussion. These are the most definite of the influences to which the beginning of laws may be traced. The law once established, no matter how, is nevertheless law in the sense of Austin's definition. It is enforced by the sovereign authority. It was originated by something very different. But when we speak of it as a command we think only of the way in which it is to-day presented to the subject. The newest order of an Act of Parliament is not more positively presented to the people as a command to be obeyed than are the elementary rules of the common law for which no legislative origin can be traced. It is not even necessary to resort to the figure of speech by which alone, according to Sir Henry Maine (*Early History of Institutions*, p. 314), the common law can be regarded as the commands of the Government. "The common law," he says, "consists of their commands because they can repeal or alter or restate it at pleasure." "They command because, being by the assumption possessed of uncontrollable force, they could innovate without limit at any moment." On the contrary, it may be said that they command because they do as a matter of fact enforce the rules laid down in the common law. It is not because they could innovate if they pleased in the common law that they are said to command it, but because it is known that they will enforce it as it stands.

The criticism of Austin's analysis resolved itself into two different sets of objections. One relates to the theory of sovereignty which underlies it; the other to its alleged failure to include rules which in common parlance are laws, and which it is felt ought to be included in any satisfactory definition of law. As the latter is to some extent anticipated and admitted by Austin himself, we may deal with it first.

A recent writer[1] has been at great pains to collect a number of laws or rules of law which do not square with the Austinian definition of law as a command creating rights and duties. Take the rule that "every will must be in writing." It is a very circuitous way of looking at things, according to Mr. Harrison, to say that such a rule creates a specific right in any determinate person of a definite description. So, again, the rule that "a legacy to the witness of a will is void." Such a rule is not "designed to give any one any rights, but simply to protect the public against wills made under undue influence." Again, the technical rule in Shelley's case that a gift to A for life, followed by a gift to the heirs of A, is a gift to A in fee simple, is pronounced to be inconsistent with the definition. It is an idle waste of ingenuity to force any of these rules into a form in which they might be said to create rights.

This would be a perfectly correct description of any attempt to take any of these rules separately and analyze it into a complete command creating specific rights and duties. But there is no occasion for doing anything of the kind. It is not contended that every grammatically complete sentence in a text-book or a statute is *per se* a command creating rights and duties. A law, like any other command, must be expressed in words, and will require the use of the usual aids to expression. The gist of it may be expressed in a sentence which, standing by itself, is not intelligible; other sentences locally separate from the principal one may contain the exceptions and the modifications and the interpretations to which that is subject. In no one of these taken by itself, but in the substance of them all taken together, is the true law, in Austin's sense, to be found. Thus the rule that every will must be in writing is a mere fragment—only the limb of a law. It belongs to the rule which fixes the rights of devisees or legatees under a will. That rule in whatever form it may be expressed is, without any straining of language, a command of the legislator. That "every person named by a testator in his last will and testament shall be entitled to the property thereby given him" is surely a command creating rights and duties. After testament add "expressed in writing;" it is still a command. Add further, "provided he be not one of the witnesses to the will," and the command, with its product of rights and duties, is still there. Each of the additions limits the operation of the command stated imperatively in the first sentence. So with the rule in Shelley's case. It is resolvable into the rule that every person to whom an estate is given by a conveyance expressed in such and such a way shall take such and such rights. To take another example from recent legislation. A statute passed in 1881 enacts nothing more than this, that an Act of a previous session shall be construed as if "that" meant "this." It would be futile indeed to force this into conformity with Austin's definition by treating it as a command addressed to the judges, and as indirectly creating rights to have such a construction respected. As it happens, the section of the previous Act referred to (the Burials Act, 1880) is an undeniable command, addressed to the clergy, and imposing upon them a specific duty. The true command—the law—is to be found in the two sections taken together.

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[1] Mr. Frederic Harrison in the *Fortnightly Review* (vols. xxx., xxxi.)

All this confusion arises from the fact that laws are not habitually expressed in imperative terms. Even in a mature system like that of England the great bulk of egal rules is hidden under forms which disguise their mperative quality. They appear as principles, maxims, propositions of fact, generalizations, points of pleading and procedure, and so forth. Even in the statutes the mperative form is not uniformly observed. It might be said that the more mature a legal system is the less do its individual rules take the form of commands. The greater portion of Roman law is expressed in terms which would not misbecome scientific or speculative reatises. The institutional works abound in propositions which have no legal significance at all, but which are not distinguished from the true law in which they are embedded by any difference in the forms of expression. Assertions about matters of history, dubious peculations in philology, and reflections on human conduct are mixed up in the same narrative with genuine ules of law. Words of description are used, not words f command, and rules of law assimilate themselves in form to the extraneous matter with which they are mixed up.

It has been said that Austin himself admitted to ome extent the force of these objections. He includes mong laws which are not imperative the following:— 'declaratory laws, or laws explaining the import of xisting positive law, and laws abrogating or repealing xisting positive law.'' He thus associates them with ules of positive morality and with laws which are only metaphorically so called. This collocation is unfortuate and out of keeping with Austin's method. Declartory and repealing laws are as completely unlike positive morality and metaphorical laws as are the laws which he describes as properly so called. And if we void the error of treating each separate proposition nunciated by the lawgiver as *a* law, the cases in question eed give us no trouble. Read the declaratory and the repealing statutes along with the principal laws which hey affect, and the result is perfectly consistent with he proposition that all law is to be resolved into a species of command. In the one case we have in the principal taken together with the interpretative statute a aw, and whether it differs or not from the law as it xisted before the interpretative statute was passed makes no difference to the true character of the latter. t contributes along with the former to the expression f a command which is a true law. In the same way repealing statutes are to be taken together with the aws which they repeal—the result being that there is o law, no command, at all. It is wholly unnecessary o class them as laws which are not truly imperative, or s exceptions to the rule that laws are a species of commands. The combination of the two sentences in which he lawgiver has expressed himself, yields the result of lence—absence of law—which is in no way incompatble with the assertion that a law, when it exists, is a ind of command. Austin's theory does not logically equire us to treat every Act of Parliament as being complete law in itself, and therefore to set aside a ertain number of Acts of Parliament as being exceptions to the great generalization which is the basis of f the whole system.

Rules of procedure again have been alleged to conitute another exception. They cannot, it is said, be egarded as commands involving punishment if they e disobeyed. Nor is anything gained by considering hem as commands addressed to the judge and other inisters of the law. There may be no doubt in the w of procedure a great deal that is resolvable into w in this sense, but the great bulk of it is to be regarded like the rules of interpretation as entering into the substantive commands which are laws. They are descriptions of the sanction and its mode of working. The bare prohibition of murder without any penalty to enforce it would not be a law. To prohibit it under penalty of death implies a reference to the whole machinery of criminal justice by which the penalty is enforced. Taken by themselves, the rules of procedure are not, any more than canons of interpretation, complete laws in Austin's sense of the term. But they form part of the complete expression of true laws. They imply a command, and they describe the sanction and the mode in which it operates.

A more formidable criticism of Austin's position is that which attacks the definition of sovereignty. There are countries, it is said, where the sovereign authority cannot by any stretch of language be said to command the laws, and yet where law manifestly exists. The ablest and the most moderate statement of this view is given by Sir Henry Maine in *Early History of Institutions*, p. 380:—

> "It is from no special love of modern examples that I take one from India, but because it happens to be the most modern precedent in point. My instance is the Indian province called the Punjab, the country of the Five Rivers, in the state in which it was for about a quarter of a century before its annexation to the British Indian empire. After passing through every conceivable phase of anarchy and dormant anarchy, it fell under the tolerably consolidated dominion of a half military half religious oligarchy known as the Sikhs. The Sikhs themselves were afterwards reduced to subjection by a single chieftain belonging to their order, Runjeet Singh. At first sight there could be no more perfect embodiment than Runjeet Singh of sovereignty as conceived by Austin. He was absolutely despotic. Except occasionally, on his wild frontier he kept the most perfect order. He could have commanded anything; the smallest disobedience to his commands would have been followed by death or mutilation; and this was perfectly well known to the enormous majority of his subjects. Yet I doubt whether once in all his life he issued a command which Austin would call a law. He took as his revenue a prodigious share of the produce of the soil. He harried villages which recalcitrated at his exactions, and he executed great numbers of men. He levied great armies; he had all material of power, and he exercised it in various ways. But he never made a law. The rules which regulated the lives of his subjects were derived from their immemorial usages, and those rules were administered by domestic tribunals in families or village communities—that is, in groups no larger or little larger than those to which the application of Austin's principles cannot be effected on his own admission without absurdity."

So far as the mere size of the community is concerned, there is no difficulty in applying the Austinian theory. In postulating a considerably numerous community Austin was thinking evidently of small isolated groups which could not without provoking a sense of the ridiculous be termed nations. Two or three families, let us suppose, occupying a small island, totally disconnected with any great power, would not claim to be and would not be treated as an independent political community. But it does not follow that Austin would have regarded the village communities spoken of by Maine in the same light. Here we have a great community, consisting of a vast number of small communities, each independent of the other, and disconnected with all the others, so far as the administration of anything like law is concerned. Suppose in each case that the headman or council takes his orders from Runjeet Singh, and enforces them, each in his own sphere, relying as the last resort on the force at the disposal of the suzerain. The mere size of the separate communities would make no sort of difference to Austin's theory. He would probably regard the empire of Runjeet Singh as divided into small districts,—an assumption which inverts no doubt the true historical order, the smaller group being generally more ancient than the larger. But provided that the other conditions prevail, the mere fact that the law is administered by local tribunals for minute areas should make no difference to the theory. The case described by Sir Henry

Maine is that of the undoubted possession of supreme power by a sovereign, coupled with the total absence of any attempt on his part to *originate* a law. That no doubt is, as we are told by the same authority, "the type of all Oriental communities in their native state during their rare intervals of peace and order." The empire was in the main in each case a tax-gathering empire. The unalterable law of the Medes and Persians was not a law at all but an occasional command. So again Maine puts his position clearly in the following sentences:—"The Athenian assembly made true laws for residents on Attic territory, but the dominion of Athens over her subject cities and islands was clearly a tax-taking as distinguished from a legislating empire." Sir Henry Maine, it will be observed, does not say that the sovereign assembly did not command the laws in the subject islands—only that it did not legislate.

In the same category may be placed without much substantial difference all the societies that have ever existed on the face of the earth previous to the point at which *legislation* becomes active. Sir Henry Maine is undoubtedly right in connecting the theories of Bentham and Austin with the overwhelming activity of legislatures in modern times. And formal legislation, as he has elsewhere shown, comes late in the history of most legal systems. Law is generated in other ways, which seem irreconcilable with anything like legislation. Not only the tax-gathering emperors of the East, indifferent to the condition of their subjects, but even actively benevolent Governments have up to a certain point left the law to grow by other means than formal enactments. What is *ex facie* more opposed to the idea of a sovereign's commands than the conception of schools of law? Does it not "sting us with a sense of the ridiculous" to hear principles which are the outcome of long debates between Proculians and Sabinians described as commands of the emperor? How is sectarianism in law possible if the sovereign's command is really all that is meant by a law? No mental attitude is more common than that which regards law as a natural product—discoverable by a diligent investigator, much in the same way as the facts of science or the principles of mathematics. The introductory portions of Justinian's *Institutes* are certainly written from this point of view, which may also be described without much unfairness as the point of view of German jurisprudence. And yet the English jurist who accepts Austin's postulate as true for the English system of our own day would have no difficulty in applying it to German or Roman law generated under the influence of such ideas as these.

Again, referring to the instance of Runjeet Singh, Sir H. Maine says no doubt rightly that "he never did or could have dreamed of changing the civil rules under which his subjects lived. Probably he was as strong a believer in the independent obligatory force of such rules as the elders themselves who applied them." That too might be said with truth of states to which the application of Austin's system would be far from difficult. The sovereign body or person enforcing the rules by all the ordinary methods of justice might conceivably believe that the rules which he enforced had an obligatory authority of their own, just as most lawyers at one time, and possibly some lawyers now, believe in the natural obligatoriness, independently of courts or parliaments, of portions of the law of England. But nevertheless, whatever ideas the sovereign or his delegates might entertain as to "the independent obligatory force" of the rules which they enforce, the fact that they do enforce them distinguishes them from all other rules. Austin seizes upon this peculiarity and fixes it as the determining characteristic of positive law. When the rule is enforced by a sovereign authority as he defines it, it is his command, even if he should never so regard it himself, or should suppose himself to be unable to alter it in a single particular.

It may be instructive to add to these examples of dubious cases one taken from what is called ecclesiastical law. In so far as this has not been adopted and enforced by the state, it would, on Austin's theory, be, not positive law, but either positive morality or possibly a portion of the Divine law. No jurist would deny that there is an essential difference between so much of ecclesiastical law as is adopted by the state and all the rest of it, and that for scientific purposes this distinction ought to be recognized. How near this kind of law approaches to the positive or political law may be seen from the sanctions on which it depended. "The theory of penitential discipline was this: that the church was an organized body with an outward and visible form of government; that all who were outside her boundaries were outside the means of divine grace; that she had a command laid upon her, and authority given to her, to gather men into her fellowship by the ceremony of baptism, but, as some of those who were admitted proved unworthy of their calling, she also had the right by the power of the keys to deprive them temporarily or absolutely of the privilege of communion with her, and on their amendment to restore them once more to church membership. On this power of exclusion and restoration was founded the system of ecclesiastical discipline. It was a purely spiritual jurisdiction. It obtained its hold over the minds of men from the belief, universal in the catholic church of the early ages, that he who was expelled from her pale was expelled also from the way of salvation, and that the sentence which was pronounced by God's church on earth was ratified by Him in heaven" (Smith's *Dictionary of Christian Antiquities*, art. "Penitence," p. 1587).

These laws are not the laws of the jurists, though they resemble them closely in many points—indeed in all points except that of the sanction by which they are enforced. It is a spiritual not a political sanction. The force which lies behind them is not that of the sovereign or the state. When physical force is used to compel obedience to the laws of the church they become positive laws. But so long as the belief in future punishments or the fear of the purely spiritual punishments of the church is sufficient to procure obedience to them, they are to be regarded as commands, not by the state, but by the church. That difference Austin makes essential. In rejecting spiritual laws from the field of positive law, his example would be followed by jurists who would nevertheless include other laws, not ecclesiastical in purpose, but enforced by very similar methods.

Compare the following account of "the mode in which justice was administered in the neighborhood of Benares towards the end of the last century," extracted from a very valuable work on the scientific study of Hindu law by Mr. J. H. Nelson. "The recognized mode of compelling a debtor to pay up appears to have been by sending a Brahman to do *dharna* before his house with a dagger or a bowl of poison to be used by the Brahman on his own body if the debtor proved obstinate. When the tax collector gave too much trouble, a ryot would sometimes erect a *koor* or pile of wood and burn an old woman on it by way of bringing sin on the head of the tormentor. The *lex talionis* obtained in the following shape. Persons who considered themselves aggrieved by acts of their enemies would kill their own wives and children, in order, as we may suppose, to compel their enemies to do a similar act to their own hurt. Thus two Brahmans cut off their mother's head to spite a foe." The same author states that he is "firmly persuaded that the normal condition of India has ever been to be without what Europeans understand by laws and law courts."

So far as the question is one of the propriety of language, the burden in this case is decidedly against those who would extend the phraseology of law to such rules as these. Can we with any advantage speak of one person having a right against another, when his remedy consists in starving himself in order to bring sin upon the head of his opponent or compel him to do likewise? If *dharna* or anything like it suffices to keep a community to its customary practices, is it possible to express such customs in terms applicable to the laws of European societies? Or is any harm done by saying that the difference between the two is so great that the former cannot be regarded as positive laws at all?

The true criterion in all these cases is, neglecting the shape and circumstances in which the rules in question may have appeared, to ask by what means compliance with them is enforced. Austin's theory in the end comes to this, that true laws are in all cases obeyed in consequence of the application of regulated physical force by some portion of the community. That is a fair

:aphrase of the position that laws are the commands
the sovereign, and is perhaps less objectionable inas-
ch as it does not imply or suggest anything about
forms in which laws are enunciated. All rules, cus-
as, practices, and laws—or by whatever name these
formities of human conduct may be called—have
ier this kind of force at their back or they have not.
t worth while to make this difference the basis of a
ntific system or not? Apparently it is. If it were
uestion of distinguishing between the law of the law
rts and the laws of fashion no one would hesitate.
ly should laws or rules having no support from any
itical authority be termed laws positive merely be-
se there are no other rules in the society having such
port?

he question may perhaps be summed up as follows.
stin's definitions are in strict accordance with the
s of government in civilized states; and, as it is put
Sir H. Maine, certain assumptions or postulates
ing been made, the great majority of Austin's posi-
s follow as of course or by ordinary logical process.
at the other extreme end of the scale of civilization
societies to which Austin himself refuses to apply
system, and where, it would be conceded on all sides,
re is neither political community nor sovereign nor
,—none of the facts which jurisprudence assumes to
t. There is an intermediate stage of society in
ch, while the rules of conduct might and generally
ld be spoken of as laws, it is difficult to trace the
nection between them and the sovereign authority
se existence is necessary to Austin's system. Are
h societies to be thrown out of account in analytical
isprudence, or is Austin's system to be regarded as
a partial explanation of the field of true law, and
definitions good only for the laws of a portion of the
ld? The true answer to this question appears to be
when the rules in any given case are habitually
orced by physical penalties, administered by a deter-
ate person or portion of the community, they should
egarded as positive laws and the appropriate subject
ter of jurisprudence. Rules which are not so en-
ed, but are enforced in any other way, whether by
t is called public opinion, or spiritual apprehensions,
atural instinct, are rightly excluded from that sub-
-matter. In all stages of society, savage or civilized,
rge body of rules of conduct, habitually obeyed, are
ertheless not enforced by any state sanction of any
l. Austin's method assimilates such rules in primi-
society, where they subserve the same purpose as
itive laws in an advanced society, not to the positive
s which they resemble in purpose but to the moral
ther rules which they resemble in operation. If we
ise to accept this position we must abandon the
mpt to frame a general definition of law and its de-
dent terms, or we must content ourselves with saying
law is one thing in one state of society and another
g in another. On the ground of clearness and con-
ience Austin's method is, we believe, substantially
it, but none the less should the student of jurispru-
ce be on his guard against such assumptions as that
slation is a universal phenomenon, or that the rela-
of sovereign and subject is discernible in all states
human society. And a careful examination of Sir
ry Maine's criticism will show that it is devoted not
nuch to a rectification of Austin's position as to cor-
ion of the misconceptions into which some of his
iples may have fallen. It is a misconception of the
lysis to suppose that it involves a difference in jurid-
character between custom not yet recognized by
judicial decision and custom after such recognition.
re is no such difference except in the case of what is
perly called "judicial legislation"—wherein an ab-
tely new rule is added for the first time to the law.
recognition of a custom or law is not necessarily the
inning of the custom or law. Where a custom pos-
es the marks by which its legality is determined
ording to well understood principles, the courts pro-
nce it to have been law at the time of the happening
of the facts as to which their jurisdiction is invoked. The fact that no previous instance of its recognition by a court of justice can be produced is not material. A lawyer before any such decision was given would nevertheless pronounce the custom to be law,—with more or less hesitation according as the marks of a legal custom were obvious or not. The character of the custom is not changed when it is for the first time enforced by a court of justice, and hence the language used by Sir Henry Maine must be understood in a very limited sense. "Until customs are enforced by courts of justice"—so he puts the position of Austin—they are merely "positive morality," rules enforced by opinion; but as soon as courts of justice enforce them they become commands of the sovereign, conveyed through the judges who are his delegates or deputies. This proposition, on Austin's theory, would only be true of customs as to which these marks were absent. It is of course true that when a rule enforced only by opinion becomes for the first time enforceable by a court of justice—which is the same thing as the first time of its being actually enforced—its juridical character is changed. It was positive morality; it is now law. So it is when that which was before the opinion of the judge only becomes by his decision a rule enforceable by courts of justice. It was not even positive morality but the opinion of an individual; it is now law.

The most difficult of the common terms of law to define is *right;* and, as right rather than duty is the basis of classification, it is a point of some importance. Assuming the truth of the analysis above discussed, we may go on to say that in the notion of law is involved an obligation on the part of some one, or on the part of every one, to do or forbear from doing. That obligation is duty; what is right? Dropping the negative of forbearance, and taking duty to mean an obligation to do something, with the alternative of punishment in default, we find that duties are of two kinds. The thing to be done may have exclusive reference to a determinate person or class of persons, on whose motion or complaint the sovereign power will execute the punishment or sanction on delinquents; or it may have no such reference, the thing being commanded, and the punishment following on disobedience, without reference to the wish or complaint of individuals. The last are absolute duties, and the omission to do, or forbear from doing, the thing specified in the command is in general what is meant by a crime. The others are relative duties, each of them implying and relating to a right in some one else. A person has a right who may in this way set in operation the sanction provided by the state. In common thought and speech, however, right appears as something a good deal more positive and definite than this,—as a power or faculty residing in individuals, and suggesting not so much the relative obligation as the advantage or enjoyment secured thereby to the person having the right. Mr. J. S. Mill, in a valuable criticism of Austin, suggests that the definition should be so modified as to introduce the element of "advantage to the person exercising the right." But it is exceedingly difficult to frame a positive definition of right which shall not introduce some term at least as ambiguous as the word to be defined. Professor Holland defines right in general as a man's "capacity of influencing the acts of another by means, not of his own strength, but of some authority or power external to himself." Direct influence exercised by virtue of one's own strength, physical or otherwise, over another's acts, is "might" as distinguished from right. When the indirect influence is the opinion of society, we have a "moral right." When it is the force exercised by the sovereign, we have a legal right. It would be more easy, no doubt, to pick holes in this definition than to frame a better one.[1]

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[1] In English speech another ambiguity is happily wanting which in many languages besets the phrase expressing "a right." The Latin "jus," the German "Recht," the Italian "diritto," and the French "droit" express not only a right, but also law in the abstract. To indicate the distinction between

The distinction between rights available against determinate persons and rights available against all the world, *jura in personam* and *jura in rem*, is of fundamental importance. The phrases are borrowed from the classical jurists, who used them originally to distinguish actions according as they were brought to enforce a personal obligation or to vindicate rights of property. The owner of property has a right to the exclusive enjoyment thereof, which avails against all and sundry, but not against one person more than another. The parties to a contract have rights available against each other, and against no other persons. The *jus in rem* is the badge of property; the *jus in personam* is a mere personal claim.

That distinction in rights which appears in the division of law into the law of persons and the law of things is thus stated by Austin. There are certain rights and duties, with certain capacities and incapacities, by which persons are determined to various classes. The rights, duties, etc., are the condition or status of the person; and one person may be invested with many status or conditions. The law of persons consists of the rights, duties, etc., constituting conditions or status; the rest of the law is the law of things. The separation is a mere matter of convenience, but of convenience so great that the distinction is universal. Thus any given right may be exercised by persons belonging to innumerable classes. The person who has the right may be under twenty-one years of age, may have been born in a foreign state, may have been convicted of crime, may be a native of a particular country, or a member of a particular profession or trade, etc.; and it might very well happen, with reference to any given right, that, while persons in general, under the circumstances of the case, would enjoy it in the same way, a person belonging to any one of these classes would not. If belonging to any one of those classes makes a difference not to one right merely but to many, the class may conveniently be abstracted, and the variations in rights and duties dependent thereon may be separately treated under the law of persons. The personality recognized in the law of persons is such as modifies indefinitely the legal relations into which the individual clothed with the personality may enter. See Holland's *Elements of Jurisprudence*, p. 90.

The author last cited disapproves of the prominence given by Austin to this distinction, instead of that between public and private law. This, according to Professor Holland, is based on the public or private character of the persons with whom the right is connected, public persons being the state or its delegates. Austin, holding that the state cannot be said to have legal rights or duties, recognizes no such distinction. The term "public law" he confines strictly to that portion of the law which is concerned with political conditions, and which ought not to be opposed to the rest of the law, but "ought to be inserted in the law of persons as one of the limbs or members of that supplemental department."

Lastly, following Austin, the main division of the law of things is into (1) primary rights with primary relative duties, (2) sanctioning rights with sanctioning duties (relative or absolute). The former exist, as it has been put, for their own sake, the latter for the sake of the former. Rights and duties arise from facts and events; and facts or events which are violations of rights and duties are *delicts* or *injuries*. Rights and duties which arise from delicts are remedial or sanctioning, their object being to prevent the violation of rights which do not arise from delicts.

We are inclined to agree with the view expressed by Mr. F. Harrison (*Fortnightly Review*, vol. xxxi.), that the rearrangement of English law on the basis of a scientific classification, whether Austin's or any other, would not result in advantages at all compensating for its difficulties. If anything like a real code were to be attempted, the scientific classification would be the best; but in the absence of that, and indeed in the absence of any habit on the part of English lawyers of studying the system as a whole, the arrangement of facts does not very much matter. It is essential, however, to the abstract study of the principles of law. Scientific arrangement might also be observed with advantage in treatises affecting to give a view of the whole law, especially those which are meant for educational rather than professional uses. The only book worth naming of that kind is Blackstone's *Commentaries*, which, in the hands of successive annotators, retains all its original defects of arrangement. It has simply been brought down to date, and its last condition is, from every point of view but that, worse than its first. As an example of the practical application of a scientific system of classification to a complete body of law, we may point to Professor W. A. Hunter's elaborate *Exposition of Roman Law* (London, 1876).

It is impossible to present the conclusions of historical jurisprudence in anything like the same shape as those which we have been discussing. As yet historical jurisprudence is little more than a method, and its results are generalizations of more or less plausibility or probability. The inquiry is in that stage which is indicated in one way by describing it as a philosophy. The philosophy of the history of law is all that it can yet claim to be. It resembles, and is indeed only part of, the study which is described as the philosophy of history. Its chief interest hitherto has been in the light which it has thrown upon rules of law and legal institutions which had been and are generally contemplated as positive facts merely, without reference to their history, or have been associated historically with principles and institutions not really connected with them.

The historical treatment of law displaces some very remarkable misconceptions. Peculiarities and anomalies abound in every legal system; and as soon as laws become the special study of a professional class, some mode of explaining or reconciling them will be resorted to. One of the prehistorical ways of philosophizing about law was to account for what wanted explanation by some theory about the origin of technical words. This implies some previous study of words and their history, and is an instance of the deep-seated and persistent tendency of the human mind to identify names with the things they represent. The *Institutes* of Justinian abound in explanations, founded on a supposed derivation of some leading term. *Testamentum*, we are told, *ex eo appellatur quod testatio mentis est*. A testament was no doubt, in effect, a declaration of intention on the part of the testator when this was written. But the *mentum* is a mere termination, and has nothing to do with *mens* at all. The history of testaments, which, it may be noticed incidentally, has been developed with conspicuous success, gives a totally different meaning to the institution from that which was expressed by this fanciful derivation. So the perplexing subject of *possessio* was supposed in some way to be explained by the derivation from *pono* and *sedeo*,—*quasi sedibus positio*. *Posthumi* was supposed to be a compound of *post* and *humus*. These examples belong to the class of rationalizing derivations with which students of philosophy are familiar. Their characteristic is that they are suggested by some prominent feature of the thing as it then appeared to observers,—which feature thereupon becomes identified with the essence of the thing at all times and places.

Another prehistorical mode of explaining law may be described as metaphysical. It conceives of a rule or principle of law as existing by virtue of some more general rule or principle in the nature of things. Thus, in the English law of inheritance, until the passing of the recent Inheritance Act, an estate belonging to a

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"law" and "a right" the Germans are therefore obliged to resort to such phrases as "objectives" and "subjectives Recht," meaning by the former law in the abstract, and by the latter a concrete right. And Blackstone, paraphrasing the distinction drawn by Roman law between the "jus quod ad res" and the "jus quod ad personas attinet," devotes the first two volumes of his *Commentaries* to the "Rights of Persons and the Rights of Things." See Holland's *Elements of Jurisprudence*, p. 57.

deceased intestate would pass to his uncle or aunt, to the exclusion of his father or other lineal ancestor. This anomaly from an early time excited the curiosity of lawyers, and the explanation accepted in the time of Bracton was that it was an example of the general law of nature:—"Descendit itaque jus quasi ponderosum quid cadens deorsum recta linea vel transversali, et nunquam reascendit ea via qua descendit." The author of an excellent summary of the history of the law of real property (Mr. Digby) supposes that the "rule really results from the associations involved in the word descent." It seems more likely, however, that these associations explained rather than that they suggested the rule,—that the omission of the lineal ancestor existed in custom before it was discovered to be in harmony with the law of nature. It would imply more influence than the reasoning of lawyers is likely to have exercised over the development of law at that time to believe that a purely artificial inference of this kind should have established so very remarkable a rule. However that may be, the explanation is typical of a way of looking at law which was common enough before the dawn of the historical method. Minds capable of reasoning in this way were, if possible, farther removed from the conceptions implied in the reasoning of the analytical jurists than they were from the historical method itself. In this connection it may be noticed that the great work of Blackstone marks an era in the development of legal ideas in England. It was not merely the first, as it still remains the only, adequate attempt to expound the leading principles of the whole body of law, but it was distinctly inspired by a rationalizing method. Blackstone tried not merely to express but to illustrate legal rules, and he had a keen sense of the value of historical illustrations. He worked of course with the materials at his command. His manner and his work are obnoxious alike to the modern jurist and to the modern historian. He is accused by the one of perverting history, and by the other of confusing the law. But his scheme is a great advance on anything that had been attempted before; and, if his work has been prolific in popular fallacies, at all events it enriched English literature by a conspectus of the law, in which the logical connection of its principles *inter se*, and its relation to historical facts, were distinctly if erroneously recognized.

While the historical method has superseded the verbal and metaphysical explanation of legal principles, it has apparently, in some cases, come into conflict with the conclusions of the analytical school. The difference between the two systems comes out most conspicuously in relation to customs. There is an unavoidable break in the analytical method between societies in which rules are backed by regulated physical force and those in which no such force exists. At what point in its development a given society passes into the condition of "an independent political society" it may not be easy to determine, for the evidence is obscure and conflicting. To the historical jurist there is no such breach. The rule which in one stage of society is a law, in another merely a rule of "positive morality," is the same thing to him throughout. By a recent Act of Parliament the Ulster custom of tenant right and other analogous customs were legalized. For the purposes of analytical jurisprudence there is no need to go beyond the Act of Parliament. The laws known as the Ulster custom are laws solely in virtue of the sovereign government. Between the law as it now is and the custom as it existed before the Act there is all the difference in the world. To the historical jurist no such separation is possible. His account of the law would not only be incomplete without embracing the precedent custom, but the Act which made the custom law is only one of the facts, and by no means the most significant or important, in the history of its development. An exactly parallel case is the legalization in England of that customary tenant right known as copyhold. It is to the historical jurist exactly the same thing as the legalization of the Ulster tenant right. In the one case a practice was made law by formal legislation, and in the other without formal legislation. And there can be very little doubt that in an earlier stage of society, when formal legislation had not become the rule, the custom would have been legalized relatively much sooner than it actually was.

Customs then are the same thing as laws to the historical jurist, and his business is to trace the influences under which they have grown up, flourished, and decayed, their dependence on the intellectual and moral conditions of society at different times, and their reaction upon them. The recognized science—and such it may now be considered to be—with which historical jurisprudence has most analogy is the science of language. Laws and customs are to the one what words are to the other, and each separate municipal system has its analogue in a language. Legal systems are related together like languages and dialects, and the investigation in both cases brings us back at last to the meagre and obscure records of savage custom and speech. A great master of the science of language (Max Müller) has indeed distinguished it from jurisprudence, as belonging to a totally different class of sciences. "It is perfectly true," he says, "that if language be the work of man in the same sense in which a statue, or a temple, or a poem, or a law are properly called the works of man, the science of language would have to be classed as an historical science. We should have a history of language as we have a history of art, of poetry, and of jurisprudence; but we could not claim for it a place side by side with the various branches of natural history." Whatever be the proper position of either philology or jurisprudence in relation to the natural sciences, it would not be difficult to show that laws and customs on the whole are equally independent of the efforts of individual human wills,—which appears to be what is meant by language not being the work of man. The most complete acceptance of Austin's theory that law everywhere and always is the command of the sovereign does not involve any withdrawal of laws from the domain of natural science, does not in the least interfere with the scientific study of their affinities and relationships. Max Müller elsewhere illustrates his conception of the different relation of words and laws to the individual will by the story of the emperor Tiberius, who was reproved for a grammatical mistake by Marcellus, whereupon Capito, another grammarian, observed that, if what the emperor said was not good Latin, it would soon be so. "Capito," said Marcellus, "is a liar; for, Cæsar, thou canst give the Roman citizenship to men, but not to words." The mere impulse of a single mind, even that of a Roman emperor, however, probably counts for little more in law than it does in language. Even in language one powerful intellect or one influential academy may, by its own decree, give a bent to modes of speech which they would not otherwise have taken. But whether law or language be conventional or natural is really an obsolete question, and the difference between historical and natural sciences in the last result is one of names.

The application of the historical method to law has not resulted in anything like the discoveries which have made comparative philology a science. There is no Grimm's law for jurisprudence; but something has been done in that direction by the discovery of the analogous processes and principles which underlie legal systems having no external resemblance to each other. It happens, however, that the historical study of law has, for the most part, been confined to a single system—the Roman law. The Roman law presents itself to the historical student in two different aspects. It is, regarded as the law of the Roman republic and empire, a system whose history can be traced throughout a great part of its duration with certainty, and in parts with great detail. It is, moreover, a body of rationalized legal principles which may be considered apart from the state system in which they were developed, and which have, in fact, entered into the jurisprudence of the whole of modern Europe on the strength of their own abstract authority,—so much so that the continued existence of the civil law, after the fall of the empire, is entitled to be considered one of the first discoveries of the historical method. Alike, therefore, in its original history, as the law of the Roman state, and as the source from which the fundamental principles of modern laws have been taken, the Roman law presented the most obvious and attractive subject of historical study. An immense impulse was given to the history of Roman law by the discovery of the *Institutes* of Gaius in 1816. A complete view of Roman law, as it existed three centuries and a half before Justinian, was then obtained, and as the later *Institutes* were, in point of form, a recension of those of Gaius,[1] the comparison of the two stages in legal history was at once easy and fruitful. Moreover, Gaius dealt with antiquities of the law which had become obsolete in the time of Justinian, and were passed over by him without notice. Roman law has accordingly been the main subject of historical study, and the conclusions of jurisprudence are to a great extent generalizations suggested by the history of Roman law.

Nowhere did Roman law in its modern aspect give a stronger impulse to the study of legal history than in Germany. The historical school of German jurists led the reaction of national sentiment against the proposals for a general code made by Thibaut. They were accused by their opponents of setting up the law of past times as intrinsically entitled to be observed, and they were no doubt strongly inspired by reverence for customs and traditions. Through the examination of their own customary laws, and through the elimination and separate study of the Roman element therein, they were led to form general views of the history of legal principles. In the hands of Savigny, the greatest master of the school, the historical theory was developed into a universal philosophy of law, covering the ground which we should assign separately to jurisprudence, analytical and historical, and to theories of legislation. There is not in Savigny's system the faintest approach to the Austinian analysis. The range of it is not the analysis of law as a command, but that of a *Rechtsverhältniss* or legal relation. Far from regarding law as the creation of the will of individuals, he maintains it to be the natural outcome of the consciousness of the people, like their social habits or their language. And he assimilates changes in law to changes in language. "As in the life of individual men no moment of complete stillness is experienced, but a constant organic development, such also is the case in the life of nations, and in every individual element in which this collective life consists; so we find in language a constant formation and development, and in the same way in law."[2] German jurisprudence is darkened by metaphysical thought, and weakened, as we believe, by defective analysis of positive law. But its conception of laws is exceedingly favorable to the growth of an historical philosophy, the results of which have a value of their own, apart altogether from the character of the first principles. Such, for instance, is Savigny's famous examination of the law of possession.

There is only one other system of law which is worthy of being placed by the side of Roman law, and that is the law of England. No other European system can be compared with that which is the origin and substratum of them all; but England, as it happens, is isolated in jurisprudence. She has solved her legal problems for herself. Whatever element of Roman law may exist in the English system has come in, whether by conscious adaptation or otherwise, *ab extra;* it is not of the essence of the system, nor does it form a large portion of the system. And, while English law is thus historically independent of Roman law, it is in all respects worthy of being associated with it on its own merits. Its originality, or, if the phrase be preferred, its peculiarity, is not more remarkable than the intellectual qualities which have gone to its formation—the ingenuity, the rigid logic, the reasonableness, of the generations of lawyers and judges who have built it up. This may seem extravagant praise for a legal system, the faults of which are and always have been matter of daily complaint, but it would be endorsed by all unprejudiced students. What men complain of is the practical hardship and inconvenience of some rule or process of law. They know, for example, that the law of real property is exceedingly complicated, and that, among other things, it makes the conveyance of land expensive. But the technical law of real property, which rests to this day on ideas that have been buried for centuries, has nevertheless the qualities we have named. So too with the law of procedure as it existed under the "science" of special pleading. The greatest practical law reformer, and the severest critic of existing systems that has ever appeared in any age or country, Jeremy Bentham, has admitted this:—"Confused, indeterminate, inadequate, ill-adapted, and inconsistent as to a vast extent the provision or no provision would be found to be that has been made by it for the various cases that have happened to present themselves for decision, yet in the character of a repository of such cases it affords, for the manufactory of real law, a stock of materials which is beyond all price. Traverse the whole continent of Europe, ransack all the libraries belonging to all the jurisprudential systems of the several political states, add the contents together, you would not be able to compose a collection of cases equal in variety, in amplitude, in clearness of statement—in a word, all points taken together, in constructiveness—to that which may be seen to be afforded by the collection of English reports of adjudged cases" (Bentham's *Works*, vol. iv. p. 460). On the other hand, the fortunes of English jurisprudence are not unworthy of comparison even with the catholic position of Roman law. In the United States of America, in India, and in the vast colonial empire, the common law of England constitutes most of the legal system in actual use, or is gradually being superimposed upon it. It would hardly be too much to say that English law of indigenous growth, and Roman law, between them govern the legal relations of the whole civilized world. Nor has the influence of the former on the intellectual habits and the ideas of men been much if at all inferior. Those who set any store by the analytical jurisprudence of the school of Austin will be glad to acknowledge that it is pure outcome of English law. Sir Henry Maine has associated its rise with the activity of modern legislatures, which is of course a characteristic of the societies in which English laws prevail. And it would not be difficult to show that the germs of Austin's principles are to be found in legal writers who never dreamed of analyzing a law. It is certainly remarkable, at all events, that the acceptance of Austin's system is as yet confined strictly to the domain of English law. Sir H. Maine has found no trace of its being even known to the jurists of the Continent, and it would appear that it has been equally without influence in Scotland, which, like the Continent, is essentially Roman in the fundamental elements of its jurisprudence.

While, however, Roman law has had many historians, and while it has been, in Germany at least, the subject of a good deal of historical philosophy, English law can hardly yet be said to have had its historian, much less its philosopher. What is wanted here, in the first place, is the setting forth of the materials in a condition fit for examination. This has been rightly described as perhaps the most important intellectual want of the present time. But in the meantime the revival of the study of Roman law in England has made the comparison of Roman and English law a matter of course in legal education, and has undoubtedly led, in accordance, no doubt, with the bent of contemporary thought, to the formation in England of

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[1] A very useful edition of the *Institutes* of Justinian, printed as a recension of the text of Gaius, has been published by Professor T. E. Holland, Oxford, Clarendon Press, 1882, 2d ed.

[2] See *Introduction to the History of Jurisprudence*, by D. Caulfield Heron, LL.D., London, 1880.

ıt may not improperly be called a great school of
orical jurists.

y far the most considerable contribution made by
land to historical jurisprudence is the writings of
Henry Maine. The first of these (*Ancient Law*),
lished in 1861, has probably had a more profound
ence on contemporary thought than any other book
his generation. *The Early History of Institutions*
Village Communities in the East and West have
e followed. In *Ancient Law* Sir Henry Maine pro-
s to trace the connection of the subject with the
y history of society and its relation to modern ideas.
ing the Roman law as a typical system, he revealed
he first time to English readers the connection be-
n the principles of forgotten lawyers and, not
ely the legal ideas, but the moral commonplaces of
own time. The book undermined what had been
pted as first principles by showing that they had a
ry. It gratified the intellectual sense by the bril-
identification of legal ideas, obscured by differ-
s of time and place and circumstance. It is not
rising that its influence has been even more exten-
among educated laymen than among professional
ers, for the latter are condemned by custom to dis-
rd everything in their science but its relation to the
ness of the day. But *Ancient Law* set the attitude
egarding a legal rule not as an isolated fact but as
last link in an historical series. In the better sort
gal text-books which have recently appeared this
ude is discernible, and on the whole to the advan-
of the exposition, even for the purposes of practice.
t the present moment conclusions based on an ex-
ation of the history of legal systems stand subject
rrection by the results of the investigation, which
ing conducted with so much diligence and success,
the condition of savage races. If it be a right
rence that the phenomena of barbarism, as it exists
e present day, represent a condition through which
ized societies have passed, it is obvious that the
n which recorded history suggests for legal ideas
practices must not be taken as absolute. It so
pens that prehistoric society has hitherto engaged
ich larger share of attention than the history of laws.
spicuous among the writers who have made import-
contributions to the literature of this subject are
E. B. Tylor, Sir J. Lubbock, Mr. Lewis Morgan,
especially Mr. J. F. M'Lennan. Many of the con-
ons to which these inquirers have been led do not
t any position taken up by historical jurists, but
rs tend to show that social forms which, seen from
side of legal history, appeared to be the absolute be-
ing of modern institutions, may themselves have
the result of a long evolution. The most con-
ious example, not of antagonism, but of what may be
d disconnection, between juridical and naturalistic
ries of the origin of society, is to be found in the
ILY (*q. v.*). Here it need only be said that the part
ed by the family in the development of legal ideas
een fully elaborated by historical jurists, sometimes
the inference, implied rather than expressed, that
arks the beginning of the history, or at least is to be
d in the earliest period of the race of which we have
worthy evidence. Substantially the conclusions of
jurists as to the influence of the conception of the
ly on historic law remain unimpaired. It is true
a great part of the "legal ideas of civilized races
be traced to this conception, and that the history
eir development is the history of its slow unwind-
"[1] But that there is no anterior condition to that
hich the patriarchal family—"a group of men,
en, and slaves, of animate and inanimate property,
onnected together by subjection to the paternal
r of the chief of the household"—is the unit of
ty, is not, so far as we are aware, affirmed by any
rical jurist. The evidence on that question will be
d in the article FAMILY above mentioned.

nother natural group whose place in legal history has recently been the subject of careful investigation is the village community. In one of its forms—the township—"it is an organized self-acting group of Teutonic families, exercising a common proprietorship over a definite tract of land, its mark, cultivating its domain on a common system, and sustaining itself by the produce. It is described by Tacitus in the *Germania* as the vicus; it is well known to have been the proprietary and even the political unit of the earliest English society; it is allowed to have existed among the Scandinavian races, and it survived to so late a date in the Orkney and Shetland Islands as to have attracted the attention of Sir Walter Scott" (Maine, *Village Communities*, p. 10). Founding on the researches of G. L. von Maurer, of Nasse, and others on the Teutonic mark, and comparing them with the observed phenomena of the village community in India, Sir H. Maine has shown, in the work just cited, how this widely diffused institution illustrates legal history, more particularly with reference to property in land, and to the conservation of customary law.

The lateness of the intervention of the state or sovereign as a direct legislator has been adverted to in the previous discussion. Formal law-making by the state is everywhere posterior to its intervention as the enforcer of law. Not that law-making was consciously separated from judging, or that the assembly or officer who represented the state was conceived as exclusively judicial. But the state, whether represented by a public assembly or by an officer, undertook to decide disputes between man and man long before it presumed to say on what principle such disputes should be decided. The judge everywhere comes before the legislator, if indeed terms so purely modern can be applied without danger to early law. That the pronouncements of the judge were themselves a source of law,—that he created the law which he professed to declare,—is true in a sense which, however, requires us to obliterate the most conspicuous of all the duties of a judge conceived in relation to mature law. That the law existed before the judgment, that the judgment should simply declare pre-existing law, that *ex post facto* laws are unjust—are the inveterate beliefs and prejudices of a civilized society, the strength of which is manifested by the fictions elsewhere noticed as concealing the manufacture of new law. No such conception is to be imported into the notions of early society as to the right and wrong of civil justice. The office of the judge was to settle disputes, to do right where wrong had been done; and whether his decision was founded on law, or custom, or religion, or on personal wisdom or inspiration, was a question which we cannot conceive as being asked, when these things were not distinguished in thought.

A conclusion suggested by the earliest forms of procedure in Roman law is that the intervention of the judge is originally that of a private arbitrator. The *legis actio sacramenti* retained down to a very late period certain symbolical proceedings, in which the features of a private quarrel were simulated. It was a petrified legal drama, like that played by the vouchers in the English action of ejectment. The parties wrangle over the disputed property, the magistrate interposes, and they agree to abide by his decision, each staking a deposit on the justice of his case. Maine felicitously compares these formalities with the trial scene depicted on the shield of Achilles in the *Iliad*, in which the *sacramentum* is represented by two talents of gold to go to the judge who shall best decide the points in dispute in the opinion of the spectators. The reward given to the private arbitrator has become in legal symbolism the fee payable to the court on the hearing of the cause. "In confirmation of this view," says Maine, "it may be added that many observers of the oldest judicial usages of modern Europe have remarked that the fines inflicted by courts on offenders were originally *sacramenta*" (*Ancient Law*, p. 378). The symbolism of another *legis actio* is susceptible of a similar interpretation. The *condictio* was a personal action taking its name from the notification to the defendant to appear before the judge on the day named, and it simulated a quarrel settled, not by the interposition of the arbitrator, but by agreement of the parties in the form of a wager, to be decided by the arbitrator at a future time. It is consistent with this view of the first manifestations of judicial functions that early as compared with mature law should assign so large a place to mere procedure. The adjective law, as it is now called, was the first portion of the law to take definite shape, and long maintained its place in the foreground of the system. When a special class in society, whether an aristocratic or priestly caste or a profession, became, as was almost universally the case, the exclusive custodians of the law, the formalities of procedure were their most important secrets. It is represented as a revolution in Roman society when the clerk of one of the aristocratic lawyers divulged to the public his master's notes for the conduct of legal proceedings. And at all times, it may be said, the law of procedure or practice is in a special sense the law of the professional lawyer, his knowledge of which makes him a skilled craftsman.

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[1] Maine's *Village Communities*, p. 15.

The more definite the judiciary power the more do we approach the state of things in which the postulates of analytical jurisprudence are true. Another mark of maturing law is its expression in writing, which, while it destroys the secret monopoly of a class, tends to develop the separate profession of free practising lawyers, who in all progressive societies count as the most powerful instrument for moulding the shape of the law. The influence of lawyers upon law is one of the topics on which the comparison of English and Roman law throws a flood of light, but its illustration would carry us beyond our present limits. Nor can we do more than allude to the importance tentatively assigned by Maine to the question whether a written law comes relatively early or late in the history of a nation. He appears to hold that the relatively early code of the Romans saved them from that degeneration of custom which takes place when it is transmitted by oral tradition from one generation to another.

We have discussed elsewhere, under the headings EQUITY and FICTIONS, two of the modes by which legal changes have been brought about indirectly. Direct law-making by the sovereign power, there is reason to believe, is not only everywhere later than these agencies, but its activity is progressive, and constantly tends to displace them. A glance at the English statute-book will show that the legislature at the present day undertakes the deliberate alteration of the law to a much greater extent than it has ever done before. A rough illustration is the fact that the chronological table of the statutes from 1235 to 1877 covers over three hundred pages, of which fully two-thirds are occupied with the legislation of the last hundred years. This activity varies of course at different times, and the variations even in recent times have been remarkable. And, large as are the contributions of modern parliaments to the law, it is notorious that but for defects in the legislative machinery they would be much larger. Nor is this activity to be accounted for by the theory that the domain of law is more intrusive than in earlier times. There has undoubtedly been within the last generation a steady increase in the control asserted by the state over the habits of its citizens, for some account of which reference may be made to the article GOVERNMENT. But on the whole the range of action with which the English law declines to interfere is probably as great now as it ever has been in civilized societies. The true explanation is that parliament has effectually secured for itself exclusive authority as the source of legal changes. The violent assault of Bentham on judiciary law was but the echo of the lesson taught by the English judges as to omnipotence of parliament, and thoroughly understood and accepted by popular opinion. To that is due the caution, not to say timidity, which now characterizes the judicial interpretation of statutes. The courts adhere to the literal meaning of the enactment unless compelled to open it by its too frequent absurdity or self-contradiction. If there is any way out of a difficulty which will not involve the slightest addition to the enacted law, that will be the way followed by judicial decision. This attitude is a complete reversal of that which once prevailed in the courts, when the law embodied in decided cases, pure drawn from the fountains of justice, was deemed superior in dignity to the enactments of an unlearned parliament. The tribunals, in so far as they now make law, operate much more freely on the cases than on the statutes.

The consequence of this relation of the judiciary and the legislature is that, while great reforms are no doubt accelerated, small reforms have to wait. Parliament does in a single session that which would have taken ages to accomplish under the natural agencies of equity and fiction, and much which would never have been brought about by these agencies at all. But the capacity of parliament is limited, and so is its foresight. The work of legislation is left incomplete, and the judicature carefully avoids completing it, leaving the legislature to take it up again when it may. An instance in point is the late history of the law of evidence. This portion of the law grew to maturity in the courts, whose creation it was. It has been wholly transformed by direct legislative enactments (under the influence of Benthamite principles), Act after Act being passed as occasion pointed out defects in what had already been accomplished. One of the latest Acts on the subject simply enables parties and their husbands or wives to give evidence in a certain class of indictments. The substitution of an affirmation for an oath has been carried out in the same piecemeal fashion, the courts refraining from developing the principle of the amendments, as they would have done if the movement had originated with themselves and in an earlier stage of their history. The most portentous example of the intervention of the legislature to complete the exact details of its enactments is the Act previously noticed, which orders the word "this" to be interpreted as "that." The defects of existing legislative methods in England result in some defects in the form of the law, which the tribunals are free to criticise but not to correct. An Act of Parliament bears upon its face the marks of the tumultuous discussion of a large popular assembly, and of the compromise which reconciles the opposing views of the two Houses. Very few Acts, no matter what care may be employed in framing them, are promulgated in the form best suited for actual exercise,—in the form which would be given to them by an intelligent legislator, charged with the expression of the principle which parliament is supposed to have sanctioned.

In what has been said regarding the relations of the legislature and the judicature it is not implied that the manufacture of case-law by the latter has ceased. On the contrary, it goes on with yearly increasing volume, and the immense accumulation of decided cases is one of the evils of the present state of the law. The hand of precedent never lay heavier on the conscience of the judge than it does now. The necessary literature of the law is increased by a dozen large volumes every year. The law becomes more voluminous without becoming more elastic or more systematic. The stereotyped judicial habit is to follow absolutely the precedents set by every tribunal of higher rank, and almost absolutely those set by tribunals of co-ordinate rank. A careful semi-official record has taken the place of the private reports published by lawyers privileged by the courts to take notes of their proceedings. Every case of any importance is recorded and becomes a precedent which the practising lawyer in future must know, and which the judge must follow. The minute detail into which legal literature is thus made to descend is becoming an intolerable load; and it is a question whether some revolution in respect to precedents is not becoming necessary.

Legislation by judges has its counterpart in the use legislative forms for judicial purposes. Long after gislative and judicial functions have been separated, e find legislative acts serving the purpose of judicial ecisions. The history of English law is full of examles, the best known of which is that of divorce. The ractice of passing private bills of divorce, at a time hen the technical law did not allow of that remedy, ardened into a purely judicial practice. The Act hich established the Divorce Court did not in effect more than create a new and better tribunal. So ith the General Enclosure Act, which took over from e legislature the purely judicial work of sanctioning closures in proper cases.

Comparative jurisprudence, in the sense in which it distinguishable from historical jurisprudence, can arcely be said as yet to have a separate existence. ince Leibnitz projected his youthful scheme for tabuting the laws of all the countries of the world, and chibiting their correspondence and differences by arallel columns, little or nothing has been done for the omparison of laws except in connection with history. ne special line of study does indeed use what may be lled a comparative method. The "conflict of laws" volves at least a contrast of a vast number of imortant points in which the laws of different nations isagree. The object of the study of this conflict is of e practical kind which comparative jurisprudence as ere conceived is meant to subserve. It is to develop me *rationale* of decisions where two or more discorant rules claim exclusive application to the case. here are circumstances which seem to show that the mere comparison of laws with no other object but that of discovering in how many ways the same thing can be done, and which way is the best, will enter more and more into the higher legal studies. For one thing, the vast increase which has taken place in the means of communication between nations has made a knowledge of each other's laws a matter of imperative necessity, and has broken down, at least as between the most advanced nations, that barrier of insularity which formerly shut out all suggestions of improvement from abroad. We have already emphasized the marked extent to which this exclusiveness has characterized English law, and we cannot but regard it as typical of a new temper that in preparing for the solution of important problems of legislation, the British Government not unfrequently collects from its agents abroad information as to the solution of the same problems in other countries. An important influence always tending in this direction, and greatly strengthened by the changes to which we have alluded, is that of commerce, and particularly of British commerce. England's business relations are coextensive with the world; it is a necessity of her business that she should know what view is taken of contracts and the relations arising out of them by the laws of different states. And it is becoming a necessity of the commercial class in all countries that, on fundamental points at least, the principles of law should be everywhere the same. Strenuous efforts, for instance, are now being made for the establishment of a uniform law of negotiable instruments in all countries, and with some prospect of success.

(E. R.)

LAW, John (1671–1729), best known as the origiator of what is usually called the Mississippi scheme, as born at Edinburgh in April, 1671. His father, a ldsmith and what we should now describe as banker, ought shortly before his death, which took place in is son's youth, the lands of Lauriston, near Edinurgh. John lived at home till he was twenty, and en went to London. He had already studied matheatics, and the theory of commerce and political econny, with much interest; but he was known rather as fop than as a scholar. In London he gambled, drank, d flirted till in April, 1694, a love intrigue resulted a duel. He killed his antagonist, and was arrested, ied, found guilty, and condemned to death. His life as spared, but he was detained in prison. He found eans to escape, and fled to Holland, then the greatest mmercial country in Europe. Here he observed with ose attention the practical working of banking and nancial business, and conceived the first ideas of his lebrated "system." After a few years spent in forgn travel, he returned to Scotland, then exhausted d enraged by the failure of the Darien expedition 695–1701). He propounded plans for the relief of s country in a work[1] entitled *Money and Trade Condered, with a Proposal for Supplying the Nation with oney* (1705). This attracted some notice, but had no actical effect, and Law again betook himself to wanring over the Continent. He visited Brussels, Paris, ienna, Genoa, Rome, making large sums by gambling and speculation, and spending them in a lavish and reckless manner. He was in Paris in 1708, and made some proposals to the Government as to their financial difficulties, but Louis XIV. declined to treat with a "Huguenot," and D'Argenson, chief of the police, had him expelled the city as a suspicious character. He had, however, become intimately acquainted with the duke of Orleans, and, when in 1715 the king died, and that prince became regent, Law at once returned to the French capital. The extravagant expenditure of the late monarch had plunged the kingdom into apparently inextricable financial confusion. The debt was 3 milliard livres, the estimated annual expenditure, exclusive of interest payments, 148 million livres, and the income about the same.

The advisability of declaring a national bankruptcy was seriously discussed, and though this plan was rejected, measures hardly less violent were resorted to. By a *visa*, or examination of the state liabilities by a committee with full powers of quashing claims, the debt was reduced nearly a half, the coin in circulation was ordered to be called in and reissued at the rate at 120 for 100,—a measure by which foreign coiners profited greatly; and a chamber of justice was established to punish speculators, to whom the difficulties of the state were ascribed. These measures had so little success that the *billets d'état* which were issued as part security for the new debt at once sank 75 per cent. below their nominal value. At this crisis Law came forward and unfolded a vast scheme to the perplexed regent. A royal bank was to be founded. It was to manage the trade and currency of the kingdom, to collect the taxes, and free the country from debt. The council of finance then under the duke of Noailles, opposed the plan, but the regent allowed Law to go on with part of it in a tentative way. By an edict of 2d May, 1716, a private institution called *La Banque Générale*, and managed by Law, was founded. The capital was 6 million livres, divided into 1200 shares of 5000 livres, payable in four instalments, one-fourth in cash, three-fourths in *billets d'état*. It was to perform the ordinary functions of a bank, and had power to issue notes payable at sight in the weight and value of the money mentioned at day of issue. The bank was a great and immediate success. By providing for the absorption of part of the state paper it raised to some extent the credit of the Government. The notes were a most desirable medium of exchange, for they had the element of fixity of value, which was, owing to the arbitrary mint decrees of the Government, wanting in the coin of the realm. They were also found the most convenient instruments of remittance between the capital and the provinces, and they thus developed and increased the industries of the latter. The rate of interest, previously enormous and uncertain, fell first to 6 and then to 4 per cent.; and when another decree (10th April, 1717) ordered collectors of taxes to receive notes as payment, and to change them for coin at request, the bank so rose in favor that it had soon a note issue of 60 million livres. Law now gained the full confidence of the regent, and was allowed to proceed with the development of the "system."

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[1] A work entitled *Proposals and Reasons for constituting a Coun- of Trade in Scotland* was published anonymously at Edinrgh in 1701. It was republished at Glasgow in 1751 with Law's ame attached; but several references in the state papers of the me mention William Paterson (1658–1719), founder of the Bank England, as the author of the plan therein propounded. ven if Law had nothing to do with the composition of the ork, he must have read it and been influenced by it. This ay explain how it contains the germs of many of the developents of the "system." Certainly the suggestion contained in e pamphlet of a central board, to manage great commercial ndertakings, to furnish occupation for the poor, to encourage ining, fishing, and manufactures, and to bring about a reducon in the rate of interest, is a plan which was to no inconsidrable extent actually realised in the Mississippi scheme. See annister's *Life of William Paterson* (ed. 1858), and *Writings of illiam Paterson* (2d ed., 3 vols., 1859).

The trade of the large and fertile region in North America about the Mississippi had been granted to a speculator named Crozart. He found the undertaking too large, and was glad to give it up. By a decree of August, 1717, Law was allowed to establish the *Compagnie des Indes-Occidentales*, and to endow it with privileges practically amounting to sovereignty over the most fertile region of North America. The capital was 100 millions, divided into 200,000 shares of 500 livres. The payments were to be one-fourth in coin and three-fourths in *billets d'état*. On these last the Government was to pay 3 millions livres interest yearly to the company. As the state paper was depreciated the shares fell much below par. The rapid rise of Law had made him many enemies, and they took advantage of this to attack the system. D'Argenson, the former chief of the police, and now, in succession to De Noailles, head of the council of finance, with the brothers Paris of Grenoble, famous tax farmers of the day, formed what was called the "anti-system." The farming of the taxes was let to them, under an assumed name, for 48½ million livres yearly. A company was formed the exact counterpart of the Mississippi company. The capital was the same, divided in the same manner, but the payments were to be entirely in money. The returns from the public revenue were sure; those from the Mississippi scheme were not. Hence the shares of the latter were for some time out of favor. Law proceeded unmoved with the development of his plans. On the 4th December, 1718, the bank became a Government institution under the name of *La Banque Royale*. Law was director, and the king guaranteed the notes. The shareholders were repaid in coin, and, to widen the influence of the new institution, the transport of money between towns where it had branches was forbidden. The paper issue now reached 110 millions. Law had such confidence in the success of his plans that he agreed to take over shares in the Mississippi company at par at a near date. The shares began rapidly to rise. The next move was to unite the companies *Des Indes Orientales* and *De Chine*, founded in 1664 and 1713 respectively, but now dwindled away to a shadow, to his company. The united association was called *La Compagnie des Indes*; it had practically the monopoly of the foreign trade of France. These proceedings necessitated the creation of new capital to the nominal amount of 25 million livres. The payment was spread over 20 months. It required four of the old shares and a premium of 50 livres to obtain a new one. All these 500 livre shares rapidly rose to 750, or 50 per cent. above par. Law now turned his attention to the obtaining of additional powers within France itself. On the 25th July, 1719, an edict was issued granting the company for nine years the management of the mint and the coin issue. For this privilege the company paid 5 million livres, and the money was raised by a new issue of shares of the nominal value of 500 livres, but with a premium of other 500. The list was only open for twenty days, and five of the former shares were required to obtain a new one. At the same time two dividends per annum of 6 per cent. each were promised. Again there was an attempt to ruin the bank by the commonplace expedient of making a run on it for coin; but the conspirators had to meet absolute power managed with fearlessness and skill. An edict appeared reducing, at a given date, the value of money, and those who had withdrawn coin from the bank hastened again to exchange it for the more stable notes. Public confidence in Law was increased, and he was enabled rapidly to proceed with the completion of the system. A decree of 27th August, 1719, deprived the rival company of the farming of the revenue, and gave it to the *Compagnie des Indes* for nine years in return for an annual payment of 52 million livres. Thus at one blow the anti-system was crushed. One thing yet remained; Law proposed to take over the national debt, and manage it on terms advantageous to the state. The mode of transfer was this. The debt was over 1500 million livres. Notes were to be issued to that amount, and with these the state creditors were to be paid in a certain order. Shares were to be issued at intervals corresponding to the payments, and it was expected that the notes would be used in buying these. The Government was to pay 3 per cent. for the loan. It had formerly been bound to pay 80 millions, it would now pay under 50, a clear gain of over 30. As the shares of the company were almost the only medium for investment, the transfer would be surely effected. The creditors would now look to the Government payments and the commercial gains of the company for their annual returns. Indeed the creditors were often not able to procure the shares, for each succeeding issue was immediately seized upon. The third, on the 2d October, for 500 millions, divided into shares of (with premium) 5000 livres each, was taken up as eagerly as its predecessors, and the shares immediately resold at 8000 livres in the Rue Quincampoix, then used as a bourse. They went on rapidly rising as new privileges were still granted to the company. Law had now more than regal power. The exiled Stuarts paid court to him; the proudest aristocracy in Europe humbled themselves before him; and his liberality made him the idol of the populace. After, as a necessary preliminary becoming a Catholic, he was made controller-general of the finances in place of D'Argenson, who was removed to make way for him. Finally, in February, 1720, the bank was in name as well as in reality united to the company.

The system was now complete; but it had already begun to decay. In December, 1719, it was at its height. The shares then had mounted to 20,000 livres, forty times their nominal price. A sort of madness possessed the nation. Men sold their all, and hastened to Paris to speculate. The population of the capital was increased by an enormous influx of provincials and foreigners. Trade received a vast though unnatural impulse. Everybody seemed to be getting richer, no one poorer. Those who could still reflect saw that this prosperity was not real. The whole issue of shares at the extreme market price valued 12 milliard livres. It would require 500 million annual revenue to give a 5 per cent. dividend on this. Now, the whole income of the company as yet was hardly sufficient to pay 5 per cent. on the original capital of 1 milliard 677 million livres. The receipts from the taxes, etc., could be precisely calculated, and it would be many years before the commercial undertakings of the company—with which only some trifling beginning had been made—would yield any considerable return. People began to sell their shares, and to buy coin, houses, land,—anything that had a stable element of value in it. There was a rapid fall in the shares, a rapid rise in all kinds of property, and consequently a rapid depreciation of the paper money. Law met these new tendencies by a succession of the most violent edicts. The notes were to bear a premium over specie. Coin was only to be used in small payments, and only a small amount was to be kept in the possession of private parties. The use of diamonds, the fabrication of gold and silver plate, was forbidden. A dividend of 40 per cent. on the original capital was promised, By several ingenious but fallaciously reasoned pamphlets Law endeavored to restore public confidence. The shares still fell. At last, on the 5th March, an edict appeared fixing the price of these at 9000 livres, and ordering the bank to buy and sell them at that price. The fall now was transferred to the notes, of which there were soon over 2½ milliard livres in circulation. A large proportion of the coined money was removed from the kingdom. Prices rose enormously. There was everywhere distress and complete financial confusion. Law became an object of popular hatred. He lost his court influence, and was obliged to consent to a decree (21st May, 1720) by which the notes and consequently the shares were reduced to half their nominal value. This created such a commotion that its promoters were forced to recall it, but the mischief was done. What confidence could there be in the depreciated paper after such a measure? Law was removed from his office, and his enemies proceeded to demolish the system. A vast number of shares had been deposited in the bank. These were destroyed. The notes were reconverted into Government debt, but there was first a *visa* which reduced that debt to the same size as before it was taken over by the company. The rate of interest was lowered, and the Government now only pledged itself to pay 37 instead of 80 millions annually. Finally the bank was abolished, and the company reduced to a mere trading association. By November the system had disappeared. With these last measures Law, it may well be believed, had nothing to do. He left France secretly in December, 1720, resumed his wandering life, and died at Venice, poor and forgotten, 21st March, 1729.

Of Law's writings the most important for the comprehension of the "system" is his *Money and Trade Considered*. In this work he says that national power and wealth consist in numbers of people, and magazines of home and foreign goods. These depend on trade, and that on money, of which a greater quantity employs more people; but credit, if the credit have a circulation, has all the beneficial effects of money. To create and increase instruments of credit is the function of a bank. Let such be created, then, and let its notes be only given in return for land sold or pledged. Such a currency would supply the nation with abundance of money; and it would have many advantages, which Law points out in detail, over silver. The bank or commission was to be a Government institution, and its profits were to be spent in encouraging the export and manufacture of the nation. A very evident error lies at the root of the system. Money is not the result but the cause of wealth, he thought. To increase it then must be beneficial, and the best way is by a properly secured paper currency. This is the motive force; but it is to be applied in a particular way. Law had a profound belief in the omnipotence of Government. He saw the evils of minor monopolies, and of private farming of taxes. He proposed to centre foreign trade and internal finance in one huge monopoly managed by the state for the people, and carrying on business through a plentiful supply of paper money. He did not see that trade and commerce are best left to private enterprise, and that such a scheme would simply result in the profits of speculators and favorites. The system indeed was never so far developed as to exhibit its inherent faults. We have already seen how the madness of speculators ruined the plan when only its foundations were laid. One part indeed might have been saved. The bank was not necessarily bound to the company, and had its note issue been retrenched it might have become a permanent institution. As M. Thiers points out, the edict of 5th March, 1720, which made the shares convertible into notes, ruined the bank without saving the company. The shares had risen to an unnatural height, and they should have been allowed to fall to their natural level. Perhaps Law felt this to be impossible. He had friends at court whose interests were involved in the shares, and he had enemies eager for his overthrow. It was necessary to succeed completely or not at all; so Law risked and lost everything. Notwithstanding the faults of the system, it cannot be denied that its author was a financial genius of the first order. He had the errors of his time; but his writings show that he first propounded many truths as to the nature of currency and banking then unknown to his contemporaries. The marvellous skill which he displayed in adapting the theory of the system to the actual condition of things in France, and in carrying out the various financial transactions rendered necessary by its development, is absolutely without parallel. His profound self-confidence and belief in the truth of his own theories were the reasons alike of his success and his ruin. He never hesitated to employ the whole force of a despotic Government for the definite ends which he saw before him. He was not self-seeking. He left France poorer than he entered it, nor was he perceptibly changed by his sudden transitions of fortune. Montesquieu visited him at Venice after his fall, and has left a description of him not without a certain touch of pathos. Law, he tells us, was still the same in character, perpetually planning and scheming, and, though in poverty, revolving vast projects to restore himself to power, and France to commercial prosperity.

The best account of the Mississippi scheme is that of Thiers, "Law et son système des Finances," first published in the *Encyclopédie progressive*, Paris, 1826; there is an American translation, New York, 1859. See also Heymann, *Law und sein System*, Munich, 1853; E. Levasseur, *Recherches historique sur le système de Law*, Paris, 1854; and Jobez, *Une préface au Socialisme, ou le système de Law et la chasse aux capitalistes*, Paris, 1848. Full biographical details are given in Wood's *Life of Law*, Edinburgh, 1824. All Law's later writings are to be found in Daire, *Collection des Principaux Economistes*, vol. i., Paris, 1843. (F. WA.)

LAW, William (1686–1761). The events of the life of this remarkable man may be very briefly stated. He was born in 1686 at King's Cliffe; in 1705 he entered as a sizar at Emmanuel College, Cambridge; in 1711 he was elected fellow of his college and received holy orders, and in 1712 he took his M. A. degree. He resided at Cambridge, taking pupils and occasional duty until the accession of George I., when his conscience forbade him to take the oaths of allegiance to the new Government and of abjuration of the Stuarts; his staunch Jacobitism had already been betrayed in a tripos speech which brought him into trouble; and he was now deprived of his fellowship, and became a non-juror. For the next few years he is said to have been a curate in London, but the point is doubtful. In 1727 we find him domiciled at Putney as tutor to Edward Gibbon, father of the historian, and "the much honored friend and spiritual director of the whole family" (Gibbon, *The Memoirs of my Life and Writings*). In the same year he accompanied his pupil to Cambridge, and resided with him as governor, in term time, for the next four years. His pupil then went abroad, but Law was left at Putney, where he remained in Mr. Gibbon's house for more than ten years, acting as a religious guide not only to the family but to a number of pious men who used to make pilgrimages to consult the Putney sage. The most eminent of these were the two brothers John and Charles Wesley, Dr. Byrom the poet, Dr. Cheyne the famous physician, and Mr. Archibald Hutcheson, M. P. for Hastings. In 1737 Mr. Gibbon the elder died, and the household was, a short time afterwards, dispersed. Law therefore was parted from his friends, leaving behind him, the historian tells us, "in our family the reputation of a worthy and pious man, who believed all that he professed, and practised all that he enjoined." In 1740 Law retired to his native village, where he had inherited from his father a house and a small property. There he was presently joined by two ladies, Mrs. Hutcheson, the rich widow of his old friend, who recommended her on his death-bed to place herself under Law's spiritual guidance, and Miss Hester Gibbon, sister to his late pupil. This curious trio lived for twenty-one years a life wholly given to devotion and charity, until the death of Law in 1761.

Such was the singularly uneventful life of this good man; but during the whole period from the time when he became a non-juror almost to the day of his death he was busily engaged in literary work which places him in the very first rank of 18th century divines. As a writer, it will be convenient to consider him under three heads.

1. As a singularly able controversialist. The first of his controversial works was *Three Letters to the Bishop of Ban-*

gor (1717), which were considered both by friend and foe as one of the most powerful contributions to the Bangorian controversy on the High Church side. Dean (afterwards Bishop) Sherlock declared that "Mr. Law was a writer so considerable that he knew but one good reason why his lordship did not answer him." Law's next controversial work was *Remarks on Mandeville's Fable of the Bees* (1723), in which he vindicates morality on the highest grounds; for pure style, caustic wit, and lucid argument this is a perfect gem; it was enthusiastically praised by John Sterling, and has been republished by F. D. Maurice. Law's *Case of Reason* (1732), in answer to Tindal's *Christianity as Old as the Creation*, is to a great extent an anticipation of Bishop Butler's famous argument in the *Analogy*. In this work Law shows himself at least the equal of the ablest champion of Deism. His *Letters to a Lady inclined to enter the Church of Rome* are excellent specimens of the attitude which a High-Churchman maintains against Romanism.

2. As a very effective writer on practical divinity. The *Serious Call to a Devout and Holy Life* (1729), together with its predecessor, *A Treatise of Christian Perfection* (1726), deeply influenced the chief actors in the great Evangelical revival. The Wesleys, Whitefield, Venn, Scott, and Adam all express their deep obligation to the author. The *Serious Call* affected others quite as deeply. Dr. Johnson, Gibbon, Lord Lyttleton, and Bishop Horne all speak enthusiastically of its merits; and it has been, until lately, perhaps the only work by which its author was popularly known. In a tract entitled *The Absolute Unlawfulness of Stage Entertainments*, Law, unlike himself, was tempted by the undoubted corruptions of the stage of the period to use language which transcends the bounds of reason.

3. As one of the few English mystics. Though the least popular, by far the most interesting, original, and suggestive of all Law's works are those which he wrote in his later years, after he had become an enthusiastic admirer (not a disciple) of Jacob Boehme, the Teutonic theosopher. From his earliest years he had been deeply impressed with the piety, beauty, and thoughtfulness of the writings of the Christian mystics, but it was not till after his accidental meeting with the works of Boehme, about 1734, that pronounced mysticism appears in his works. It would far transcend the limits of this article to describe, however briefly, the purport of Law's mystic writings. All are very beautiful; some are wild and fanciful; but not one of them is inconsistent with his position as a churchman, and even a very high churchman of the spiritual type. The titles of the works written by Law in his mystic stage are *A Demonstration of the Gross and Fundamental Errors of a late Book called a "Plain Account, etc., of the Lord's Supper,"* 1737; *An Appeal to all that Doubt and Disbelieve the Truths of Revelation*, 1739; *The Grounds and Reason of Christian Regeneration*, 1739; *An Earnest and Serious Answer to Dr. Trapp's Sermon on being Righteous Overmuch*, 1740; *The Spirit of Prayer*, 1749, 1752; *The Way to Divine Knowledge*, 1752; *The Spirit of Love*, 1752, 1754; *A Short but Sufficient Confutation of Dr. Warburton's Projected Defence* (*as he calls it*) *of Christianity in his Divine Legation of Moses*, 1757; *A Series of Letters*, 1760; a *Dialogue between a Methodist and a Churchman*, 1760; and *An Humble, Earnest, and Affectionate Address to the Clergy*, 1761.

Mr. R. Tighe wrote a short account of Law's life at the beginning of this century. Mr. C. Walton printed for private circulation *Notes and Materials for a Complete Biography of W. Law*, in 1848; Mr. Leslie Stephen in his *English Thought in the 18th Century*, Mr. Lecky in his *History of England in the 18th Century*, and Mr. Abbey in *The English Church in the 18th Century*, all give sketches of Law's life, character, and works; and Mr. Overton has devoted a volume to him, entitled *William Law, Non-juror and Mystic*, 1881.

LAWES, Henry (1595–1662), a prominent member of the school of early English musicians, which culminated in Purcell, and was nipped in the bud by his early death, was born at Dinton in Wiltshire in December, 1595, and received his musical education from John Cooper, better known under his Italian pseudonym Giovanni Coperario, a famous composer of the day. In 1626 he was received as one of the gentlemen of the chapel royal, which place he held till the Commonwealth put a stop to church music. But even during that songless time Lawes continued his work as a composer, and the famous collection of his vocal pieces, *Ayres and Dialogues for One, Two, and Three Voyces*, was published in 1653, being followed by two other books under the same title in 1655 and 1658 respectively. When in 1660 the king returned, Lawes once more entered the royal chapel, and composed an anthem for the coronation of Charles II. His death took place October 11, 1662. Lawes's name has become known beyond musical circles by his friendship with Milton, whose *Comus* he supplied with incidental music for the performance of the masque in 1634. The poet in return immortalized his friend in the famous sonnet beginning:—

> Harry, whose tuneful and well-measured song
> First taught our English music how to span
> Words with just note and accent, not to scan
> With Midas' ears, committing short and long.

In these lines, Milton, with a musical perception not common amongst poets, exactly indicates the great merit of Lawes, which distinguishes his compositions from those of many of his contemporaries and successors. His careful attention to the words of the poet, the manner in which his music seems to grow from those words, the perfect coincidence of the musical with the metrical accent, all put Lawes's songs on a level with those of Schumann or Liszt or any modern composer. At the same time he is by no means wanting in genuine melodic invention, and his concerted music shows the learned contrapuntist.

LAWN TENNIS. See Tennis.

LAW OF NATIONS. See International Law.

LAWRENCE, a city of Kansas, U. S., the capital of Douglas county, is situated on both sides of the Kansas river, about 40 miles above its junction with the Missouri. Founded in 1854 by the Massachusetts Emigrant Aid Society as a centre of the anti-slavery party, Lawrence was at first retarded in its development by the disturbed condition of the State; but its population has rapidly increased from 1645 in 1860 to 8510 in 1880, and it is now the fourth city in the State in population and wealth. It is a considerable railway junction, has a good trade, and numbers among its manufacturing establishments a pork-packing factory, planing-mills, foundries, carriage works, grist-mills, and breweries. A dam has been constructed across the Kansas. In 1862–63 the State University was settled at Lawrence, the buildings occupying a fine site on Mount Oread, a bluff in the south-west part of the city; in 1880 it had 14 teachers and 438 students. In 1856 Lawrence was sacked and partially burned by a party of soldiers and Missourians claiming to act with the sanction of the U. S. Government, and in 1863, during the civil war, it was captured and burned by a Confederate guerilla force.

LAWRENCE, a city of Massachusetts, U. S., one of the county seats of Essex county, 26 miles by rail north of Boston, on the Merrimack, about 35 miles from its mouth. The greater part lies on the north side of the river, to the west of the Spicket. Lawrence is emphatically a manufacturing town, and its rise and rapid development are mainly due to the abundant water-power supplied by the dam across the Merrimack and distributed by a canal a mile long and 14 feet deep. This is the property of the Essex Company, which was incorporated in 1845, and spent $250,000 on the construction of the dam—a piece of granite masonry 1629 feet in length. The Bay State Woollen Mills (capital $2,000,000) and the Atlantic Cotton Mills (capital $1,800,000), both chartered in 1846, were the first great establishments to take advantage of the position. The Lawrence Duck Company and the Pacific Mills (capital $300,000 and $2,500,000) followed in 1853; the Washington Mills ($1,650,000), taking the place of the Bay State, in 1858; the Everett ($800,000) and the Pemberton Mills ($450,000) in 1860, the Lawrence Woollen Company in 1863, the Arlington in 1865. There are now eight large "corporations," the largest of which, the Pacific Mills, alone employs 5800 operatives, and produces weekly 1,500,000 yards of cloth, printed or dyed. In 1880 the total number of looms in the cotton and woollen mills was 10,460, of spindles 345,988, and of operatives 12,124; and it is calculated that the average rate of production is 28,800,000 yards per week. The goods are of a varied description—broad cloth, fine flannels, shawls, pantaloon stuffs, felts, ticks, ginghams, etc. There are a number of large paper-mills in the town, as well as establishments for the manufacture of steam-engines, carriages, sewing machines, cordage, earthenware. Among the principal buildings and institutions may be mentioned the city hall (erected in 1847), the county court-house, the opera-house, the Oliver grammar school, and a public library (22,000 volumes). There are three public parks, one (17½ acres) in the heart of the city. Water works, deriving their supplies from the Merrimack, were opened in 1876 at a cost of $1,700,000; the people had previously depended on wells and cisterns for drinking water. The population in 1850 was 8232; in 1860, 17,669; in 1870, 28,921; in 1880, 39,151. Lawrence, so-called in honor of the Lawrence family of Boston, was incorporated as a town in 1847, and attained the rank of a city in 1853.

LAWRENCE (LAURENTIUS, LORENZO), ST., according to Pope Leo the Great, whose account is that given also in the Roman Breviary, was a deacon, who in a time of persecution had been called on by the magistrate to give up the treasures committed to his keeping, and who thereupon had produced the church's poor, who were his special charge. Next, for his firmness in refusing to renounce Christ, he was subjected to scourging and laceration, and finally roasted to death on a gridiron. The later accounts of the martyrologists are much more circumstantial. According to these, Lawrence was a native of Huesca in Spain, but at a very early age had gone to Rome, where for his meekness and blamelessness he was chosen archdeacon by Pope Sixtus II., and intrusted with the treasures of the church, consisting of vestments, plate, and a little money. Sixtus, having (in the reign of Valerian) been denounced as a Christian, was imprisoned and sentenced to death, whereupon Lawrence addressed to him the words which now form one of the antiphons in the office for St. Lawrence's day (August 10): "Whither goest thou, O my father! without thy son and servant?" To this the pope replied with a prophecy that in three days Lawrence the Levite should follow Sixtus the priest. At the same time Lawrence was directed to distribute the church treasures among the poor, and so prevent them from falling into the hands of the persecutor. When under the cruel punishment to which he was at last condemned for his steadfastness, he is said to have triumphed over the tyrant by the famous ironical speech—"Assatus est; jam versa et manduca." The fact of the martyrdom of St. Lawrence seems to be well established, the most probable date being August 10, 258. The earliest extant mention of the event occurs in the writings of St. Ambrose. Lawrence and his martyrdom have been favorite subjects for artistic treatment. Nuremberg, Genoa, and the Escorial are under his patronage.

LAWRENCE, JOHN LAIRD MAIR LAWRENCE, BARON (1811–1879), viceroy and governor-general of India, was born at Richmond, Yorkshire, 24th March, 1811. His father, Colonel Alexander Lawrence, volunteered the forlorn hope at Seringapatam in presence of Baird and of Wellington, whose friend he became. His mother, Letitia Knox, was a collateral descendant of John Knox. To this couple were born twelve children, of whom three became famous in India, Sir George St. Patrick, Sir Henry (noticed below), and Lord Lawrence. Irish Protestants, the boys were trained at Foyle College, Derry, and at Clifton, and received commissions from their mother's cousin, Mr. Huddleston, who had been the friend of Schwartz in Tanjore. In 1829, when only seventeen, John Lawrence landed at Calcutta; he mastered the Persian language at the college of Fort William, and was sent to Delhi, on his own application, as assistant to the collector. The position was the most dangerous and difficult to which a Bengal civilian could be appointed at that time. The titular court of the pensioner who represented the Great Mogul was the centre of that disaffection and sensuality which found their opportunity in 1857. A Mussulman rabble filled the city. The district around, stretching from the desert of Rajpootana to the Jumna, was slowly recovering from the anarchy to which Lord Lake had given the first blow. When not administering justice in the city courts or under the village tree, John Lawrence was scouring the country after the marauding Meos and Mohammedan freebooters. His keen insight and sleepless energy at once detected the murderer of his official superior, William Fraser, in 1835, in the person of the nawab of Loharu, whose father had been raised to the principality by Lake, and the assassin was executed. The first twenty years, from 1829 to 1849, during which John Lawrence acted as the magistrate and land revenue collector of the most turbulent and backward portion of the Indian empire as it then was, formed the period of the reforms of Lord William Bentinck. To what is now the lieutenant-governorship of the North-Western Provinces Lord Wellesley had promised the same permanent settlement of the land-tax which Lord Cornwallis had made with the large landholders or zemindars of Bengal. The court of directors, going to the opposite extreme, had sanctioned leases for only five years, so that agricultural progress was arrested. In 1833 Mertins Bird and Thomason introduced the system of thirty years' leases based on a careful survey of every estate by trained civilians, and on the mapping of every village holding by native subordinates. These two revenue officers created a school of enthusiastic economists who rapidly registered and assessed an area as large as that of Great Britain, with a rural population of twenty-three millions. Of that school John Lawrence proved the most ardent and the most renowned. Intermitting his work at Delhi, he became land revenue settlement officer in the district of Etawah, and there began, by buying out or getting rid of the talukdars, to realize the ideal which he did much to create throughout the rest of his career—a country "thickly cultivated by a fat contented yeomanry, each man riding his own horse, sitting under his own fig-tree, and enjoying his rude family comforts." This and a quiet persistent hostility to the oppression of the people by their chiefs formed the two features of his administrative policy throughout life.

It was fortunate for the British power that when the first Sikh war broke out John Lawrence was still collector of Delhi. The critical engagements at Firozsháh, following Mudki, and hardly redeemed by Aliwál, left the British army somewhat exhausted at the gate of the Punjab, in front of the Sikh entrenchments on the Sutlej. For the first seven weeks of 1846 there poured into camp, day by day, the supplies and munitions of war which this one man raised and pushed forward, with all the influence acquired during fifteen years of an iron yet sympathetic rule in the land between the Sutlej and the Jumna. The crowning victory of Sobraon was the result, and at thirty-five Lawrence became commissioner of the Jalandhar Doab, the fertile belt of hill and dale stretching from the Sutlej north to the Indus. The still youthful civilian did for the newly annexed territory what he had long before accomplished in and around Delhi. He restored it to order, without one regular soldier. By the fascination of his personal influence he organized levies of the Sikhs who had just been defeated, led them now against a chief in the upper hills and now to storm the fort of a raja in the lower, till he so welded the people into a loyal mass that he was ready to repeat the service of 1846 when, three years after, the second Sikh war ended in the conversion of the Punjab up to Peshawar into a British province.

The marquis of Dalhousie had to devise a government for a warlike population now numbering twenty-three millions, and covering an area little less than that of the United Kingdom. The first results were not hopeful (see next article), and it was not till John Lawrence became chief commissioner, and stood alone face to face with the chiefs and people and ring fence of still untamed border tribes, that there became possible the most successful experiment in the art of civilizing turbulent millions which history presents. The province was mapped out into districts, now numbering thirty-two, in addition to thirty-six tributary states, small and great. To each the thirty years' leases of the north-west settlement were applied, after a patient survey and assessment by skilled officials ever in the saddle or the tent. The revenue was raised on principles so fair to the peasantry that Ranjit Singh's exactions were reduced by a fourth, while agricultural improvements were encouraged. For the first time in its history since the earliest Aryan settlers had been overwhelmed by successive waves of invaders, the soil of the Punjab came to have a marketable value, which every year of British rule has increased. A stalwart police was organized; roads were cut through every district, and canals were constructed. Commerce followed on increasing cultivation and communications, courts brought justice to every man's door, and crime hid its head. The adventurous and warlike spirits, Sikh and Mohammedan, found a career in the new force of Irregulars directed by the chief commissioner himself under the governor-general, while Dost Mohammed kept within his own fastnesses, and the long extent of frontier at the foot of the passes was patrolled. In the brilliance of his later services to his country, this, the first, which alone rendered those possible, has not yet received justice.

Seven years of such work prepared the lately hostile and always anarchic Punjab under such a pilot as John Lawrence not only to weather the storm of 1857 but to lead the older provinces into port. On the 12th May the news of the tragedies at Meerut and Delhi reached him at Rawal Pindi. The position was critical in the last degree, for of 50,000 native soldiers 38,000 were Hindustanis of the very class that had mutinied elsewhere, and the British troops were few and scattered. For five days the fate of the Punjab hung upon a thread, for the question was, Could the 12,000 Punjabis be trusted and the 38,000 Hindustanis be disarmed? Not an hour was lost in beginning the disarming at Lahore; and, as one by one the Hindustani corps succumbed to the epidemic of mutiny, the sepoys were deported or disappeared, or swelled the military rabble in and around the city of Delhi. The remembrance of the ten years' war which had closed only in 1849, a bountiful harvest, the old love of battle, the offer of good pay, but, above all, the personality of Lawrence and his officers, raised the Punjabi force into a new army of 59,000 men, and induced the non-combatant classes to subscribe to a 6 per cent. loan. Delhi was invested, but for three months the rebel city did not fall. Under John Nicholson, Lawrence sent on still more men to the siege, till every available European and faithful native soldier was there, while a movable column swept the country, and the border was kept by an improvised militia. At length, when even in the Punjab confidence became doubt, and doubt distrust, and that was passing into disaffection, John Lawrence was ready to consider whether we should not give up the Peshawar valley as a last resource, and send its garrison to recruit the force around Delhi. Another week and that must have been faced. But on the 20th September the city and palace were again in British hands, and the chief commissioner and his officers united in ascribing "to the Lord our God all the praise due for nerving the hearts of our statesmen and the arms of our soldiers." As Sir John Lawrence, Bart., G. C. B., with the thanks of parliament, the gratitude of his country, and a life pension of £2000 a year in addition to his ordinary pension of £1000, the "Saviour of India" returned home in 1859. While guarding the interests of India and its people as a member of the secretary of state's council, he was sent out again in 1864 as viceroy and governor-general on the resignation and death of Lord Elgin. At what appeared to be a critical time on the Punjab frontier Lord Palmerston recommended for the office the first civilian, not a peer, who has filled the governor-general's seat since Warren Hastings. If no great crisis enabled him to increase the lustre of his reputation, his five years' administration of the whole Indian empire was worthy of the ruler of the Punjab. His foreign policy has become a subject of imperial interest; his internal administration was remarkable for financial prudence, a jealous regard for the good of the masses of the people and of the British soldiers, and a generous interest in education, especially in its Christian aspects.

When in 1854 Dost Mohammed Khan, weakened by the antagonism of his brothers in Kandahar, and by the interference of Persia, sent his son to Peshawar to make a treaty, Sir John Lawrence was opposed to any entangling relation with the Afghans after the experience of 1838–42, but he obeyed Lord Dalhousie so far as to sign a treaty of perpetual peace and friendship. His ruling idea, the fruit of long and sad experience, was that *de facto* powers only should be recognized beyond the frontier. When in 1863 Dost Mohammed's death let loose the factions of Afghanistan he acted on this policy to such an extent that he recognized both the sons, Afzul Khan and Shere Ali, at different times, and the latter fully only when he had made himself master of all his father's kingdom. The steady advance of Russia from the north, notwithstanding the Gortchakoff circular of 1864, led to severe criticism of this cautious "buffer" policy which he justified under the term of "masterly inactivity." But he was ready to receive Shere Ali in conference, and to aid him in consolidating his power after it had been established and maintained for a time, when his term of office came to an end and it fell to Lord Mayo, his successor, to hold the Ambala conference in 1869. When, nine years after, the second Afghan war was precipitated, the retired viceroy gave the last days of his life to an unsparing exposure, in the House of Lords and in the press, of a policy which he had striven to prevent in its inception, and which he did not cease to denounce in its course and consequences.

On his final return to England early in 1869, after forty years' service in and for India, "the great proconsul of our English Christian empire" was created Baron Lawrence of the Punjab, and of Grately, Hants. He assumed the same arms and crest as those of his brother Henry, with a Pathan and a Sikh trooper as supporters, and took as his motto "Be ready," his brother's being "Never give in." For ten years he gave himself to the work of the London school board, of which he was the first chairman, and of the Church Missionary Society. Latterly his eyesight failed, and on the 27th June, 1879, he died at the age of sixty-eight. He was buried in the nave of Westminster Abbey, beside Clyde, Outram, and Livingstone. He married the daughter of the Rev. Richard Hamilton, Harriette Katherine, C. I., who survived him; and he was succeeded by his eldest son, John Hamilton, born in 1846.

Beyond numerous minutes and reports, written in plain and trenchant English, and occasional letters, Lord Lawrence published nothing. These, the printed *Summaries of Affairs* during his term of office as viceroy, the *Friend of India* from 1856 to 1870, the evidence which he gave before the East Indian Finance Committee of the House of Commons in June and July, 1873, and the *Causes of the Afghan War*, edited by Sir Arthur Hobhouse, are the authorities for his life, until the memoir appears which Mr. Bosworth Smith is preparing. (G. SM.)

LAWRENCE, Sir Henry Montgomery (1806–1857), one of the greatest military statesmen of India, and provisional governor-general in the mutiny of 1857, was born at Matura, Ceylon, on 28th June. 1806 (see last article). He inherited his father's stern devotion to duty and Celtic impulsiveness, tempered by his mother's gentleness and power of organization. Early in 1823 he joined the Bengal Artillery at the Calcutta suburb of Dum Dum where also Havelock was stationed about the same time. The two officers pursued a very similar career, and developed the same Puritan character up to the time that both passed away at Lucknow in 1857. In the first Burmese war Henry Lawrence and his guns formed part of the Chittagong column which General Morrison led over the jungly hills of Arakan, till fever decimated the officers and men, and the lieutenant found himself at home again, wasted by a disease which never left him. On his return to India with his younger brother John in 1829 he was appointed revenue surveyor by Lord William Bentinck. At Gorakhpur the wonderful personal influence which radiated from the young officer formed a school of attached friends and subordinates who were always eager to serve under him. After some years spent in camp, during which he had married his cousin Honoria Marshall, and had surveyed every village in four districts each larger than Yorkshire, he was recalled to a brigade by the outbreak of the first Afghan war towards the close of 1838. As assistant to Sir George Clerk, he now added to his knowledge of the people political experience in the management of the district of Firozpur; and when disaster came he was sent to Peshawar in order to push up supports for the relief of Sale and the garrison of Jalalabad. The war had been begun under the tripartite treaty signed at Lahore on 20th June, 1838. But the Sikhs were slow to play their part when the calamities in Afghanistan made it possible that the British might be driven south of the Jumna. No one but Henry Lawrence could manage the disorderly contingent which they reluctantly supplied to Pollock's avenging army in 1842. He helped to force the Khyber Pass on 5th April, playing his guns from the heights, for eight and twenty miles. In recognition of his services Lord Ellenborough appointed him to the charge of the charming valley of Dehra Dun and its hill stations, Mussuri and Landaur, where he first formed the idea of asylums for the children of European soldiers. After a month's experience there it was discovered that the coveted appointment was the legal right of the civil service, and he was transferred, as assistant to the envoy at Lahore, to Ambala, where he reduced to order the lapsed territory of Kaithal. Soon he received the well-paid office of resident at the protected court of Nepal, amid the rest of which, assisted by his noble wife, he began a series of contributions to the *Calcutta Review*, a selected volume of which forms an Anglo-Indian classic. There, too, he elaborated his plans which resulted in the erection and endowment of the noblest philanthropic establishments in the East—the Lawrence military asylums at Sanáwar (on the road to Simla), at Murree in the Punjab, at Mount Abu in Rajputana, and on the Madras Nilgiris. From 1844 to his death he devoted all his comparatively large income, above a modest pittance for his children, to this and other forms of catholic Christian charity.

The *Review* articles led the new governor-general, Lord Hardinge, to summon Lawrence to his side during the first Sikh war; and not these articles only. He had published the results of his experience of Sikh rule and soldiering in a vivid work, the *Adventures of an Officer in the Service of Ranjit Singh* (1845), in which he vainly attempted to disguise his own personality and exploits. For the next four years he virtually became Ranjit Singh's successor in the government of the Punjab. After the doubtful triumphs of Mudki and Firozshah, Lawrence was summoned from Nepal to take the place of the heroic Major George Broadfoot, who had fallen. Aliwal came; then the guns of Sobraon chased the demoralized Sikhs across the Sutlej. All through the smoke Lawrence was at the side of the chivalrous governor-general. He gave his voice, not for the rescue of the people from anarchy by annexation, but for the reconstruction of the Sikh government, and was himself appointed resident at Lahore, with power "over every department and to any extent" as president of the council of regency till the maharaja Dhalip Singh should come of age. Soon disgusted by the "venal and selfish durbar" who formed his Sikh colleagues, he summoned to his side assistants like Nicholson, James Abbott, and Edwardes, till they all did too much for the people, as he regretfully confessed. But "my chief confidence was in my brother John, . . . who gave me always such help as only a brother could." Wearied out, he went home with Lord Hardinge, and was made K. C. B., when the second Sikh war summoned him back at the end of 1848 to see the whole edifice of Sikh "reconstruction" collapse. It fell to the marquis of Dalhousie to proclaim the Punjab up to the Khyber British territory on 29th March, 1849. But still another compromise was tried. As the best man to reconcile the Sikh chiefs to the inevitable, Henry Lawrence was made president of the new board of administration with charge of the political duties, and his brother John was entrusted with the finances. John could not find the revenue necessary for the rapid civilization of the new province so long as Henry would, for political reasons, insist on granting life pensions and alienating large estates to the needy and sensual remnants of Ranjit Singh's court. Lord Dalhousie delicately but firmly removed Sir Henry Lawrence to the charge of the great nobles of Rajputana, and installed John as chief commissioner. If resentment burned in Henry's heart, it was not against his younger brother, who would fain have retired. To him he said, "If you preserve the peace of the country and make the people high and low happy, I shall have no regrets that I vacated the field for you."

In the comparative rest of Rajputana he once more took up the pen as an army reformer. In March and September, 1856, he published two articles, called forth by conversations with Lord Dalhousie at Calcutta, whither he had gone as the hero of a public banquet. The governor-general had vainly warned the home authorities against reducing below 40,000 the British garrison of India even for the Crimean campaigns, and had sought to improve the position of the sepoys. Lawrence pointed out the latent causes of mutiny, and uttered warnings only to be too soon justified. In March, 1857, he yielded to Lord Canning's request that he should then take the helm at Lucknow, but it was too late. In ten days his magic rule put down administrative difficulties indeed, as he had done at Lahore. But what could even he effect with only 700 European soldiers, when the epidemic spread after the Meerut outbreak of mutiny on 10th May? In one week he had completed those preparations which made the defence of the Lucknow residency for ever memorable. Amid the deepening gloom Lord Canning ever wrote home of him as "a tower of strength," and he was appointed provisional governor-general. On the 30th May mutiny burst forth in Oudh, and he was ready. On 29th June, pressed by fretful colleagues, and wasted by unceasing toil, he led 336 British soldiers with 11 guns and 220 natives out to Chinhat to reconnoitre the insurgents, when the natives joined the enemy and the residency was besieged. On 2d July, as he lay exhausted by the day's work and the terrific heat in an exposed room, a shot struck him, and in forty-eight hours he was no more. A baronetcy was conferred on his son. A marble statue was placed in St. Paul's as the national memorial of one who has been declared to be the noblest man that has lived and died for the good of India.

The authorities for his career, besides his own writings above mentioned, are his *Life* by Sir Herbert Edwardes (vol. i.) and Herman Merivale (vol. ii.), and the *Mutiny Papers* (1857–58) published by Parliament. His form was tall, spare, and wasted, as is best seen in the engraving from a Lucknow photograph prefixed to Rees's *Personal Narrative of the Siege*. (G. SM.)

LAWRENCE, Sir Thomas (1769–1830), was born at Bristol on the 4th of May, 1769. His father was an innkeeper first at Bristol and afterwards at Devizes, and at the age of six Thomas was already shown off to the guests of the Black Boar as an infant prodigy who could sketch their likenesses and declaim speeches from Milton. In 1779 the elder Lawrence had to leave Devizes, having failed in business, and the precocious talent of the son, who had gained a sort of reputation along the Bath road, became the support of the family. His debut as a crayon portrait painter was made at Oxford, where he was well patronized, and in 1782 the family settled in Bath, where the young artist soon found himself fully employed in taking crayon likenesses of the fashionables of the place at a guinea or a guinea and a half a head. In 1784 he gained the prize and silver gilt palette of the Society of Arts for a crayon drawing after Raphael's Transfiguration, and presently beginning to paint in oil, and throwing aside the idea of going on the stage which he had for a short time entertained, he came to London in 1787, was kindly received by Reynolds, and entered as a student at the Royal Academy. He began to exhibit almost immediately, and his reputation increased so rapidly that he became an associate of the Academy in 1791. The death of Sir Joshua in 1792 opened the way to further successes. He was at once appointed painter to the Dilettanti Society, and principal painter to the king in room of Reynolds. In 1794 he was a Royal Academician, and he became the fashionable portrait painter of the age, having as his sitters all the rank, fashion, and talent of England, and ultimately most of the crowned heads of Europe. In 1815 he was knighted; in 1818 he went to Aix-la-Chapelle to paint the sovereigns and diplomatists gathered there, and extended his residence on the Continent by visiting Vienna and Rome, everywhere receiving flattering marks of distinction from princes, due as much to his courtly manners as to his merits as an artist. After eighteen months he returned to England, and on the very day of his arrival was chosen president of the Academy in room of West, who had died a few days before. This office he held from 1820 to his death on 7th January, 1830. He was never married.

Sir Thomas Lawrence had all the qualities of personal manner and artistic style necessary to make a fashionable painter, and at a period when aristocratic opinion had even more weight than at present his public reputation was extravagantly high. The judgment of his fellow artists was less favorable, and in the present day no one would claim for him a place among great portrait painters, while his more ambitious works, in the classical style, such as his once celebrated Satan, are practically forgotten. His chief merit lay in a certain dexterity of touch and in the conventional grace with which he contrived to clothe his figures.

The best display of Lawrence's work is in the Waterloo Gallery of Windsor, a collection of much historical interest. "Master Lambton," painted for Lord Durham at the price of 600 guineas, is regarded as one of his best portraits, and a fine head in the National Gallery shows his power to advantage. The *Life and Correspondence of Sir T. Lawrence*, by Williams, appeared in 1831. See also Cunningham's *British Painters*, 1833.

LAYAMON, or **Lawman**, the author of a chronicle of Britain entitled *Brut*, a poetical semi-Saxon paraphrase of the *Brut d'Angleterre* of Wace, was as he himself informs us a priest who read the services of the church at Ernleye, on the banks of the Severn (now Lower Arley or Arley Regis, 3½ miles south-east from Bewdley, Worcestershire). Of his personal history nothing further is known. Nor can the date of the work with which his name is associated be very accurately ascertained; but the probability is that it was not completed before the beginning of the 13th century. The original text, with a literal translation, notes, and a grammatical glossary, was first edited by Sir Frederic Madden in 1847. See English Language, vol. viii. p. 352; and English Literature, *ib.* p. 365.

LAYBACH. See Laibach.

LAYNEZ, Diego. See Jesuits.

LAZARITES, **Lazarists**, or **Lazarians**. The origin of the "Congregation of Priests of the Mission" may in some sense be traced back to 1617, the year of the successful labors of St. Vincent de Paul, assisted by five other priests, for the evangelization of the common people in the parish of Châtillon-sur-Chalaronne, near Bourg. More immediately it dates from 1625, when the little community acquired a permanent settlement in the Collége des Bons Enfans in Paris. Archiepiscopal recognition was obtained in 1626; and by papal bull in January, 1632, the society was constituted a congregation, with St. Vincent de Paul at its head. Shortly afterwards the establishment was confirmed by letters patent from Louis XIII. About the same time the canons regular of St. Victor handed over to the congregation the priory of St. Lazarus in Paris, which henceforth became its chief house, and gave to the fathers of the mission the name by which they are best known. Within a few years they had acquired another house in Paris and set up other establishments throughout France; and in 1639, 1641, and 1651 they broke ground in Savoy, Italy, and Poland respectively. A fresh bull of Alexander VII. in April, 1655, further confirmed the society; this was followed by a brief in September of the same year, regulating its constitution. The rules then adopted, which were framed on the model of those of the Jesuits, were published at Paris in 1658 under the title *Regulæ seu Constitutiones communes congregationis missionis*. The special objects contemplated were the religious instruction of the lower classes, the training of the clergy, the relief or redemption of prisoners in Barbary, and foreign missions. In the pursuit of these objects the Lazarite priests have had a chequered history in the various quarters of the world where they have gained a footing. At the French Revolution they were dispersed, so far as France was concerned, but permitted to reappear under the empire, and rehabilitated at the Restoration. In Sardinia they had a similar history. Throughout Italy they have been affected by recent political changes just as the rest of the religious orders have been. The Lazarist province of Poland was singularly prosperous; at the date of suppression in 1796 it possessed thirty-five establishments. The order was permitted to return in 1816, but is now extinct there. In Madagascar it had a mission from 1648 till 1674. In 1783 Lazarists were appointed to take the place of the Jesuits in the Levantine and Chinese missions; they still have some footing in China, and in 1874 their establishments throughout the Turkish empire numbered sixteen. In the same year they had fourteen establishments in the United States of America. The total number of Lazarists throughout the world is computed at about 3000.

LAZARUS, St., Order of. This religious and military order dates its origin from the occupation of Jerusalem by the first crusaders, its primary object being the succor of the leprous, of whom Lazarus (Luke xvi. 20 *sq.*) was regarded as the patron. After the expulsion of the crusaders the hospitallers of St. Lazarus established themselves in France, where Louis VII. (1253) gave them the lands of Boigny near Orleans, and a building at the gates of Paris which they turned into a lazar house for the use of the lepers of the city. A papal confirmation was obtained from Alexander IV. in 1255. The gradual disappearance of leprosy combined with other causes to change the order into a purely civil corporation. In 1572 it was in Savoy merged by Gregory XIII. in the order of St. Maurice. In 1608 it was in France united with that of Notre-Dame du Mont-Carmel; abolished at the Revolution, it was reintroduced at the Restoration, but is again in abeyance, the only order at present conferred or recognized being that of the Legion of Honor. In 1633 the buildings of the priory in Paris were handed over to St. Vincent de Paul for the use of the fathers of his mission, who from this circumstance came to be generally known as Lazarites.

LEAD. This metal was known to the ancients, and is mentioned in the Old Testament. The Romans used it largely, as it is still used, for the making of water pipes, and soldered these with an alloy of lead and tin. Pliny treats of these two metals as *plumbum nigrum* and *plumbum album* respectively, which seems to show that at his time they were looked upon as being only two varieties of the same species. In regard to the ancients' knowledge of lead compounds, we may state

; the substance described by Dioscorides as μολυβδαίνα undoubtedly litharge, that Pliny uses the word min- in its present sense of red lead, and that white lead well known to Geber in the 8th century.

f the various plumbiferous minerals, galena (a com- nd of lead and sulphur, formula PbS, demanding per cent. of metal) and white lead ore or cerusite,)CO_2 (77·5 per cent.), might almost be said to be the ones which come into consideration as lead ores. asionally, however, the following also are utilized:— -vitriol or anglesite, $PbOSO_3$ (68·3 per cent.), and pyromorphite group, $3(P_2 \text{ or } As_2)O_5.3PbO + PbCl_2$ to 69 per cent.). Bournonite, CuPbSbS, may be named, although, containing 13 per cent. of er besides 42·3 per cent. of lead, it is rather a er than a lead ore.

alena, the principal lead ore of the Old World, is rk-colored metallic-looking compact solid of 7·3 to specific gravity and 2°·5 hardness, crystallizing in s or other forms of the regular system, but often enting itself in non-crystallized granular masses. galena is contaminated with sulphide of silver,—the ortion of noble metal varying from about 0·01 or to 0·3 per cent., and in rare cases coming up to ½ per cent. Galena occurs in veins in the Cambrian slate, accompanied by copper and iron pyrites, zinc- le, quartz, calc-spar, iron-spar, etc.; also in beds ests within sandstones and rudimentary limestones, in a great many other geological formations. It is y widely diffused throughout the earth's crust. principal English lead mines are in Derbyshire; there are also mines at Allandale and other parts estern Northumberland, at Alston Moor and other of Cumberland, in the western parts of Durham, waledale and Arkendale and other parts of York- , in Salop, in Cornwall, in the Mendip Hills in ersetshire, and in the Isle of Man. The Welsh s are chiefly in Flint, Cardigan, and Montgomery s; the Scotch in Dumfries, Lanark, and Argyll; the Irish in Wicklow, Waterford, and Down. Of inental mines we may mention those in Saxony, in the Harz, Germany; those of Carinthia, Aus- and especially those of the southern provinces of n, from which country large quantities of lead are imported into Great Britain.

e native carbonate occasionally presents itself in form of pure crystals of the compound $PbCO_3$ rusite"), but more frequently in a state of intimate mixture with clay ("Bleierde"), limestone, oxide on, etc. (as in the ores of Nevada and Colorado), sometimes also with coal ("black lead ore"). All e carbonate of lead seems to be derived from what originally galena, which, in fact, is always present as an admixture. This ore, metallurgically, was reckoned of much value, until immense quantities were discovered in Nevada and in Colorado (U. S.). Nevada mines are mostly grouped around the city ureka, about 200 leagues from San Francisco. The here occurs in "pockets" disseminated at random ugh limestone. The dimensions of these pockets are variable; one is quoted measuring 300 by 60 by feet. The crude ore contains about 30 per cent. of and 0·2 to 0·3 per cent. of silver. The Colorado district is situated pretty high up in the Rocky ntains, a few miles from the source of the Arkansas . The ore was discovered as late as 1877 by a min- ngineer, Stephens. It forms gigantic deposits of st constant thickness, embedded between a floor mestone and a roof of porphyry. Stephens's dis- ry was the making of the city of Leadville, which, 78, within a year of its birth, had over 10,000 in- tants. The Leadville ore contains from 24 to 42 per of lead and 0·1 to 2 per cent. of silver. In Ne- and Colorado the ore is worked chiefly for the sake e silver; but this industry, especially since 1878, developed at such a rate as to seriously affect the of lead even in Europe. Of other American lead icts the most important are those of Utah, of Missouri, and of the Upper Mississippi, where the ore consists substantially of galena.

The extraction of the metal from pure (or nearly pure) galena is the simplest of all metallurgical operations. The ore is roasted (*i. e.*, heated in the presence of atmospheric oxygen) until all the sulphur is burned away and the lead left. This simple statement, however, correctly formulates only the final result. The first effect of the roasting is the elimination of sulphur as sulphurous acid, with formation of oxide and sulphate of lead. In practice, this oxidation process is continued until the whole of the oxygen is as nearly as possible equal in weight to the sulphur present as sulphide or as sulphate. The heat is then raised in (relative) absence of air, when the two elements named unite into sulphurous acid (SO_2), while a regulus of molten lead remains. In Wales and the south of England the process is conducted in reverberatory furnaces of the form shown in fig. 1. The sole of the furnace is paved with slags from previous operations, and has a depression in the middle where the metal formed collects to be let off by a tap-hole T. The dressed ore, 12 to 24 cwts., is introduced through the "hopper" H at the top, and exposed to a moderate oxidizing flame until a certain proportion of ore is oxidized, the openings O,O at the side enabling the workmen to stir up the ore so as to constantly renew the surface exposed to the air. At this stage as a rule some rich slags of a former operation are added, and a quantity of quicklime is incorporated, the chief object of which is to diminish the fluidity of the mass in the next stage, which consists in this, that, with closed air-holes, the heat is raised so as to cause the oxide and sulphate on the one hand, and the sulphide on the other, to reduce each other to metal. The lead produced runs into the hollow and is tapped off. The roasting process is then resumed, to be followed by another reduction, and so on.

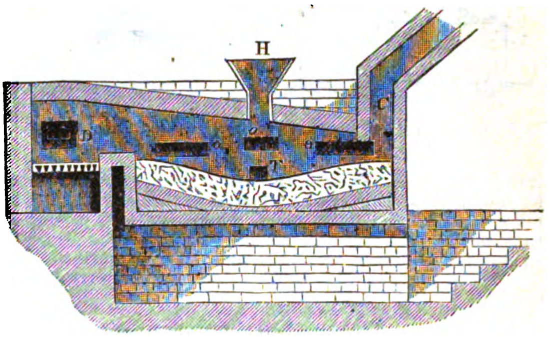

FIG. 1.—Reverberatory Furnace. C, chimney; D, opening for feeding the fire.

A similar process is used in Carinthia; only the furnaces are smaller (adapted to a charge of only 420 lb) and of a somewhat different form. They are long and narrow; the sole is plain, but slopes from the fire-bridge towards the flue, so that the metal runs to the latter end to collect in pots placed *outside* the furnace. In Carinthia the oxidizing process from the first is pushed on so far that metallic lead begins to show, and the oxygen introduced predominates over the sulphur left. The mass is then stirred to liberate the lead, which is removed as "Rührblei." Charcoal is now added, and the heat urged on to obtain "Pressblei," an inferior metal formed partly by the action of the charcoal on the oxide of lead. The fuel used is fir-wood.[1]

In Cumberland, Northumberland, and Durham the reverberatory furnace is used only for roasting the ore, and the oxidized ore is then reduced by fusion in a low square blast furnace (a "Scottish hearth furnace") as depicted in figs. 2 and 3. The rectangular cavity C is lined with cast-iron, as is also the inclined sole-plate which is made to project beyond the furnace, the outside portion W (the "work-stone") being provided with grooves *g* guiding any molten metal that may be placed on the "stone" into the cast-iron pot P; *t* is the "tuyere" for the introduction of the wind.

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[1] In England coal is employed everywhere, sometimes along with peat.

As a preliminary to the melting process, the "browse" left in the preceding operation (half-fused and imperfectly reduced ore) is introduced with some peat and coal, and heated with the help of the blast. It is then raked out on the work-stone and divided into a very poor "gray" slag which is put aside and a richer portion which goes back into the furnace. Some of the roasted ore is strewed upon it, and, after a quarter of an hour's working, the whole is taken out on the work-stone, where the lead produced runs off. The "browse," after removal of the "gray" slag, is reintroduced, ore added, and, after a quarter of an hour's heating, the mass again placed on the work-stone, etc.

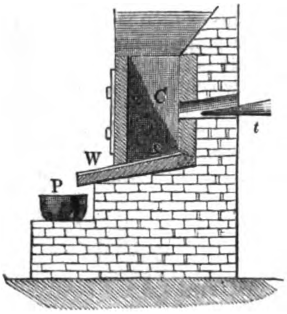

FIG. 2.—Vertical Section of Furnace.

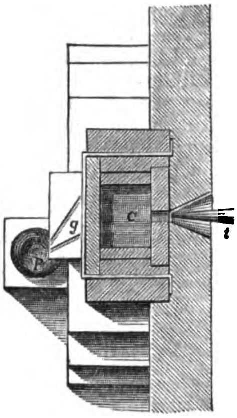

FIG. 3.—Horizontal Section.

In any form of the lead-smelting process one of the conditions of complete success is the absence of silica, because this when present unites with a certain proportion of the oxide of lead into a fusible silicate (slag). Practically the formation of a plumbiferous slag cannot be altogether avoided in any case, and such slag accordingly must be worked up. At Alston Moor, Cumberland, this is effected by means of a hearth (blast) furnace similar to the one just described. The slags (oxide, sulphate, and silicate of lead) are introduced with coal-ashes, furnace bottoms, and other residues, and melted down, this leading to the formation of lead and of a poorer slag. The lead is run off as much as possible; the slag is run into water, which disintegrates it so that the particles of metal shut up within it are set free and become recoverable by elutriation.

Lead being very appreciably volatile at a red heat, lead-smelting generally, but more especially the Scottish-hearth process, and pre-eminently the slag-recovery process, involve the production of large quantities of "lead-smoke" (finely divided highly impure oxide and sulphate of lead), which, for sanitary and economic reasons, must be condensed and recovered. At Alston Moor the smoke for this purpose is led through a very long succession of flues, ascending the slope of a hill, into a chamber at the top which communicates with a chimney. The chamber, by a number of screens going alternately from the floor to near the top, and *vice versa*, is divided into compartments charged with such a quantity of water that the smoke, which is propelled by means of a fan, is compelled to bubble repeatedly through the water, where most of what has failed to come down in the flues is precipitated. The smoke deposit is collected, dried, and worked up for lead.

Carbonate and oxide of lead are easily reduced by charcoal or coal. In Leadville and Eureka (U. S.), the carbonate is smelted with charcoal in small blast furnaces, about 8 feet high, and rectangular section of 31 by 47 inches, worked with charges of about three tons of ore. There are five tuyeres, two at each of the longer sides, and one at the end opposite the outlet-hole. The "crucible" is quite surrounded by hollow wrought-iron plates, kept cool by circulating water.

Complex lead ores of course demand a complex treatment. The famous Frankenscharner Hütte near Klausthal in the Harz, where a very complex ore is worked up with a wonderful degree of exhaustiveness and precision, may serve as an example. The ore in this case consists of argentiferous galena associated with copper pyrites, fahl-ore, bournonite, zinc blende, and a gangue consisting of silica, limestone, and heavy spar. After the copper pyrites has been, as far as possible, picked out by hand, the remainder is assorted so as to produce an average of about 55 per cent. of lead. One hundred parts of such ore are mixed with 11 of hearth-mass and litharge, 90 parts of a variety of slags from previous operations, and 11 parts of metallic iron (or the equivalent of some rich iron ore plus charcoal), and melted down in blast furnaces similar to those used for iron-smelting, but only 22 feet high. The furnace is charged with alternate layers of ore mixture and charcoal. The smelting takes fourteen hours, and yields per charge of 100 parts of ore (containing in all about 74 parts of lead) 25 parts of metallic lead, and 18·4 parts of a "stein" consisting of an alloy of sulphides of lead, iron, copper, zinc, silver, antimony, intimately mixed with particles of metallic and (? subsulphide of) lead—apart from the slags formed, which contain 4 to 8 per cent. of lead and a trace of silver. The "stein" is subjected to a protracted series of roastings, and then melted down with iron and selected slags. There result a ferruginous slag, a certain proportion of metallic lead, and a "stein" of the second order, which of course is richer in copper than the original one was. This "stein" is again roasted, melted down with iron, etc., until the whole of the lead is extracted, and the copper concentrated in a mass sufficiently rich and pure to be wrought as a copper "stein."

Refining.—The lead obtained by any of the above processes is as a rule contaminated with more or less of iron, antimony, zinc, arsenic, and silver, which must be removed,—the base foreign metals because they deteriorate the lead, the silver on account of its high commercial value. The base metals are easily eliminated by subjecting the crude metal to oxidizing fusion in a shallow cast-iron dish inserted into a reverberatory furnace; the foreign metals, being more oxidizable than lead, go to the top as an oxide-scum, which is constantly removed until pure litharge, instead of the foreign oxides, makes its appearance.

The extraction of the silver is easily effected by means of the process of cupellation, one of the oldest metallurgical operations, which dates back to a time beyond that of Pliny. The metal is placed on a shallow kind of dish made of compressed bone-ash powder and forming the sole of a reverberatory furnace, and therein kept at a red-heat in the presence of an abundant supply of air. The lead (and with it the foreign base metals) is oxidized into "litharge" (PbO), which, at the temperature prevailing, melts into a thin liquid, and is made to run off through a slit or hole made in the side of the "cupel" (or "test"); the silver remains unchanged, so that the regulus becomes richer and richer as the process proceeds. The foreign base metals, as will readily be understood, go off as oxides along with the first portion of litharge, and accordingly can be removed without contaminating the bulk of the latter product. When the percentage of silver has increased to about 8 per cent., the regulus, as a rule, is transferred to a fresh cupel, and thereon treated in the same way as before, until the last trace of litharge is seen to go off as a thin film on the regulus, presenting, on account of its thinness, in the glow of the fire, the magnificent appearance of a soap-bubble in sunlight. The silver then is "fine," *i. e.*, almost pure, and ready for the market. The lead, however, is all obtained in the shape of oxide, and consequently, if not salable as such, must be reduced with charcoal or coal. The process accordingly is expensive, and generally does not pay with a raw lead containing less than $\frac{1}{10}$ per cent. of the nobler metal.

The process, in its direct application to the lead, is now almost extinct, being superseded by the following two methods of "concentration," which offer the advantage of desilverizing at least the bulk of the lead without depriving it of its metallicity.

1. *Pattinson's Process* (invented about forty years ago) is founded upon the fact that, when molten argentiferous lead is allowed to cool slowly, a relatively silver-free lead crystallizes out while a richer metal remains as a mother-liquor. It will be readily understood that, by a persistent systematic application of this method of partial separation to the primary products and again to their derivatives, it is possible to, so to say, split the original material into a very poor portion containing most of the lead, and a "rich" one containing almost all the silver. Practical smelters are generally satisfied when the proportion of silver in the former is reduced to from the one to the three millionth of the weight of the lead. and the latter enriched to the extent of 0·5 to 1·5 per cent. of silver, although it is possible to bring up the percentage to 2·5. A lead containing as little as half an ounce of silver per ton can be "Pattinsonized" with a profit.

2. *Karsten's Process* is still more perfect. It has long been known that lead refuses to alloy itself with more than traces of zinc. In 1842 the eminent metallurgist Karsten[1] made the important discovery that, when argentiferous lead is mixed with 1 per cent. or more of zinc (at a temperature insuring liquidity to even the latter metal), about ½ per cent. of zinc remains dissolved in the lead, while the rest rises to the top as a scum, and, besides a deal of lead, takes almost the whole of the silver with it. Parkes subsequently brought the process into a workable form, for which he took a patent in England in 1850. The argentiferous lead is molten in large cast-iron pots, intimately mixed with about 30 parts of zinc per unit of silver present, the mixture allowed to rest, and the argentiferous scum removed by means of perforated ladles. The scum, when subjected to "liquation" (partial fusion) on an inclined sole, lets off a quantity of rich lead, which goes to the cupel. From the residue the bulk of the zinc can be withdrawn by distillation, the non-volatile part being fit for cupellation. The desilverized lead is freed from its zinc and the other base impurities it may contain by "refining" (see above). The Parkes process seems to be on a fair way of being superseded by a far more perfect form of the Karsten method which was patented by Cordurié for France in 1866 (October 18, No. 73,167), and of which the most characteristic feature is that the removal of the zinc from the scum and the refining of the desilverized lead are both effected by means of superheated steam. The treatment with zinc is effected in a deep upright half-egg-shaped cast-iron pan (standing on an upper floor), which is provided with a vertical shaft bearing horizontal paddles, and at its lowest point a perforated cast-iron box, which serves to accommodate the zinc; 1 kilogramme per 100 kilos of crude lead containing 0·1 kilo of silver, or up to twice the proportion for richer leads. The argentiferous lead—10 tons at a time—is melted down in the pan, and the paddle-shaft with the zinc introduced and made to revolve until all the zinc has become incorporated with the mass. The shaft is then withdrawn, the mixture allowed to rest for a time at a lower temperature, the scum removed, and the zinc treatment repeated once or twice to eliminate the whole of the silver. The desilverized lead runs direct from the pan into another pan standing on the ground floor, which has no tap-hole, but is provided with a wrought-iron hood communicating by means of a pipe with a condensation chamber. In this pan the metal is heated to redness, and a current of superheated steam is blown through it for two or three hours. The zinc and the rest of the impurities are thereby converted into oxides which mostly remain on the surface of the metal, the rest being carried into the chamber and deposited there. The silver scums, after abstraction from them of argentiferous lead by liquation, are collected, and, when a sufficient quantity has accumulated, worked with superheated steam like the zinciferous lead —to produce a richly argentiferous regulus, adapted for cupelling, and an oxide-mixture intimately intermixed with particles of the former and containing even some silver oxide. The working of this bye-product seems to have given the inventor a deal of trouble. Passing over his method, we will mention the one introduced in Lautenthal since 1869. There they dispose of the argentiferous oxides by adding them to the rich lead during its cupellation; the silver is sucked in by the regulus, the base oxides amalgamate with the litharge. The "poor" lead resulting from this form of the Karsten process contains only 5 or 6 grammes of silver per metric ton (*i. e.*, per million grammes). The loss of lead with a pure material is only 1 per cent. as against the 4 per cent. involved in the Pattinson process.

It is worth stating that the zinc removes, besides the silver, all the copper that may be present, and no doubt also part of the other foreign base metals. At any rate the purity of commercial lead, since the introduction of Cordurié's process, has undergone a marked increase. Hampé analyzed a "refined" lead produced in the "Lautenthaler Hütte" in 1870, and found it to contain only ·016 per cent. of impurities. This to all intents and purposes means chemical purity; yet even such lead is not fit for silver assaying, on account of the trace of silver contained in it. To obtain silver-free lead, we must prepare silver-free acetate of lead—by digesting its solution in a lead vessel with lead shavings and filtering—and reduce the dried salt with black flux in a crucible lined with charcoal.

Properties of Lead and its Oxides.—Pure lead is a feebly lustrous bluish-white metal, endowed with a characteristically high degree of softness and plasticity, and almost entirely devoid of elasticity. Its breaking strain is very small: a wire $\frac{1}{10}$th of an inch thick is ruptured by a charge of about 30 ℔. The specific gravity was determined exactly by Reich, who found for ingot 11·352, for sheet metal 11·354 to 11·365 (water of 4° C. = 1). The expansion of unit-length from 0° C. to 100° C. is ·002948 (Fizeau). The conductivity for heat (Wiedeman and Franz) or electricity is 8·5, that of silver being taken as unity. It melts at 334° C. = 633° Fahr. (Personne); at a bright red heat it emits vapors, at the rate, according to A. de Riemsdyk, of about $\frac{1}{1000}$th of its weight per hour; but he does not specify the surface. At a white heat it boils. The specific heat is ·0314 (Regnault), that of water near 0° C. being taken as unity. Lead exposed to ordinary air is rapidly tarnished, but the thin dark film (of suboxide?) formed is very slow in increasing. When kept in fusion in the presence of air lead readily takes up oxygen, with formation first of a dark-colored scum (of suboxide?), then of monoxide PbO, the rate of oxidation increasing with the temperature. This oxide is produced industrially in two forms, known as "massicot" and "litharge." The former is produced at temperatures below, the latter at temperatures above, the fusing point of the oxide. The liquid litharge when allowed to cool solidifies into a hard stone-like mass, which, however, when left to itself, soon crumbles up spontaneously into a heap of resplendent dark-yellow scales known as "flake litharge." Litharge is much used in the arts for the preparation of lead salts, for the manufacture of oil varnishes, of certain cements, and of lead plaster, and for other purposes. Massicot is important as being the raw material for the manufacture of "red lead" or "minium." Finely divided massicot, free from admixed metal by elutriation, is spread out on the flat sole of a kind of baker's oven, or (better) of a "muffle" heated from the outside, and therein exposed for twenty-four hours or more to air at a temperature of about 300° C. or 600° Fahr. The massicot, at a gradually decreasing rate, absorbs oxygen, and as the latter increases the color becomes more and more intensely red,—the point of saturation corresponding very nearly to the formula Pb_4O_5. A more highly oxygenated kind of minium ("orange lead") can be produced by substituting white lead for massicot as a raw material. The composition of orange lead approximates to Pb_3O_4. It is very singular that this higher oxide cannot be obtained from massicot, although the first effect of heat on white lead is its conversion into the oxide PbO. Besides the two named there is another red oxide, of the composition Pb_2O_3, but it is not much known. Red lead is largely used as a pigment and as an ingredient for flint glass, also for the making of certain cements. Any of these red oxides when treated with dilute nitric acid is converted into the binoxide PbO_2, protoxide passing into solution as nitrate: *e. g.*, $Pb_3O_4 + 2H_2ON_2O_5 - 2PbON_2O_5 + PbO_2 + 2H_2O$. The binoxide is a brown powder, insoluble in aqueous oxygenated acids, but converted by hot hydrochloric acid into chloride $PbCl_2$ with evolution of chlorine. To obtain the binoxide in the state of purity, the best method is to pass chlorine into a solution of acetate of lead mixed with excess of carbonate of soda. The hypochlorite formed oxidizes the PbO into PbO_2, with formation of chloride of sodium and free acetic acid (Wöhler).

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[1] [K. J. Bernhard Karsten (1782–1853) was for forty years Prussian chief of mines.—Am. Ed.]

Action of Aqueous Reagents.—Water when absolutely pure has no action on lead by itself. In the presence of free oxygen (air), however, the lead is quickly attacked, with formation of hydrated oxide ($PbOH_2O$), which is appreciably soluble in water forming an alkaline liquid. When carbonic acid is present the dissolved oxide is soon precipitated as basic carbonate, so that there is room made, so to say, for fresh hydrated oxide, and the corrosion of the lead progresses. Now, all soluble lead compounds are strong cumulative poisons, hence the danger involved in using lead cisterns or pipes in the distribution of *pure* waters. We emphasize the word "pure" because experience shows that the presence in a water of even small proportions of bicarbonate or sulphate of lime prevents its action on lead. All impurities do not act in a similar way. Nitrate and nitrite of ammonia, for instance, intensify the action of a water on lead. It is to be remarked, however, that even pure waters, such as that of Loch Katrine (which forms the Glasgow supply), act so slowly, at least on such lead pipes as have already been in use for some time, that there is no danger in using short lead service pipes even for them, if the taps, as in any household under normal circumstances, are being constantly used. Lead cisterns of course must be unhesitatingly condemned. G. Bischoff found that a water pipe made of a "composition" consisting of 1·7 per cent. of antimony and 98·3 of lead was rapidly corroded by a water which, in virtue of its composition, had no action on lead pipes.

Action of Acids.—The presence of carbonic acid in a water does not affect its action on lead (Pattison Muir). Aqueous non-oxidizing acids generally have little or no action on lead in the absence of air. Dilute sulphuric acid (say an acid of 20 per cent. of H_2SO_4 or less) has no action on lead even when air is present, nor on boiling. Stronger acid (*e.g.*, any acid strong enough to fairly fall within the meaning of "vitriol") does act, slowly in general, but appreciably, the more so the greater its concentration and the higher its temperature. According to Hasenclever, whose experiments were subsequently confirmed by A. Bauer and by James Mactear, pure lead, *cæt. par.*, is far more readily corroded than a metal contaminated with 1 per cent. or even less of antimony or copper. Hasenclever treated an almost pure lead with pure vitriol of 54° Beaumé (1·55 sp. gr., or 64–65 per cent. H_2SO_4) in a glass flask. At 40° C. an evolution of gas was observable, which at 80° C. became very distinct. The same lead, after having been alloyed with a little antimony, was not visibly attacked below 85° C. A decided gas-evolution commenced only at 140° C. Boiling concentrated vitriol converts lead into sulphate, with evolution of sulphurous acid. Dilute nitric acid readily dissolves the metal, with formation of nitrate $Pb(NO_3)_2$.

Lead Alloys.—Lead unites readily with almost all other metals: hence, and on account of its being used for the extraction of (for instance) silver, its alchemistic name of saturnus. Of the alloys the following may be named:—

With Antimony.—Lead contaminated with small proportions of antimony is more highly proof against vitriol than the pure metal. An alloy of 83 parts of lead and 17 of antimony is used as type metal; other proportions are used, however, and other metals added besides antimony (*e. g.*, tin, bismuth) to give the alloy certain properties.

Arsenic renders lead harder. An alloy made by addition of about $\frac{1}{35}$th of arsenic is used for making shot.

Bismuth and Antimony.—An alloy consisting of 9 parts of lead, 2 of antimony, and 2 of bismuth is used for stereotype plates.

Bismuth and Tin.—These triple alloys are noted for their low fusing points. An alloy of 5 of lead, 8 of bismuth, and 3 of tin fuses at 94°·4 C., *i. e.*, below the boiling-point of water (Rose's metal). An alloy of 15 parts of bismuth, 8 of lead, 4 of tin, and 3 of cadmium (Wood's alloy) melts below 70° C.

Tin unites with lead in any proportion with slight expansion (Kuppfer), the alloy fusing at a lower temperature than either component. It is used largely for soldering. The following are the compositions and melting-points of frequently used compounds (Tomlinson):—

	Tin.	Lead.	Melts at
Fine solder...................	2	1	340° F.
Common do.	1	1	370° F.
Coarse do.	1	2	441° F.

"Pewter" may be said to be substantially an alloy of the same two metals; but small quantities of copper, antimony, and zinc are frequently added. Common pewter contains about 5 parts of tin for 1 of lead. In France a tin-lead alloy, containing not over 18 per cent. of lead, is recognised by law as being fit for measures for wine or vinegar. "Best pewter" is just tin alloyed with a mere trifle (½ per cent. or less) of copper.

Lead Salts.—Of the oxides of lead the protoxide, PbO, is the only one which under ordinary conditions is capable of forming salts. Towards potash and soda it plays the part of a feeble acid, being readily soluble in solutions of either caustic alkali; while with acids it behaves as a decided diacid base. By a "diacid base" is meant a base which can unite with two monovalent acids at the same time, and form a stable salt. Take, for instance, the case of chloride of lead, $PbCl_2$, which is related to HCl and $Pb(OH)_2$ exactly as KCl is to HCl and K(OH); but, while there is nothing between KCl and K(OH), the two lead compounds readily unite into Cl—Pb—(OH), oxychloride of lead. This property, common to all diacid bases, is developed in lead oxide to a characteristically high degree.

The nitrate, $PbON_2O_5$ or $Pb(NO_3)_2$, easily obtained from the metal as explained above, or by dissolving the oxide in aqueous nitric acid, forms white crystals, difficultly soluble in cold, readily in hot water, almost insoluble in strong nitric acid. It is decomposed by heat into oxide, peroxide of nitrogen (N_2O_4), and oxygen. It is used for the manufacture of fusees and other deflagrating compounds. The numerous basic nitrates must here be passed over.

The acetate, $Pb(C_2H_3O_2)_2.3H_2O$ (called "sugar" of lead, on account of its sweetish taste), is manufactured by dissolving massicot in aqueous acetic acid. It forms colorless transparent crystals, soluble in one and a half parts of cold water and in eight parts of alcohol, which on exposure to ordinary air become opaque through absorption of carbonic acid, which forms a crust of basic carbonate. An aqueous solution readily dissolves oxide of lead, with formation of a strongly alkaline solution containing basic acetates (*Acetum Plumbi* or *Saturni*). When carbonic acid is passed into this solution the whole of the added oxide, and even part of the oxide of the normal salt, is precipitated as a basic carbonate chemically similar, but not quite equivalent as a pigment, to white lead.

The carbonate, $PbCO_3$, exists in nature as cerusite. It can be produced by addition of a solution of lead salt to an excess of carbonate of ammonia, as an almost insoluble white precipitate. Of greater practical importance is a basic carbonate, substantially $2PbCO_3.Pb(OH)_2$, which is largely used as a white pigment under the name of "white lead." For the manufacture of this important substance two methods chiefly are used. In the Old Dutch method, pieces of sheet lead are suspended in stoneware pots so as to occupy the upper two-thirds of the vessels. A little vinegar is poured into each pot; they are then covered with plates of sheet lead, buried in horse-dung or spent tanners' bark, and left to themselves for a considerable time. The organic bath, through its fermentation, keeps up a suitable temperature and a constant supply of carbonic acid. By the conjoint action of the acetic acid and atmospheric oxygen, the lead is converted superficially into a basic acetate, which is at once decomposed by the carbonic acid, with formation of white lead and acetic acid, which latter then acts *de novo*. After a month or so the plates

verted to a more or less considerable depth into
of white lead. These are knocked off, ground up
ater, freed from metal particles by elutriation, and
ste of white lead is allowed to set and dry in small
forms. The coherent, snow-white cones are sent
to commerce. The German method differs from the
in this that the lead is suspended in a large chamber
d by ordinary means, and there exposed to the simul-
s action of vapor of aqueous acetic acid and of car-
acid. In the famous works at Klagenfurth and in
vantthal, Carinthia, the carbonic acid is produced
e fermentation of apple-must or infusion of raisins
in tubs below the chambers. The inferior varieties
mmercial "white lead" are produced by mixing the
ne article with more or less of finely powdered heavy
or occasionally zinc-white (ZnO), which latter, we
state in passing, is the most important of the rela-
non-poisonous substitutes for white lead.

chloride, $PbCl_2$, is obtained by adding hydrochloric
a solution of lead salt, as a white precipitate, little
le in cold water, less so in dilute hydrochloric acid,
so in the strong acid, and readily soluble in hot
, from which on cooling, the excess of dissolved salt
ates out in acicular crystals. A basic chloride Pb_2OCl_2
ntroduced by Pattinson as a substitute for white lead.
ered galena is dissolved in hot muriatic acid ($PbS +$
$= PbCl_2 + H_2S$), the solution allowed to cool, and the
it of impure chloride of lead washed with cold water
nove iron and copper. The residue is then dissolved
water, the dregs are filtered off, and the clear solu-
mixed with very thin milk of lime so adjusted that
es out one-half of the chlorine of the $PbCl_2$. The
loride comes down as an amorphous white precipitate.
er oxychloride, $PbCl_2.7PbO$, known as "Cassel yel-
is produced by fusing pure oxide, PbO, with $\frac{1}{10}$th of
ight of sal-ammoniac.

sulphate, $PbSO_4$, is obtained, by addition of sulphuric
o solutions of lead salts, as a white precipitate almost
ble in water, less soluble still in dilute sulphuric
insoluble in alcohol. Sulphide of ammonium blackens
d it is soluble in solution of alkaline acetate of am-
, which distinguishes it from sulphate of baryta.
ften obtained industrially as a bye-product.

chromate, $PbOCrO_3$, is prepared industrially as a
pigment, by precipitating sugar of lead solution
bichromate of potash. The beautiful yellow precipi-
s little soluble in dilute nitric acid, but soluble in
c potash ley. The vermilion-like pigment which
in commerce as "chrome-red" is a basic chromate,
red by treating recently precipitated normal chromate
a properly adjusted proportion of caustic soda, or by
g it with normal (yellow) chromate of potash. The
ximate composition is $CrO_3.2PbO$.

identification of lead compounds is easy. When
with carbonate of soda and heated on charcoal in
ducing flame they yield malleable globules of metal
yellow oxide ring. Solutions of lead salts (colorless
absence of colored acids) are characterized by their
ior to hydrochloric acid, sulphuric acid, and chro-
of potash. But the most delicate precipitant for lead
huretted hydrogen, which produces a black precipi-
f sulphide of lead, insoluble in cold dilute nitric
ess so in cold hydrochloric, easily decomposed by hot
chloric acid with formation of the characteristic
de.

istics.—The lead, pig or sheet, imported into Great
n during the year 1880 amounted to 95,202 tons, and
g 1881 to 93,400 tons. In 1881 there were 12,824 tons
ted to China, 8355 to Russia, 4715 to Australia, 3390
ance, 3349 to British India, 1041 to Germany, and
o other countries.

following table exhibits the production of lead
g 1876:—

	Tons.		Tons.
	101,522	Italy	9000
any	82,772	Greece	8000
Britain	59,606	Belgium	7375
d States	57,210	Austria	4291
e	21,339	Russia	1083

importation and production of lead in the United
were in the years stated respectively as follows:—

	Imported.	Produced.
	Tons.	Tons.
	23,225	14,630
	35,111 (max.)	15,650
	285	81,304

(W. D.)

LEADVILLE, a flourishing mining town of the United States, capital of Lake county, Colorado, is situated at a height of 10,200 feet above the sea, on a narrow plateau between the Saguache or Continental Divide and the Park Range of the Rocky Mountains, about 70 miles south-west of Denver. It is connected with Denver by a branch of the Union Pacific Railway (172 miles), and by the Denver and Rio Grande Railway (279 miles). Though a place of 14,820 inhabitants at the census of 1881, Leadville was then the creation of scarcely more than three years.

As early as 1860 gold placers were discovered in the neighborhood, and for a little time the settlement of Bough Town, as it was then called, was a busy spot in this thinly peopled region. But the gold was soon exhausted; and, though it was vaguely understood that the heavy black sand which had often proved troublesome to the gold-washers was more or less argentiferous, it was not till 1877 that the first practical attempt to turn it to account was made. No sooner, however, was the real character of the ore ascertained than eager adventurers rushed to Leadville by thousands. In August, 1877, there were not more than twenty shanties on the site of the town; but the population rapidly increased, and in less than two years numbered upwards of 12,000. The first smelting-furnace was set to work in October, 1877. It has been estimated that up to the close of 1880 the value of the metals extracted from the soil at Leadville exceeded $35,700.000.

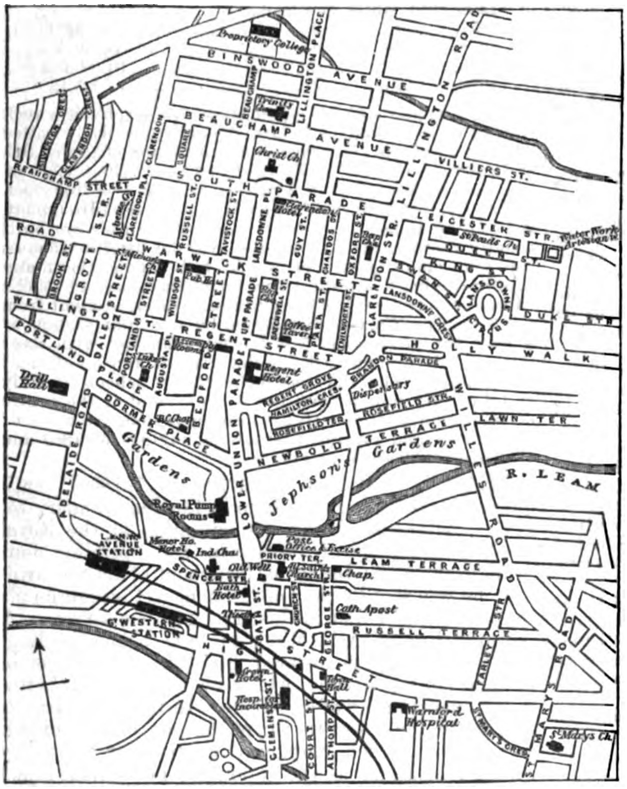
1860–73, gold from placers	$6,400,000
1874, gold and silver	145,000
1875, do. do.	113,000
1876, gold, silver, and lead	85.200
1877, do. do.	555,330
1878, do. do.	3,152,925
1879, do. do.	10,189,521
1880, do. do.	15,095,153

Its site consists for the most part of a porphyritic rock resting on a strongly silicified dolomite popularly called "limestone;" and the brown sand, the source of the wealth of Leadville, is sometimes found just below the surface of the soil, sometimes at a depth of several hundred feet. None of the streets maintain the same level throughout, the contour lines of the declivity on which they are built usually running at right angles. Of the dwelling-houses the vast majority are of wood; but among the many substantial brick structures are an opera-house, a Catholic church, and several bank buildings. Water, brought from the higher grounds, is distributed by a regular system of mains; the principal streets are macadamized with slag; there is a well-organized fire department and an efficient police force. The city has 6 churches, 7 schools, 3 daily and 2 weekly newspapers, and 6 banks, and is the centre of supply for a large outlying mining region, the value of its general and mining business averaging for 1880 and 1881 over $40,000,000 yearly.

LEAKE, **William Martin** (1777–1860), antiquarian topographer, was born in London, January 14, 1777. After completing his education at the Royal Military Academy of Woolwich, and spending four years in the West Indies as lieutenant of marine artillery, he was sent by the Government to Constantinople to instruct the Turks in this branch of the service. A journey through Asia Minor in 1800 to join the English fleet at Cyprus inspired him with an interest in antiquarian topography, which he had afterwards frequent opportunities of gratifying. In 1801, after travelling across the desert to Egypt, he was, on the expulsion of the French, employed in surveying the valley of the Nile as far as the cataracts; but having sailed with the ship engaged to convey the Elgin marbles from Athens to England, he lost all his maps and observations when the vessel foundered off the island of Cerigo. Shortly after his arrival in England he was appointed to survey the west coast of Albania and the Morea, with the view of assisting the Turks against attacks of the French from Italy, and of this he took advantage to form a valuable collection of coins and inscriptions, and to explore many ancient sites. In 1807 he was made prisoner at Salonica; but, obtaining his release the same year, he was sent on a diplomatic mission to Ali Pasha, whose confidence he completely won, and with whom he remained for more than a year as the representative of England. In 1815 he retired from the army, in which he held the rank of colonel, devoting the remainder of his life to topographical and antiquarian studies, the results of which were given to the world in the following volumes:—*Topography of Athens*, 1821; *Journal of a Tour in Asia Minor*, 1824; *Travels in the Morea*, 1830; *Travels in Northern Greece*, 1835; and *Numismata Hellenica*, 1854, followed by a supplement in 1859. A characteristic of the researches of Leake was their comprehensive minuteness, which was greatly aided by his mastery of technical details. His *Topography of Athens*, the first attempt at a scientific treatment of the subject, is still authoritative in regard to many important points. He died January 6, 1860.

A *Memoir* of Leake by the Rev. J. H. Marsden was printed for private circulation in 1864. See also a paper in the *Architect* for October 7, 1876; and a notice of him by Professor Curtius of Berlin in the *Preussische Jahrbücher* for September, 1876.

LEAMINGTON, anciently **Leamington Priors**, or, by license, since 1838, **Royal Leamington Spa**, is a municipal borough and watering-place of Warwickshire, England, situated 2 miles east from Warwick, on the Leam, near its junction with Shakespeare's Avon. Its rise dates from about 1786, when baths were first erected in connection with saline springs which are held to possess various curative properties, and which had been noticed by Camden in 1586. But the rapid increase and continued prosperity of the town are due also, among other causes, to its beautiful and finely sheltered site, to its aristocratic neighborhood, and to the fine hunting country by which it is surrounded. To this must be added its advantages of railway communication by the Great Western and North-Western lines, and the proximity of places of historical and sentimental interest. Warwick is but 2 miles off, Kenilworth 5, Coventry 9, and Stratford-on-Avon 10; while Evesham, Naseby and Bosworth, and Oxford are all within easy reach. Though the houses are handsome, and the streets spacious and well kept, the rates are low, and living is not expensive. There is a choice of social clubs, with churches and chapels in large number, hospitals, an important college, and many fashionable schools. The town has five newspapers, a free library, and a school board. The water, supplied from artesian wells, is pure and abundant. The death rate is but 15 per 1000, which, considering the large numbers of elderly people who settle there, is very low. The fact that nearly all the property is freehold offers great facilities to those desirous of living in their own houses, and is among the inducements to people to make this a place of permanent residence. The Jephson and pump-room gardens are delightful promenades. Leamington was incorporated in 1875. From a population of 543 in 1811 it has, with its suburbs, increased to 26,074 in 1881.



LEANDER. See Hero.

LEASE. See Landlord and Tenant.

LEATHER consists of the hides and skins of certain animals, prepared by chemical and mechanical means in such a manner as to resist influences to which in their natural condition they are subject, and also to give them certain entirely new properties and qualities. Skins in an unprepared moist condition are readily disintegrated and destroyed by putrefaction, and if they are dried raw they become hard, horny, and intractable. The art of the leather manufacturer is principally directed to overcoming the tendency to putrefaction, to securing suppleness in the material, to rendering it impervious to and unalterable by water, and to increasing the strength of the skin and its power to resist tear and wear.

Leather is made by three processes, or with three classes of substances. Thus we have—(1) tanned leather, in which the hides and skins are combined with tannin or tannic acid; (2) tawed leather, in which skins are prepared with mineral salts; (3) shamoyed leather, consisting of skins combined with oils or fatty substances.

Tanned Leather.

Hides and Skins.—The skins of all mammalians may be made into leather, but in practice it is only from a few of the larger animals, readily obtainable in sufficient numbers, and reared and slaughtered for other objects, that commercial supplies are obtained. The term hides is by tanners restricted to the large and heavy skins of full-grown oxen, horses, and other large animals—all the lighter stock being known as skins (calf skins, sheep skins, goat skins, etc.). Of all hides and skins used by the tanner, by far the most important and valuable are those obtained from oxen. Not only do these yield the most useful and valuable hides, but they are slaughtered in all civilized countries in enormous quantities; and, while in Europe the skins of cattle are only of secondary importance, the vast herds which roam practically wild in the plains of South America are valuable more on account of their hides and other products than as sources of animal food. Ox hides are imported into Europe and the United States of America in enormous quantities, and come principally from South America, the Cape, Australia, the East Indies, and North Africa. The main centres of the import trade in hides are Antwerp, Liverpool, Havre, and New York. For tanners' purposes calf skins are distinguished from ox hides, and the kinds of leather into which they are manufactured are entirely distinct. Intermediate between the heavy ox hides and calf skins are East Indian kips, a medium weight skin which comes both raw and tanned from Calcutta and Madras in such large quantities as to form a distinct branch of the leather trade. Horse hides and the skins of the other *Equidæ*—the ass, zebra, quagga, etc.—have in modern times become important raw materials of leather. The various breeds of sheep

ccount of the vast numbers in which their skins
into the market and the numerous applications
eep and lamb skins, come near in value to oxen
urces of leather. As a rule the importance of a
l of sheep for the purposes of the tanner is in in-
proportion to its value as a source of wool. Goat
kid skins come next in order of importance, the
ucts they yield being beautiful in texture, of high
, and of varied usefulness. Goat skins are ob-
d chiefly from the East Indies, the Cape, North
a, South America, Mexico, Asia Minor, and the
regions of Europe. Seal skins, obtained from the
regions, are an important material, while hog
are of value for the purposes of the tanner almost
sively for making saddle leather. Among the
which are only occasionally or locally used may
numerated walrus, rhinoceros, hippopotamus, and
ant hide, yielding very thick leather used for
g wheels in cutlery manufacture, etc., and the
of the numerous species of deer and antelope,
kangaroo, and other Australian marsupials, por-
s, alligators, and occasionally boas.

ructure of Skin.—All hides and skins are exter-
clothed more or less with wool, hair, bristles, or
. The skin itself has a thin superficial horny and
ar layer, the cuticle or epidermis, into which
er nerves nor blood-vessels penetrate. This layer
ring the life of the animal, continually in progress
eling off in the form of small flat scales, and is
ved from the inner portion of the epidermis known
e *rete mucosum* or Malpighian net. The skin
r (*corium*, *dermis*, or *cutis*), which is the only
on of the hide of use for the tanner, consists of a
plexus of fibrous bundles, knit together and in-
ven in every direction, the interspaces being filled
ith an albuminoid substance. The bundles of
terminate on the upper surface of the corium in
ate masses, producing the irregularly papillated
rance seen in the "grain" of leather, and hence
surface is distinguished as the grain side in contra-
ction to the flesh or under side. Chemically the
ctive tissue or fibrous portion of the corium con-
of gelatigenous tissue or collagen, which, accord-
o Reimer, is similar in composition to the fibroin
k. It is insoluble in cold water, weak acids, and
es, but with boiling water it dissolves, forming
n, and it is also soluble in concentrated acids and
es. It combines with tannic acid, forming the
tial basis of leather, and it similarly combines with
nd fats. The interfibrous binding albuminoid
ial called by the same authority coriin is soluble
aline solutions (being withdrawn from the skin
atment with lime water, etc.) and in strong hydro-
c acids, but insoluble in water. It is precipitated
solutions by tannin, with which it combines.
competent authorities maintain that the distinc-
etween the fibrous and nonfibrous portions of skin
y one of physical condition.

ning Materials.—Tannin or tannic acid is a
ct of the vegetable kingdom, abundantly formed
ery large number of plants, and secreted in such
e organs and members as the bark, wood, roots,
, seed-pods, fruit, etc. The tannin obtained from
s sources is not precisely the same in its chemical
ons and reactions. Dr. Stenhouse was the first to
on the principal distinction which possesses prac-
nterest to the tanner. He pointed out that tan-
roducing bodies may be divided into two classes,
rst class comprising such as by their decomposi-
levelop into gallic acid, and by destructive distilla-
ield pyrogallic acid. Of these gallotannic acid,
able from galls, is the type. The other principal
g materials which yield gallotannic acid are su-
, valonia, divi-divi, and myrobalans. The second
embraces tannins which do not resolve themselves
allic acid or yield pyrogallic acid, and of this class
ark, mimosa bark, and gambier yield character-
ypes. All varieties of tannin, however, agree in
possessing a powerfully astringent but not bitter taste, and a distinctly acid reaction; they yield with solutions of salts of peroxide of iron a deep blue-black or green-black solution, and particularly they combine and form insoluble compounds with gelatin and with the gelatigenous tissue which constitutes the principal portion of animal skins. By the action of ether, containing a little water, on gall-nuts, pure gallotannic acid may be procured. The ethereal solution separates by repose into two layers, the lower one, which is of an amber color, being a solution of tannin in water, while the upper layer contains gallic acid, mixed with other substances. On gently evaporating the aqueous solution, nearly pure gallotannic acid is procured, to the extent of from 35 to 40 per cent., from galls. Obtained in this way, it is a shining, porous, uncrystallizable mass; it is soluble in water, and then exerts the properties of an acid. By exposure to air it absorbs oxygen and gives off carbonic acid,—two new products, gallic acid and ellagic acid, being formed at the expense of the tannin; the latter is insoluble. Gallotannic acid may be precipitated from its solutions by sulphuric and some other acids; by boiling the precipitate with sulphuric acid for a few minutes in a dilute solution of the same acid, gallic acid is formed, and crystallizes in cooling. Gallic acid also exists ready formed in gall-nuts, sumach, valonia, tea, and other substances. It does not combine with gelatin, and is therefore useless in tanning. Some tanners, however, imagine the gallic acid of the waste liquor to be useful in swelling or raising the hides, preparatory to removing them to a stronger liquor.

Tannin is in no case isolated for use as a tanning agent. It is only brought in contact with skins and hides by the medium of infusions, decoctions, or extracts of the various tanning materials in which a percentage of tannin is present mixed with coloring and other extractive material.

The substances enumerated below comprise the principal tanning materials in use throughout Europe and America.

Oak Bark.—In early times the bark of the common oak, *Quercus Robur*, was almost the only tanning material used by British tanners, and it still is the substance from which the highest quality of heavy tanned leather is prepared, although with it the process is necessarily tedious. Throughout the country there are still a few tanners of sole leather whose boast is that they use nothing but oak bark. The entire supply of British oak bark is estimated at from 200,000 to 300,000 tons annually. This quantity, with the additional import of 30,000 tons from the Continent, is altogether inadequate to meet the demands of the tanners, apart from the necessity which is now felt for forcing the tanning operation much more rapidly than was formerly the rule. The most useful bark is obtained from coppice wood of about twelve years' growth, although in inner bark of longer growth a large proportion of tannin is secreted. The amount of astringent matter in coppice bark may be taken to average from 8 to 10 per cent., but the statements of the quantities of tannin in different samples vary within wide limits, as much as 18 per cent. being in some cases found. There is no doubt that the peculiar excellence of the sole leather of England is due in great measure to the superior oak bark produced there. Oak bark imparts firmness and solidity to leather, while other sorts give softness; thus the peculiar softness of French curried leather is referred to the bark of the evergreen oak, with which the better kinds are tanned, while the other tanning materials next to be named give each its peculiar quality with respect to color, scent, toughness, or the power of resisting moisture and decay.

Other species of oak also yield tanning materials of much importance, and are extensively used. The cork oak, *Quercus Suber*, of south Europe and north Africa, in addition to its well-known external layer (the cork of commerce), possesses a fibrous inner bark which is richer in tannin than ordinary oak bark. It is much employed in France, and is imported also to some extent into the United Kingdom. In the United States several varieties of oak yield staple tanning materials. Of these the principal are the rock or chestnut oak, yellow oak or quercitron, both important sources of tanning barks; the red oak and white oak are of less consequence.

Mimosa Bark.—Under this general name a large amount of bark comes to the English market from Australia, principally from Melbourne and Adelaide, and from Tasmania. It is obtained from a large number of trees belonging to the genus *Acacia*, widely distributed throughout Australasia, and the various barks are rich in tannin, which ranges from 15 up to 32 per cent. The qualities imported into England are the richer kinds. They amount to about 30,000 tons annually, and may be assumed to contain on an average 28 per cent. of astringent matter. These richer barks are the produce of *A. harpophylla*, a Queensland tree, the black wattle (*A. molissima*), the gold wattle (*A. pycnantha*), the silver wattle of Tasmania (*A. leucophylla*), and *A. cyanophylla*. The red color of mimosa bark produces a dark leather against which there is a prejudice, and the material has therefore to be used sparingly in mixtures. It is also said that mimosa tanning results in a somewhat hard brittle leather.

Hemlock Bark is the most important tanning material in North America. It is the produce of the hemlock spruce, *Abies canadensis*, which grows in vast forests throughout Canada and the northern and eastern States of the Union, the principal bark-producing States being Pennsylvania, Michigan, and Wisconsin. Hemlock bark is obtained by cutting down the trees; and, as no provision is made for renewing the denuded forests, the strain on the more accessible portions of the American forests is already beginning to make itself apparent. The bark contains 7 or 8 per cent. of tannin, and the leather it makes has a strong reddish-brown color. A large and increasing amount of hemlock extract, an inspissated decoction of the bark having a specified richness in tannin, is now imported into Europe, principally to the United Kingdom.

Among barks used to a limited extent and for special purposes are *larch* and *Scotch fir barks*, used for tanning sheep skins into basils, etc. *Willow bark* is used in Russia for tanning russia leather. *Mangrove barks* (*Rhizophora Mangle*), which are exceedingly abundant in India, and rich in tannin, have been tried in the United Kingdom, but their use did not prove satisfactory.

Wood.—Quebracho wood (*Aspidospermum Quebracho*), a wood rich in tannin, obtained from the river Plate, has recently grown rapidly in favor as a tanning substance in the United States and France, and is now coming into notice in the United Kingdom.

Fruits.—Under this head are comprised valonia, myrobalans, and divi-divi, three substances which now play an important part in tanning both in Europe and America. *Valonia* consists of the imbricated acorn cups of a species of oak, *Quercus Ægilops*, which is indigenous in Asia Minor, Greece, and southern Turkey, and is mainly shipped from Smyrna. It contains as much as from 40 to 45 per cent. of tannin, and the average annual imports into the United Kingdom are now not less than 30,000 tons. *Myrobalans* are the dried immature fruit of species of *Terminalia*, principally *T. Bellerica* and *T. Chebula.*. They vary in size and appearance, but in general they are oval hard wrinkled nuts rather larger than a filbert. The amount of tannin they yield varies from 20 to 36 or sometimes as high as 40 per cent. Myrobalans grow abundantly throughout India, and are largely and increasingly exported from the three presidencies to the United Kingdom. DIVI-DIVI (*q. v.*) contains as much as 50 per cent. of tannin. Though it is in considerable use, tanning with divi-divi is subject to several grave objections. The abundant mucilage of the pods ferments readily, and thereby sometimes causes a rotting of the hides. Leather tanned by divi-divi also draws moisture readily in presence of damp, while in a dry atmosphere it is hard and horny, and further this agent leaves finished leather very dark in color.

Leaves. Sumach.—The leaves of various species of *Rhus*, under the name of sumach, or sumac, form materials of the first importance for the tanning of light skins in which it is essential to have a fine white color, as in the case of bright morocco leather, etc. Of the species the most important is the Sicilian sumach, *R. Coriaria*, a shrub or low tree indigenous to Italy, Spain, France, and the Mediterranean coasts of Africa. It is cultivated with much care in Sicily, the leaves being gathered from shoots not more than a year old, which thereafter are cut down close to the parent stem. The same shrub is largely cultivated in the southern departments of France, in Spain, and in Portugal. The leaves gathered in June are dried and ground under edge rollers to a fine dust, in which condition the material comes into the market. It has a bright olive-green color with something of the odor of tea, and should contain in the best qualities from 25 to 30 per cent. of gallotannic acid, the same tannin which is present in galls. The leaves of the Venetian sumach, *R. Cotinus*, are similarly used in the eastern countries bordering on the Mediterranean. In America a large quantity of sumach for tanning is obtained from two species of *Rhus*, *R. copallina* and *R. glabra*, growing principally in Virginia, the Carolinas, Georgia, and Alabama. These are, however, much inferior to European sumach, both on account of the color they communicate to leather, and also from the smaller percentage of tannin they yield, although it is believed that with careful cultivation and proper attention the quality might be greatly improved.

Extracts.—*Cutch* and *Gambir*, vegetable extracts obtained from the East are frequently confounded, and in commerce they indifferently pass under the name of terra-japonica and catechu (see CATECHU, vol. v. p. 192). Gambir, which comes almost exclusively from Singapore, is the inspissated juice of the leaves of *Uncaria Gambir*, a tall shrub belonging to the natural order *Rubiaceæ*. The extract comes into the market in the form of cubes about an inch in size, of a dull brown earthy appearance. In composition and properties it agrees with Cutch. The exports from Singapore amount to about 80,000 tons annually. KINO (*q. v.*) is exceedingly rich in a variety of tannic acid, but its high price precludes its use in tanning. These extracts are used in tanning only in conjunction with other materials; they not only hasten the operation, but, judiciously used, they tend to render the leather soft and mellow.

Galls.—Although galls are among the richest of all bodies in tannic acid, they do not form an important item among the materials of the tanner, being most valuable for other industrial purposes, and therefore too costly for use as tanning agents. The "knoppern" galls of Hungary, which are formed on the acorn cups of a species of oak, however, are to some extent used in Continental tanneries. For full information regarding galls, see vol. x. p. 40.

It is to be noted that most of the tanning substances above alluded to may be and are used in dyeing as well as for tanning.

Grinding and Leaching of Tanning Materials.—Bark, valonia, myrobalans, and other tanning bodies are reduced to a small and as far as possible uniform size by means of grinding or comminuting machinery. The main object in such machines is to produce uniformity of size with as little dust as possible, and the apparatus most commonly used is similar in principle to the ordinary coffee-mill, with breaking arms for the bark and segmental cutters for smaller materials. Various forms of disintegrator are also used, which produce their effect by violent concussion obtained by the revolution in opposite directions of two large and strong disks armed with projecting spikes on the sides of the disks facing each other. These disks are enclosed within a stout iron drum; and, as they revolve at a speed rising to three thousand revolutions per minute, some conception of the violence with which the tanning materials are struck and smashed may be formed. The tanning materials so prepared are next leached, latched, or infused for preparing the strongest tanning solutions for use in the "layers" or lay-away pits noticed below. In making these leaches or infusions, some tanners use hot (even boiling) water, others use cold water alone; some employ only pure water, and by some the weak and exhausted oozes or woozes from the pits are strengthened up by renewed leaching. The sole object of the tanner is to obtain the greatest amount of the tanning principle contained in the materials operated on, and to take care that what he gets is not lost or wasted. The method of leaching commonly adopted in the United Kingdom is to pass the bark through a series of leachers or spender pits. New or fresh bark is put into the first of the series, and over it is pumped cold the well-strengthened ooze from the next leacher. In this first pit the ooze or infusion is brought up to the full strength required for the lay away tan-pits, and after the infusion is pumped off the tan (now somewhat reduced in strength) is passed over into No. 2 leacher, where it is treated with liquor in its turn also somewhat lower in strength. In this manner the bark passes by stages through a series of pits, diminishing in richness in tannin at each stage, and in the same gradual manner being infused in a weaker and weaker liquor, till in the last of the series it is fully exhausted with pure warm water. Thus pure water is put in at one end of the range and fresh tanning material at the other; the water as it ascends is gradually strengthened till it reaches the maximum rich-in tanning principle, while the tanning material lescends is in like proportion deprived of its exve constituents, till in the end nothing further e remains. From the last pit the bark, etc., are l out as "spent tan," usually to be burned in a l form of tan-burning furnace for raising steam. ise of leaches or infusions was first insisted on by n about the end of the 18th century, and the ion of his suggestion led to the shortening of the occupied in tanning heavy leather by about one

ting *Tan Liquors.*—The methods by which the g value of any substance is determined are numerut few of them are at once capable of simple apion and minutely accurate. One of the commonins for ascertaining the strength of the tan liquor cally called ooze, or wooze, is by means of a kind lrometer called a *barkometer*. It is graduated to andard of pure water; and, when it is placed in a nen of ooze, the strength of the latter is judged the position of the stem above or below the water-

But, as bark or other tanning material may n several soluble substances besides tannin, the meter obviously cannot be relied on. Some tanudge of the strength of ooze by its astringency to ste. Seguin, who in the end of the 18th century e first to insist on the advantage of tanning with usly prepared infusions, proposed the use of a n of gelatin as a test of the presence of the tan- In trying the quantity of tannin by Seguin's pro- 80 grains of the bark in coarse powder should be on by half a pint of boiling water. The mixture be frequently stirred, and suffered to stand -four hours; the fluid should then be strained h a linen cloth, and mixed with an equal quansolution of gelatin, made by dissolving glue, or isinglass, in hot water, in the proportion of a n of glue or isinglass, or six table-spoonfuls of to a pint of water. The precipitate should be ed by passing the mixture of the solution and inthrough folds of blotting-paper, and the paper d to the air till its contents are quite dry. Every ains of precipitate contains 40 grains of tannin

As, however, some kinds of tannin produce precipitates of gelatin than other kinds, and as nposition of tanno-gelatin varies with the strength of the solution of gelatin and of tannin, this d is not reliable. Sulphate of cinchonin is said rd a better test; a solution of this, acidulated few drops of sulphuric acid, will, it is said, pree tannin completely from the solution. Löwenmethod, founded on the fact that solutions of in presence of sulphuric acid are readily oxidized manganate of potash, is very useful for the comre determination of the value of different tanning nces. A given weight of tanning material is inand the solution is brought up to a definite vol- One half of this measured quantity of tannin n is mixed with definite quantities of a standard carmine solution and sulphuric acid, and to this e permanganate solution is added from a gradunbe till the color of the indigo is completely disd, when both tannin and indigo are oxidized. A l experiment is next made with similar measured ts of indigo and sulphuric acid solutions, but t any tannin infusion. The difference between antity of permanganate required to discharge the the two experiments gives the standard for calg the amount of tannin in the solution to be tested. er good method of testing the value of tanning al is to digest a piece of dry prepared hide or skin own quantity of the infusion, until the whole of nnin and other matters be separated. The skin taken out, slightly washed, dried, and weighed, he increase of weight is supposed to be the weight in and of the other matters required. An appaevised by MM. Muntz and Ramspacker has rebeen introduced for facilitating this last test. It consists essentially of a small vessel sufficient to hold a measured quantity of a tanning infusion, the specific gravity of which is carefully ascertained. That vessel is so arranged that strong pressure can be brought to bear on it by means of a screw acting on an india-rubber surface, thereby forcing the liquid through a piece of skin which covers the lower part. The skin absorbs the whole of the tannin during the passage through it of the infusion, and by ascertaining the specific gravity of the escaped liquor the percentage of the tannin material in the infusion can be readily determined. This apparatus has been extensively introduced in practice in England and on the Continent.

Sole Leather or Heavy Leather Tanning.—The hides of oxen are received in the tan-yard in four different conditions. These are—(1) market or slaughter-hides, which, coming direct from local abattoirs, are soft, moist, and covered with dirt and blood; (2) wet salted hides; (3) dry salted hides; and (4) sun-dried or "flint" hides,—the three last forms being the condition in which the imports of foreign hides are made. The first operation in the tannery is to clean the hides, to free them from salt, and to bring the hard dry hides to the uniformly soft, flaccid condition in which all market hides are obtained. The treatment at this stage requires skill and attention to prevent the more soluble constituents of the hide from dissolving out in the washing and soaking processes, and also to secure the complete softening of the entire substance, upon which the successful tanning greatly depends. In the case of market hides, cleaning and softening are principally effected by washing and soaking in spent lime-water, while for dry hides and dry salted hides brine is essential. The softening of these materials is helped and rendered thorough by working them for some time in the stocks (fig. 1) after they have been well soaked. After being thus brought as nearly as possible into a uniform condition, all hides are treated alike. The first operation to which they are subjected is *depilation*, which removes, not only the hair, but also the scarf-skin. This is effected variously in different countries. In England the most common plan is to throw the hide or skin into a strong watery ley of slaked lime, with lime in excess. By this, in a few days, more or less according to the proportion of lime present, the hair is easily detached, the hair-sheath having been dissolved. The hair was formerly taken off by making a sour liquor from fermented vegetable matter, in which the hides lay for several days; they were also smoked in a damp state for the same purpose; but both those methods are now abandoned. They are still, sometimes, especially on the Continent, sweated, that is, they are laid in heaps and kept wet and warm, a plan which is still adopted in England for skins. In America the sweating is performed cold; the hides are hung up wet in a damp underground cellar, and are kept moist for ten days or a fortnight. In either of these sweating processes, incipient putrefaction takes place sooner or later, when the hair and scarf-skin are

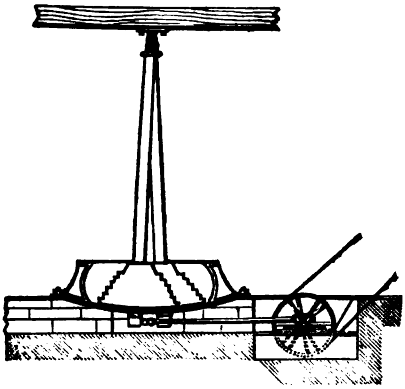


Fig. 1.—Double-acting Stocks.

easily removed; but the fatty matter remains, and in some cases prevents the hide from taking the tan.

There have been numerous other methods proposed and patented for unhairing skins, few of which have been received with much favor. Among the agents proposed may be mentioned caustic soda, sulphide of sodium and sulphide of calcium, borax, sugar, and charcoal—substances which it is obvious must act in very different manners. Lime and alkaline solutions not only loosen the hair and scarf-skin, but also "plump" the corium or true skin, that is, they swell it and render it consequently porous and more permeable to the tanning solution. Lime further forms with the fatty matter of the flesh side calcareous soap, thus neutralizing the fat, which would otherwise interfere with the tannin. Some tanners, especially Americans, who work the so-called acid process, plump their hides by the use of sulphuric acid, hanging them six or eight hours in a solution containing $\frac{1}{100}$th of acid. The plumping is sometimes done as a preliminary operation, and again others add the acid to the color pits, or the first pit into which the hides go for the tanning process. Among non-acid tanners, the plumping of sweat stock in which there is no lime is secured in the weak acid, liquors of the coloring and handling pits. In the case of limed stock the hides, at the proper stage, are withdrawn from the pits and stretched over an unhairing beam (fig. 2), when with a working knife (fig. 3, *a*) a workman partly scrapes partly shaves off the hair and scarf-skin. Another workman in a similar way with a fleshing knife (fig. 3, *b*) removes the fatty compounds and flesh from the flesh side. For these operations several machines have been adapted, working mostly with revolving knives or cutters, under which the hides or skins pass in a fully extended state. Such machines are, however, only applied to the smaller skins. The next step in the preparation of the hide is to remove from it as thoroughly as possible all traces of lime. This is partly accomplished by going over the hide on the beam with a scudding knife, pressing the combined lime and interfibrous matter out of the tissue. For more complete neutralization of lime in the larger hides the influence of the weak acid of the coloring pits is trusted to. Harness hides are washed by some means in pure water, the most convenient and generally adopted method being to place them in the dash wheel (fig. 4), in which they revolve and tumble about whilst fresh water is continually being poured on them within the revolving wheel.

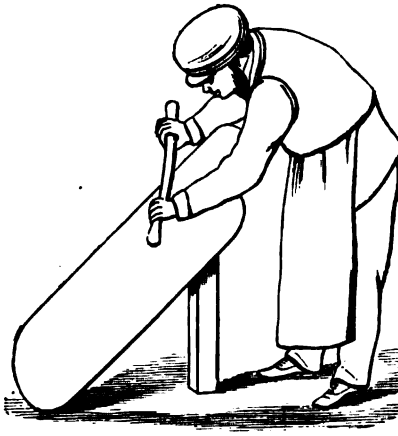


FIG. 2.—Tanner's Beam.

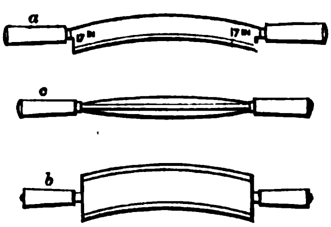


FIG. 3.—Tanner's Knives and Pin.

The hides now come to be trimmed and prepared for tanning in the shape in which they are intended ultimately to be sent into the market. An entire untrimmed hide (fig. 5) is termed a crop; a side is half a crop, the dividing line of the two sides being shown at EF; a butt is the back portion ABCD, and a bend is half a butt ABFE. G, G are belly pieces, and H, H the cheeks, both together being the offal. When the shoulder (the upper part of the butt) is removed, what remains is a short butt.

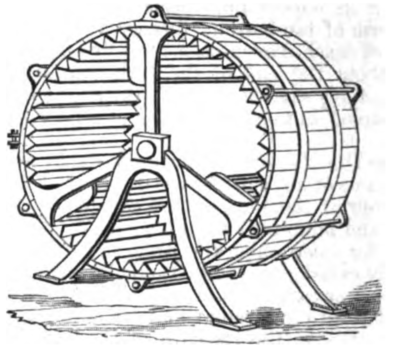


FIG. 4.—Dash Wheel.

The actual tanning now commences, and the operations involved may be divided into a series of three—(1) coloring, (2) handling, and (3) the laying away. The coloring consists in exposing the hides in a series of pits containing oozes which are almost entirely deprived of tannin, but in which some amount of gallic and acetic acids have been developed, and which, moreover, contain a large proportion of the coloring matter extracted from the tanning substances. In these pits (also called suspenders) the hides are suspended over poles laid across the pit, and they are moved daily from one to another of a series of four or six, this stage usually occupying about a week. As the hides are moved forward in the series they are exposed to a liquor containing a small and steadily increasing proportion of tannin, and this, it may be said, holds good till the hide reaches the last lay-away pit, in which the tanning is completed. The objects attained in the coloring pits are the superficial coloring or dyeing of the hide, some amount of plumping from the acids of the ooze, and a dissolving out of remaining traces of lime, principally by the acetic acid to which the hide is exposed. After coloring, the hides pass on to the handlers or handling pits, a round or series of which may consist of from four to twelve, according to the mode of working. In the handlers the hides are spread out horizontally; and in the first series they are "handled" once a day or more frequently if convenient. The handling consists of lifting the hides out of the pit by means of a tanner's hook (fig. 6), piling them on the side till they drain, and returning them into the pit, the hide on the top in one handling going to the bottom in the next. This operation is continued throughout the series; only as the hides advance the necessity and advantage of frequent handling decreases, while the strength of the tan liquor in which they are handled

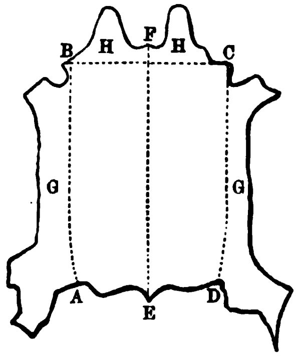


FIG. 5.—Divisions of a Hide.

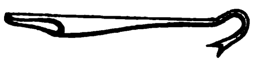


FIG. 6.—Tanner's Hook (without handle).

increases. The whole handling stage consumes on an average about six weeks. Finally, the hides are carried over into the layers or lay-aways. In these the stock is exposed to the strongest tanning liquors, and between the hides thin layers of the tanning bark or mixture are strewn. The object of this interstratification is to separate the mass of hides so as to secure the more ready permeation of the entire mass by the liquor, and also to feed and strengthen the ooze itself as its tannin is absorbed by the hides. In these layers the hides are allowed to rest for about six weeks, after which the pits are cleared out, charged with fresh ooze, and filled with the hides and tan as before. These processes may be repeated three or four times before the tanning is completed. When the process is deemed complete, each hide, on being taken out, will be found to be converted into leather, and a portion of its gelatin which has been dissolved from its interior is, by combination with a portion of tannin from the strong solution, deposited upon its surfaces, where it is found in the form of a yellow deposit, technically known as *bloom*, or *pitching*, which disguises the under color of the leather just as if it were covered with yellow paint. This, prejudice says, must be on its surface, or it is not salable, but it is so much quality and weight lost to the consumer, as he pays for it on the outside of his leather to be worked off in the dressing and currying operations. By some tanning agents—mimosa, for example—there is little or no bloom deposited.

The theory of the formation of the bloom is this. As soon as ooze has penetrated into a hide it loses its tanning material, but by capillary attraction is detained; this exhausted ooze acts by maceration on the finer and more soluble interstitial gelatin, and dissolves it. In handling, about one-twelfth of this flows out; the remaining eleven-twelfths accompany the hide into the next stronger solution, of which only one-twelfth is absorbed directly, and a small portion is slowly exchanged by endosmosis and exosmosis. The small portion of strong solution which passes into the pores of the hide contributes to tan the hard fibrous portions not dissolved, and the small portion of weak solution passing out of the hide by exosmosis gives up its dissolved gelatin to the tan of the stronger solution outside to form tannate of gelatin, which partly adheres to the surface as bloom, and partly falls to the bottom of the pit as pitching.

From the time when the raw ox hide is taken in hand till the leather is fully dried, not less than a year is consumed in the case of the best qualities of sole leather. It was formerly the practice in England, as it still is on the Continent, to tan by the process of *stratification*, for which purpose a bed of bark is made upon the bottom of the pit; upon this is laid the hide, then bark, then a hide, and so on until the pit is full; water is sometimes pumped in, and the pit left for some months; it is then emptied, and the same hides returned with fresh bark and water for a few months longer; this is repeated again and again, until the tanning is completed, the time varying from one to four years for heavy leather.

The devices and processes which have been proposed and to some degree put in operation with the view of shortening the time occupied in tanning are beyond all enumeration. In scarcely any case have time-abridging processes proved successful in practical working, so far as the production of good leather is involved; and now the opinion appears to be completely established that, for the thorough tanning of heavy leather, a slowly operating influence and consequently long time are essential. The devices for the hastening of tanning have for the most part turned upon some plan for forcing the tan liquor into and through the pelt, or for alternate soaking and squeezing of the hides. Among the plans which have been tried on a commercial scale may be enumerated tanning by the application of hydrostatic pressure to force the liquor through the hides, a method which failed simply because the pressure was equal on both sides. The vacuum tanning principle is another which has been extensively tried, only to issue in disappointment. It consists in hanging the hides in a pit or cylinder so constructed that the air can be exhausted by an air pump, after which tan liquors are forced into the vessel, air readmitted, and again withdrawn. Hides, however, loaded with water swell little under diminished atmospheric pressure, and the practical difficulty of procuring and maintaining a vacuum in tan pits is very great More promising results have been obtained by setting up in tan pits the physical process of endosmosis and exosmosis. This is done by sewing up hides two and two as bags which, being filled with solution differing in specific gravity from the tan liquor in which they are immersed, thereby set up transfusion through the hide. This process failed chiefly through the hardness of the leather it yielded. A plan of sewing hides into bags and suspending them filled with strong tan liquor, which as the fluid exuded was renewed, was also tried for some time. Again, it has been attempted to keep the hide suspended stationary in the pits and move the liquors instead of carrying over hides from one pit into another. A more recent device, which may not yet be fully tested, consists in keeping up the strength of the liquor by a continuous circulation through pipes from the stronger into the weaker infusions. By this system of circulation, instead of the oozes in which hides are immersed becoming weaker and weaker the longer they rest in the liquor, the ooze is kept up at least to its original strength, and it may indeed, if desirable, be increased in proportion as the tannin combines with the hide.

Heavy hides for sole leather, belting, and similar purposes do not require to undergo any elaborate dressing or currying. When finally removed from the tan pits they are piled grain to grain and flesh to flesh to drain, care being taken that no tan liquor is allowed to lurk in the pile, which is covered over from the light. When sufficiently drained, they are brushed or scoured to free them from adhering impurities, and removed to the drying loft, where, after lightly rubbing over with oil, they are hung on poles to dry. In the loft steam-heated pipes keep a dry atmosphere during winter, and enable the attendants to regulate and control the drying of the leather. The leather when dried in this condition is rough tanned, and for finishing as sole leather it has to be struck out or "pinned" and compressed by rolling. For striking or pinning by hand the hide is dampened with water, thrown over a beam, and worked all over the grain side with a striking pin (fig. 3, *c*). This operation smoothes and levels the grain, removes smaller wrinkles, and to some extent compresses and solidifies the leather. Striking machines (fig. 7) are now very generally used for the operation. These consist of a drum or cylinder having a parallel series of projecting knives, or plates of gun-metal, set angularly across its surface. Underneath the drum is a brass bed, fixed on a yielding cushion, which can be pressed up or eased by means of a foot lever, according as the leather operated on is thick or thin. The drum is made to revolve at a very rapid rate, the blunt edges and external angles of the knives thereby striking the surface of the leather with great violence, and thus the

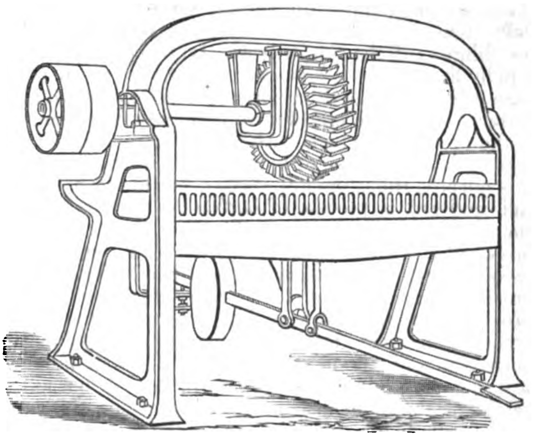


FIG. 7.—Leather Striking Machine.

grain is struck out, smoothed, and compressed in a very rapid and efficient manner. Finally, the leather is rolled and compressed on a level zinc-lined wooden bed by a heavy hand roller, such as is shown in fig. 8, or on the platform of one of the numerous forms of machines designed for that purpose.

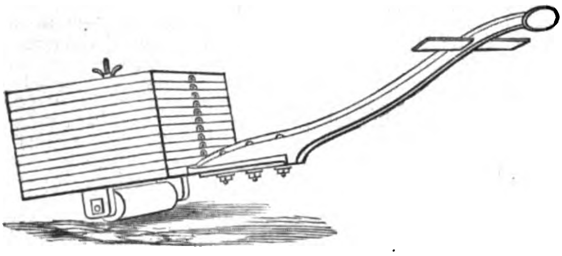


FIG. 8.—Hand Roller.

The yield of leather from a given weight of dry hide varies very much according to the different styles of tannage and materials used. As a mean outcome, it may be said that 100 ℔ of green hide, tanned with from 300 to 400 of oak bark, will yield 40 to 50 ℔ of leather; 100 ℔ of green hide, however, when deprived of hair, flesh, and moisture, will weigh only 18 ℔, and, taking 100 ℔ of dry hide, which, fleshed and unhaired, weighs 85 ℔, the yield of leather will be from 180 to 200 ℔ according to tannage. The percentage of tannin alone absorbed from different tanning agents has been found to be for hemlock, 64·2; pine, 90·8; chestnut, 85·2; oak, 76·9; oak, three years in pit, 70·2. Heavy leathers, being sold by weight, are subject to adulteration, and have fictitious weight given them without any benefit to the material, but rather the opposite, by impregnation with such salts as sulphate of magnesium or chloride of barium, or with glucose, the last being the most frequently used adulterant.

Upper Leather.—Under this head are included the thin, soft, and pliable leathers which find their principal, but by no means exclusive, application in making the uppers of boots and shoes, which may be taken as the type of a class of leathers. Upper leathers are made from such hides and skins as East Indian kips, light cow hide, calf skins, horse hide, and also from split heavy hides. The preparatory dressing of such skins, and the tanning operations, do not differ essentially from those already described. In proportion to the thinness of the skin treated, the processes are more rapidly finished and less complex, while at the same time the skins absorb a large percentage of tanning extract. The lime used for unhairing must be removed in the preliminary stage, with greater thoroughness than is essential in the case of hides for sole leather; and for this purpose the skins are washed in the dash wheel, and undergo a process of *bating* or *grainering*. A quantity of pigeon's dung is dissolved in water, and in this the hides are steeped for a week or ten days, with occasional removals and strikings. The theory of this process is obscure, but it has been explained on the supposition that the uric acid of the dung removes the excess of lime, and that the ammonia generated by the putrefaction of the mixture tends to form an ammoniacal soap with any remaining fat of the hide; but as the gelatin of the hide exists in two states,—one the principal, hard, or fibrous portion, and the other (which is more soluble) contained between the fibres, and more affected by agents and putrefaction—this softer portion is removed by grainering, and the leather, when tanned, is light and porous, and more readily permeable by water. Small skins are not fished one by one out of the coloring and handling pits, but the whole contents of the pits are tied together, so that when the upper skin is seized it is thrown over a sparred cylinder erected between each pair of pits, and, the wheel being set in motion, the entire string of skins comes up over its surface and is passed into the neighboring pit with the utmost rapidity. Such an apparatus is used for handling all small pieces and fragments, as for example the cheeks and bellies of heavy hides.

The time occupied in tanning an upper leather, say an East Indian kip, with a mixed mimosa, sumach, valonia, and terra tannage, may be about three months. In the fine tanning of calf and kip skins on the Continent, for which French and German tanners are famous, the duration of the operation may be from four to eight months.

Splitting.—In the preparation of most kinds of upper leather, the hides are split into two, or three, and sometimes more portions. In the case of a single split the portions form a grain and flesh side; when three sections, or slices, are made they result in grain, middle, and flesh splits. Some tanners split their hides in the green condition, others after coloring, and in many instances the splitting is done, after the leather is fully tanned, by the currier, as a regular part of his operations, this being particularly the case with imported tanned East India kips, and other fully tanned leather of foreign origin. Splitting machines will be alluded to in connection with the operations of currying.

Currying.—Leather as it leaves the tannery is a comparatively rough, harsh, and intractable substance, and the duty of the currier is to dress and otherwise fit it for the use of the shoemaker, coachbuilder, saddler, and the numerous other tradesmen who work in it. The currier has to smooth the leather, so to pare it down as to reduce inequalities of thickness, to impregnate it with fatty matter in order to render it soft and pliable, and to give it such a surface-dressing, color, and finish as will please the eye and suit the purposes of its consumers. The operations of currying are complex and varied, each particular class of goods receiving a treatment in many respects peculiar to itself. The fact also that machinery is used by some curriers for nearly every mechanical operation, while others adhere to the old manual system, renders it almost impossible to give in brief an outline of operations which will be consistent with the practice of any considerable number of curriers.

Regarding currying as principally a handicraft, the following may be taken as an outline of the range of operations for the preparation of a waxed calf leather, the commonest form of upper leather in use. The leather is first made pliable by soaking in water, after which it is shaved on the flesh side, and a tolerably smooth surface is produced. This operation is carried on at a beam, or strong frame of wood, supporting a stout plank faced with lignum vitæ, and set vertically, or nearly so. The knife (fig. 9) is a double-edged rectangular blade, about 12 inches by 5 inches, with a straight handle at one end, and a cross handle at the other in the plane of the blade. The edges of this knife are first made very keen, and are then turned

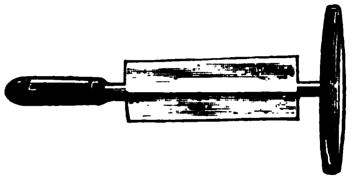


FIG. 9.—Currying Knife.

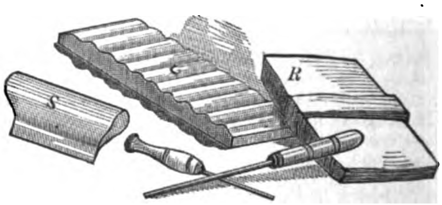


FIG. 10.—Currying Apparatus. C, pommel; R, raising board; S, slicker.

over so as to form a wire edge by means of the thicker of the two straight steel tools shown in fig. 10. The wire edge is preserved by drawing the thinner steel tool along the interior angle of the wire edge from time to time as required, for which purpose the man holds this smaller tool between his fingers, together with the beam-knife. The skin being thrown over the plank, the man presses his body against it, and leaning over the top holds the knife by its two handles, almost perpendicularly to the leather, and proceeds to shave it, shifting it from time to time so as to bring all the parts under the action of the knife, and frequently passing a fold between his fingers to test the progress of his work. The skin is then placed in hot water, and removed to a mahogany or stone table, to which the wet flesh side adheres, and is worked with a tool called a stretching iron, or slicker S (fig. 10), consisting of a flat, rectangular piece of iron, copper, or smooth hard stone, fixed in a handle. With this tool a man scrapes the surface of the skin, exerting a strong pressure with both hands, and dashing water upon it from time to time, by which means lumps and inequalities are made to disappear, the leather is equalized and extended, and the bloom is brought to the surface. The superfluous moisture and the superficial bloom are now *slicked* out, and a stuffing, or *dubbing*, of cod oil and tallow is rubbed into both sides of the skin, but chiefly the flesh side, by means of a brush, or with the woolly side of a piece of sheep skin. The skin is now dried in a loft, and, as the water only evaporates, the dubbing sinks into the pores. When dry enough for the purpose, the skin is *boarded*, or worked with a graining board or pommel C (fig. 10), the effect of which is to bring up the *grain*, or give a granular appearance to the leather, and also to make it supple. The pommel is a piece of hard wood, grooved like a crimping-board, and attached to the hand by means of a strap, whence the word pommel, from the French *paumelle*, or palm of the hand. The leather passes through various manipulations, each having its distinct name; thus *graining* consists in folding the skin with the grain sides in contact, and rubbing strongly on the flesh side; *bruising*, or rubbing the extended skin on the grain side; *whitening*, or passing a knife with a very fine edge over the skin at the beam, so as to clean the flesh side preparatory to *waxing*, which is done just before the skins are sold; for at this point the currier stores his skins, as they can be kept best in the state of *finished russet*, as it is called, previous to waxing. Waxing consists of two parts: the first is the laying on the *color*, or blacking of oil, lampblack, and tallow, which is well rubbed in on the flesh side with a hard brush; then, secondly, the skin is black-sized, with stiff size and tallow, laid on with a sponge or soft brush, and thoroughly rubbed with a glass slicker, a finishing gloss being given with a little thin size. The curried skin is now said to be *black on the flesh*, or *waxed*, in which state it is used for the upper leathers of men's boots and shoes. In the case of any of the numerous varieties of grained leather which are blackened and dressed on the grain side, the finishing operations are different. These are hard dried after slicking, and the operation of stuffing or dubbing is omitted. They are grained in the dry state, often by machinery, then boarded to soften them, and next blackened on the grain side with a solution of copperas. The flesh side is whitened or *fluffed* and the grain is treated with sweet oil or some similar oil, and finally glazed with a thin solution of gelatin or of shellac.

For almost every operation in currying efficient machinery has now been adapted, the use of which not only modifies the operations of the currier, but also enables him to split up hides and to finish his splits as imitations of any kind of leather he may desire to copy. In machine currying the tanned hides, duly damped, are struck out in a "stoning" machine. It consists of a strong oscillating arm or bar having a blunt steel blade fixed on its end, which works back and forward over a concave bed on which the hide is laid, and which by its scraping and striking action on the softened leather smooths and equalizes the grain, and produces a compact uniform surface on it. From the stoning machine the hide may pass to the splitting machine, of which there are numerous forms, the American union splitter with a fixed knife being the oldest and best known. A much more perfect machine, however, is the belt or band splitting machine. In this machine (fig. 11) the knife or cutter *a* is an endless band of steel which revolves at considerable speed with its cutting edges close to the sides of a pair of rollers through which the leather is fed and pressed against the knife. The lower of these rollers is made of short segments or rings, each separately capable of yielding to some extent so as to accommodate itself to the unequal thicknesses of various parts of a hide. The thickness of the slice of leather to be cut is gauged to the utmost minuteness by means of the hand screws *b*, *b*, which raise or lower the upper roller. The knife edge of the cutter is kept keen by rubbing against revolving emery wheels *c* as it passes round. So delicately can this machine effect its work that slices of leather uniform throughout and as thin as paper can be easily prepared by it, and with its help it is no uncommon practice to divide a comparatively thin East Indian kip into three useful splits. Another machine now largely used by curriers is the scouring machine (fig. 12). a level table or platform freely movable in all directions, having mounted over it a reciprocating frame in which are fixed brushes and pieces of slate or thin stone. These, with a small jet of water, scour and brush the entire surface of the leather lying on the platform, effectually scouring out bloom and all soluble impurities. Other machines are washing and stuffing drums and whitening machines. In the latter the leather is pared and equalized by the

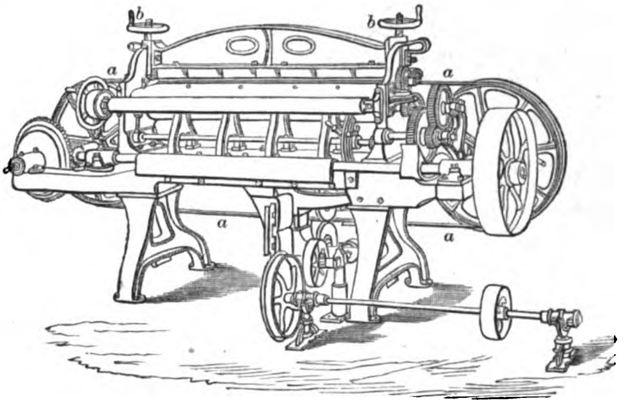


FIG. 11.—Belt Knife Splitting Machine.

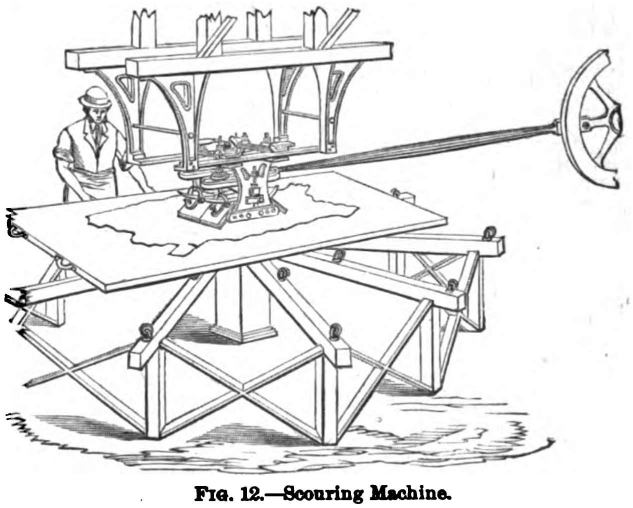


FIG. 12.—Scouring Machine.

cutting action of a small cylinder armed with oblique cutting edges. The cylinder, moved to and fro with a pendulum motion, and revolving at the enormous rate of from 2000 to 3000 revolutions per minute, pares and shaves the leather on the same principle as the lawn-mower cuts grass. Embossing or graining cylinders, boarding cylinders, glassing machines, and emery wheels for fluffing the flesh side of levant leather are also among the mechanical adaptations for currier's use.

Patent or Enamelled Leather.—Leather finished with a brilliant, smooth, and glossy surface, used for dress boots and shoes, dress belts, and fine harness, is known under a variety of names, as lacquered, varnished, japanned, and enamelled leather, etc. Such leather is finished principally from tanned calf skins, and in more recent times from seal, goat, and sheep skins, but lighter ox hides and horse leather are also japanned for special purposes. The finishing of leather in this style involves two processes—(1) the grounding or preparation of a smooth surface, and (2) the varnishing and polishing. The grounding material used by French and German finishers, who greatly excel in the production of such leather, consists of a thick syrupy mixture of lampblack with a varnish of boiled linseed oil, umber, and litharge. This is uniformly spread over the surface of the leather, which has been previously stretched and tacked on a wooden frame. The first coating is dried in the air, then exposed in the japanning stove to a heat of about 170° Fahr., and afterwards rubbed smooth with pumice stone. This process of coating, drying, and smoothing is repeated several times, and the leather is next varnished with a compound of boiled oil, Berlin blue, litharge, and some dryer, thinned either with oil of turpentine or petroleum spirit. Two or three thin coatings of such varnish are given, the surface being carefully polished after each; but the composition of the varnishes, etc., and the number of coatings applied, vary much in the hands of different manufacturers. Colored enamel leathers receive two preliminary coatings of oil, rosin, and spirit of turpentine, which are sun-dried; they are then brought up with several coatings of oil, varnish, and the special coloring substance, and finished with a thin coat of copal varnish.

Seal Leather.—The tanning of seal skins is now an important department of the leather industry of the United Kingdom, in which this branch has been specially developed. The skins form one of the items of the whaling industry, which principally centres in Dundee, and at that port, as well as at Hull and Peterhead, they are received in large quantities from the arctic regions. A considerable number are also imported at Greenock from the coast of Newfoundland. The skin of these seals is light but exceedingly close in texture, and yields a very strong tough leather. The skins are prepared, split, and tanned in the same way as other light leathers, tanning with mixed oak bark and sumach usually occupying about six weeks. Seal leather is generally finished on the grain side as "levant" seal with a large coarse grain, and in that form it is principally used by bootmakers. A proportion of seal leather is finished as enamel and japanned leather.

Russia Leather was originally, as the name implies, a specialty of Russia, where it was made from the hides of young cattle, and dressed either a brownish-red or a black color, for upper leather or for bookbinding, dressing-cases, purses, and similar objects. Russia leather is now made throughout both Europe and America, the best qualities being obtained from Austria. Horse hides, calf, goat, and sheep skins, and even splits, are now finished as russia leather; but most of these are decidedly inferior in quality, and, as they are merely treated with birch bark oil to give them something of the odor by which an ordinary observer recognizes russia leather, they scarcely deserve the name under which they pass. Genuine russia leather is tanned like other light leathers, but properly in willow bark, although poplar and spruce fir barks also are used. After tanning, scouring, and setting out, the hides are treated on the flesh side with an empyreumatic oil obtained by the dry distillation of birch tree bark and buds, to which the peculiar smell of the leather is due. The red color commonly seen in russia leather is given by dyeing with a preparation of brazil wood, rubbed over the grain side with a brush or sponge. Black-colored russia leather owes its color to repeated stainings with acetate of iron. The leather of genuine quality is very water-tight and strong, and, owing to its impregnation with empyreumatic oil, it wards off the attacks of insects.

Morocco and Thin Leathers.—Originally morocco leather was a product of the Levant, Turkey, and the Mediterranean coast of Africa, where the leather was made from goat skins tanned with sumach, and finished either black or various bright colors. Such leather was peculiarly clear in color, elastic, and soft, yet firm and fine in grain and texture, and has long been much prized for bindings, being the material in which most of the artistic work of the 16th century binders was executed. Now, in addition to genuine morocco made from goat skins, we have imitation or French moroccos, for which split calf and especially sheep skins are employed, and it may be said that, as the appearance of morocco is the result of the style of graining, which can be artificially produced on any leather, and of the finish, morocco can be made from all varieties of thin leather. The Germans distinguish between saffian and morocco, including under the former term leather tanned with sumach, and dyed bright colors without previous stuffing with fats, while as morocco proper they reckon leather which may be prepared with mixed tannage, is stuffed, and afterwards is finished black. Saffians are, according to this classification, the leathers principally used for bindings and fancy purposes, morocco being more especially devoted to shoe work.

The preparation of skins for morocco leathers must be conducted with much care. The skins, being usually hard and dry when received, are first soaked and softened by milling in the stocks and working on the tanner's beam. They are next limed, unhaired, fleshed, and trimmed in effect as already described in the section on sole leather, and they are pured or bated in a preparation of dog's dung. After undergoing the influence of this preparation, the skins are washed and slated with a knife-edged piece of slate to remove from their surface fine hairs and adhering dirt, and then they are put into a drench of bran and water, heated to about 185° Fahr., after which they ought to be perfectly free from deleterious impurities and ready for tanning. Several processes are adopted in tanning, but that most approved is based on the original Eastern practice, which consists in first treating the skins with an already used sumach infusion. Next they are, in pairs, sewed up as bags, grain side outwards, and these bags are filled with concentrated sumach liquor and a proportion of powdered sumach, and by the exudation of the liquor through the skins, partly aided by pressure, the tanning is quickly completed. After ripping out, the skins are thrown into vats containing sumach liquor, to tan the edges and shanks, which are not reached by the liquor in the bags. The fully tanned skins are now struck out on the beam with the striking pin, and hung in the loft to dry, when they are ready for the finishing processes. A large proportion of the goat skins imported into western Europe from the East Indies, whence they are exported in enormous quantities, are received in the fully tanned condition, and ready for the morocco finishing operations, after a short treatment with sumach liquor. For finishing, the leather is first damped in soap-suds, and shaved on the flesh side to equalize the thickness of the leather, and next on a table worked over repeatedly with slickers, which renders the skin firm, smooth, and uniform. The skins are next blacked on the grain side with a solution of acetate of iron, and from this point the methods of finish diverge in an endless manner according as it is desired to finish the leather as "kid," "levant," "peb

d," "bright," or "dull," etc. The bright-colored
roccos are dyed in two different methods, the dye-
g being done as a preliminary to the finishing opera-
s. In the case of genuine moroccos, the skins are
pped and drawn through small troughs containing the
liquor; two skins are taken, placed flesh side to
h side, and so worked through the liquor by hand,
operation being repeated as often as necessary to
ng up the requisite strength of color. Imitation
rocco, on the other hand, is usually dyed by stretch-
g the skins on a table and brushing the dye liquor
er the grain side. After the dyeing the skins are
aved and dressed, the dyed surface is rubbed over
th an emulsion of white of egg, linseed oil, and dye
uor, and afterwards grained and glassed, or finished
ooth and glossy, according to the purpose for which
e leather may be required. In recent times aniline
lors have been very largely employed in the dyeing
all bright leathers.

In the tanning of sheep and lamb skins the general
erations outlined above in the case of goat skins are
essary. Previous to tanning, the prepared skins are
mitted to hydraulic pressure, to expel the oleaginous
tter with which sheep skins are richly impregnated.
eep skins tanned, generally with beech bark in the
ited Kingdom, and uncolored, are known as *basils*.
an Leather is sheep skin tanned in sumach, colored
l dressed throughout in the same manner as imita-
n morocco, excepting that it is finished smooth and
sed. *Skivers* are split grain sides of sheep skins
ned in sumach, and similarly finished,—the flesh split
ng shamoyed for inferior qualities of shamoy or wash
her. Skivers from their thinness are quickly tanned
ough in a sumach liquor, and in no case are they
ed into bags, as is most commonly the case with en-
sheep and goat skins. The splitting machine used
splitting sheep skins has two rollers, the lower one
gun-metal and solid, and the upper made of gun-
al rings, while between the two rollers, and nearly
ontact, is the edge of the sharp knife, to which an
llating movement is given by a crank. When a
is introduced between the two rollers, it is dragged
ugh against the knife edge and divided, the solid
r roller supporting the membrane, while the upper
being capable of moving through a small space by
ns of its rings, adjusts itself to inequalities in the
nbrane; where this is thin the rings become de-
sed, and where it is thick they rise up, so that no
escapes the action of the knife. Skivers are fin-
d white, or in colors in variously lined or diced pat-
s, and in imitation grain, and are principally em-
ed for hat and other linings and various purposes
hich they meet little strain or tear and wear.

anish Leather is tanned sheep and lamb skins prin-
ly, but goat and kid skins also are used. The tan-
medium is willow bark, and the leather, bright in
and highly elastic, is used for strong gloves. The
name is also applied to tawed lamb skins, dressed
finished on the flesh side.

ligator Leather.—For a number of years leather
d from the skins of the Mississippi alligator has
ed an item in the trade lists of the United States,
t is now also being sought after in the European
ets. The industry was started about the year 1860,
entred first at New Orleans, the raw skins being
ned from the rivers of Louisiana. Now, however,
kins are principally procured in Florida, and the
ng is a considerable industry in Jacksonville. The
of the skin useful for leather making are the belly
lanks, and these portions alone are steeped in lime
eserve them for the tanner. Alligator leather,
n has a scaly surface, is useful for fancy boot and
making, and for many small articles such as cigar
pocket books, etc.

ngaroo Leather.—The Australian colonists have
d their attention to the preparation of leather from
kins of the kangaroo, wallaby, and other marsu-
native to their continent. These skins are both tanned and tawed, the principal tanning agent being the mimosa bark, which abounds in Australia. The leathers they yield are of excellent quality, strong, and elastic, and rival in texture and appearance the kid of European tanners. The circumstance that the animals exist only in the wild state renders this a limited and insecure source of leather.

Tawed Leather.

Under the term tawing is embraced the preparation of leather by the action of mineral substances on hides and skins. In the process of tawing the substance principally employed is alum or some of the simple aluminous salts, although many other inorganic salts have been proposed, some of which have given considerable promise of practical success. The system of tawing is principally applied to thin and light skins of sheep, lambs, kids, and goats, although in former times much heavier leather was tawed for military belts, heavy gloves, machine belts, etc., for most of which purposes, however, sumach-tanned or similar leathers are now found more applicable and durable. The products obtained by tawing are of a pure white color, whence the name white leather is frequently applied to goods of this class. The most important departments of the tawing industry are the calf kid manufactures for boots and shoes, and glove kid or glacé leather tawing, the products of which are exclusively devoted to glove making. A large number of white tawed sheep skins are also used by druggists and perfumers as tie-over leather for bottles, and for linings by bootmakers, etc.

Calf Kid.—The various steps of preparation through which the light skins suitable for this manufacture pass, in respect of softening, liming, unhairing, puring, and drenching, are similar to the process by which morocco skins are prepared for tanning. The tawing itself is accomplished in a drum or cylinder the same as the currier's stuffing wheel, into which is introduced for one hundred average skins a mixture consisting of 20 ℔ of alum, 9 ℔ salt, 40 ℔ flour, 250 eggs (or about 1½ gallons of egg yolk), ¾ pint of olive oil, and 12 to 16 gallons of water. In this mixture, at a temperature of not more than 100° Fahr., the skins are worked for about forty minutes, by which action the tawing is completed. After the withdrawal from the drum the skins are allowed to drain, dried rapidly by artifical heat, damped, staked out by drawing them over a blunt steel tool, and then wetted and shaved down on the beam to the required thickness. Next they receive, if necessary, a second treatment with the tawing mixture. The dyeing or coloring follows, which in the case of calf kid is always black, the color consisting of a compound of bichromate of potash, stale urine, logwood extract, and copperas. It is applied either by brushes on a table, or by dyeing the leather in small vats as in the parallel case of morocco leather. The dyed leather is washed with pure water, dried, grounded with a curious moon knife, stretched in all directions, ironed, and oiled on the flesh side with a mixture of oil, wax, etc.

Glove Kid.—In the preparation of kid leather for gloves the tender skins of young kids alone are used for the best qualities, but for a large proportion of such leather young lamb skins are also tawed. The genuine kid leather is for the most part produced in France, specially at Annonay and Paris, while lamb kid is more particularly a product of Germany, Austria, and Denmark. In all stages of the preparation of this leather the utmost care and attention are requisite, and it is specially of consequence that the operations preparatory to tawing should receive thorough attention. The unhairing is best effected by steeping the skins in a mixture of lime and orpiment, and, while the general sequence of unhairing, fleshing, bathing with dog's dung, scudding, washing, and treating with the bran drench is the same as in the case of other skins, much more attention is bestowed on each stage in order to maintain the smoothness of grain, and to obtain a thoroughly clean elastic pelt, than is absolutely needful for any other variety of leather. The tawing mixture consists for each 100 ℔ of skins of about 28 ℔ of flour, 3½ ℔ of alum, nearly 1 ℔ of common salt, and 230 eggs. These substances are made into the consistency of a cream with water, and placed either in a vat or in a revolving drum. In the former case, the skins are trodden with the feet, while in the latter they are tumbled about. The tawed skins are hung over poles, grain side inwards, and dried rapidly; when hard dry they are heaped in a damp place to soften a little, then damped by passing them through water, next trodden out by foot on a ridged or barred floor, staked or stretched over a blunt knife, partly dried, and again staked and dried thoroughly. For dyeing, the skins are first washed out in warm water to free them from superfluous alum, and then again "fed" with yolk of eggs and salt. For bright colors such as soft grays, lavenders, and yellows, the skins are plunged into small dye vats of the proper dye colors; but for all the darker colors the skins are stretched out on a table and the dye stuffs applied with a brush. In the latter case the leather is first grounded with some alkaline solution, then dyed mostly with logwood, brazil wood, fustic, Prussian berries, or preparations of indigo,—aniline colors being now little used for glove dyeing. The dye is mordanted by a wash of the sulphate of either zinc, copper, or iron, which operation also clears and develops the color. After dyeing it only remains to free the leather from superfluous moisture, dry it, and then with slight damping stake or stretch it out once or twice, which finishes the preparation of this valuable class of leather.

The "feeding" of kid leathers with yolk and sometimes oil produces a partial shamoying, softening the texture and giving the leather that peculiar suppleness to which much of its value is due. The flour added, by means of the gluten it contains, is supposed to facilitate the absorption of the alumina and thus hasten the tawing.

Hungarian Leather consists of hides and heavy skins partly tawed and partly shamoyed. In the preparation of this leather it was formerly the practice to shave off the hair with a sharp knife, but now the hides are unhaired either by sweating or liming. After tawing with alum and salt the leather is stuffed by first heating it over a charcoal fire and impregnating the hot leather with tallow, or, as is now common, by working it in a drum with a hot mixture of cod oil and tallow. This leather, being comparatively cheap, is much used on the Continent for common saddlery purposes, for which it is blackened, and it is also serviceable for machinery belts.

A leather has been patented by Professor Knapp, in which the active tanning or tawing principle is a basic salt of the oxide of iron. It was intended principally for sole leather, but it does not appear to have met with practical success, and its manufacture is understoood to have been abandoned.

Heinzerling's Chrome-tanned Leather.—Quite recently a large amount of attention has been devoted to a system of tanning or tawing by means of chromium compounds patented by Dr. Heinzerling, a German chemist. The oxidizing power of chromate salts, and the deoxidizing effect which organic matter has upon these salts, have long been recognized, and the knowledge of this action and counteraction has led to many unsuccessful attempts, in the past, to use chromates in tanning. It is claimed, however, that the difficulties have been overcome by Dr. Heinzerling's process, which consists practically in the use of bichromate of potash, chloride of potassium or chloride of sodium, and sulphate of alumina. These are mixed together in one large stock tank, from which is drawn by means of a system of piping communicating with each pit the quantity required to make the necessary strength of liquor; this at first, as in tanning by bark, is very weak, but is strengthened systematically every few days according to the thickness of the hides being tanned. The quantity of chromic acid used ordinarily amounts to from about 2½ to 5 per cent. of the weight of leather produced. The price of bichrome at present is 5¾d. per ℔, so that 100 ℔ weight of leather would cost for this agent from 1s. to 3s.

Light skins such as sheep skins and calf skins are tanned in less than a week, ox and buffalo hides in about a fortnight, and walrus hides, over 2 inches thick, in six weeks. After being tanned, the hides, which are at this stage of a yellowish tint like sumach-tanned leather, are dipped in chloride of barium, which converts the soluble chromates on the surface into the insoluble chromate of barium. If any particular shade of color is desired it is then put on, and in general hides are colored like ordinary leather. After being colored the leather is allowed to get nearly dry, when it is immersed in pure paraffin wax and resin dissolved together in certain proportions. These materials, with chloride of potassium or chloride of sodium and sulphate of alumina, go to give the necessary substance, weight, and waterproofing to the leather. The hides are afterwards dried and brushed clean by brushing machinery. Thus finished, the leather differs very little in appearance from ordinary leather.

Dr. Heinzerling claims as the meritorious and original features of his process the combined use of chromate compounds and fatty matters. The stuffing with fat or paraffin of chrome leather, he maintains, in the first place, reduces chromic acid to chrome oxide, and secondly the oxygen thus liberated in the substance of the hide oxidizes the fatty into acid bodies, which, uniting with the chrome oxide, form a third insoluble compound mordanted in the fibre of the leather, rendering it at once supple and waterproof.

The leather has been reported on by Mr. David Kirkcaldy, London, as considerably stronger than the best bark-tanned leather he was able to procure. After steeping samples of it in cold water six days it has been found that the total quantity of tanning material extracted amounted to from ·014 to ·135 per cent., while first-class bark-tanned leather similarly treated yielded 6·79 per cent. By boiling chrome leather in water for half an hour, the loss ranged from ·005 to ·054 per cent.

The process seems to offer the means of utilizing classes of hides, such as sheep skins, and very heavy hides, as those of the walrus, hippopotamus, etc., in a way which has not hitherto been found practicable by other processes. Sheep skins in chrome tanning do not require to be pured and freed from their oleaginous constituents, and when finished by this process are no longer porous, but become waterproof. They can be shaved and whitened like calf skins, and may be used for shoe purposes.

The Heinzerling process is at work in various localities throughout Germany. For the United Kingdom and British colonies the patent rights have been acquired by the Eglinton Chemical Company of Glasgow, who, as manufacturers of bichromate of potash, have an indirect interest in the development of the system. Although the method has yet scarcely passed the critical stage of practical experiment the products appear to be gaining the favor of men of experience; and should the system meet the expectation of its originator and promoters, it cannot in the end fail greatly to cheapen many useful classes of leather.

Shamoy or Oil Leather.

The process of preparing leather by impregnating hides and skins with oil is probably the oldest system of leather manufacture. It is that which in earlier times was most largely followed, and among rude and semi-civilized people it is still commonly practised. Notwithstanding this, well-shamoyed leather requires the exercise of much care and numerous manipulative processes. Hides and skins of all classes are prepared by shamoying; but sheep, goat, deer, antelope, and small calf skins are those usually treated, an enormous number of flesh splits of sheep being shamoyed for common purposes. The extensive employment of deer skins in shamoying gives the product the name of buck or doe leather, and from the use of the chamois skin of the Alps is derived the name of the process chamois or shamoy, while from the fact that it may be easily washed like cloth it is called wash leather. In former times a large number of ox hides were shamoyed, but now that is little practised.

Skins for shamoying are in the preliminary stages treated almost as for ordinary tanning; but, beyond unhairing, the surface of the grain is shaved off in all except the small thin skins. They are afterwards treated with fresh lime solution, and repeatedly washed to bring the pelt to somewhat open and porous condition, drenched with bran to remove all lime, and rinsed in an acid liquor. The skins are next staked out and taken to the fulling machine or stocks, where, after being rubbed over individually with fish oil, they are hammered for about two hours to force the oil into the substance of the skin. They are then stretched, hung up for some time, again oiled, and fulled; and these operations may be repeated from six to twelve times, according to the thickness of the skins treated. After thorough impregnation the skins are dried, then heaped up in a heated room, where a process of oxidation is quickly set up. So soon as the skins assume a yellow color and give off a peculiar odor, not at all like fish oil, the process is complete and the fermentation is stopped. It is now found that about one-half of the oil is oxidized within the skin and combined with the tissue to form leather, while the remainder is present only in the condition of mechanical impregnation. This uncombined oil is washed out with a warm potash solution, and the fat so recovered, known as *degras*, forms a valuable material for the dressing of common leather by curriers.

Parchment, Vellum, and Shagreen.

These substances, properly speaking, do not come under the heading of leather at all, seeing they are neither tanned nor tawed, but simply are dressed skins dried and prepared for their peculiar uses. Parchment is made from calf, goat, sheep, ass, and swine skins by the unhairing and dressing processes through which all skins pass preparatory to tanning. When they are thoroughly scudded and fleshed, the skins are stretched tightly in every direction over a frame, and in that condition shaved and equalized on both sides with the currier's knife. After drying, the skins are ready for use as drum leather and for the other ordinary applications of parchment. The common kinds of vellum are made from sheepskin splits, of which two may be obtained from a single skin. To prepare these for use, the splits are, after stretching and drying, repeatedly rubbed over with powdered chalk and powdered stone to raise the fine even velvety surface peculiar to vellum. Common shagreen consists of the skins of various species of sharks and rays prepared in a similar manner to parchment; and Persian shagreen is a kind of tawed parchment with an artificial grain embossed in it, by pressing into the substance while in a damp condition the small round seeds of a species of *Chenopodium*. Shagreen is frequently dyed in bright colors, and used for ornamenting the surfaces of small articles, and the handles of daggers, swords, etc.

Commerce and Statistics.

It is quite impossible to form any adequate estimate of the extent and value of such a trade as that in leather. The raw materials are obtained, in almost equal abundance, throughout the civilized world, and the manufacturing operations are, to a greater or less degree, carried on in every centre of industry. Thus local wants are largely supplied by local producers, and much of this trade is never recorded in any statistical returns. There can be no doubt that leather takes rank among the foremost half dozen of human industries. Both in Europe and America there is a large international trade in the raw materials and manufactured products, while from the East Indies and the British colonies the largest supplies of various untanned and tanned hides and skins are now exported. Taking cattle hides alone, the import trade of the great manufacturing centres has been thus stated for 1879:—

United Kingdom	1,162,405
Marseilles	652,967
Havre	853,741
Antwerp	958,412
Hamburg	646,330
Boston and New York (U. S.)	3,153,026
Total for Europe and America	7,426,881

These came principally from the River Plate, Rio Grande, and Brazil, and are exclusive of 250,000 horse hides imported into Europe, and the whole of the enormous exports of the East Indies. The total number of hides, raw and tanned, exported from India in the year 1877–78 was 9,300,955, and the average for the four preceding years exceeded 7,250,000. A great proportion of these are tanned kips, shipped from Madras almost exclusively to the United Kingdom,—buffalo and the heavier flint dry hides going more largely to the United States. The imports of East Indian kips into the United Kingdom during 1880 amounted to 6,135,978, and in 1881 the number fell to 4,580,303. Of tanned goat and sheep skins, again, the annual export from Madras alone reaches nearly 10,000,000 skins, the numbers for 1880 having been 9,799,900 skins. The total number of sheep and goat skins, raw and rough tanned, imported into the United States in 1880 was 11,731,885, of which 6,332,635 were raw soft stock, 3,353,750 were raw hard East Indian skins, principally from Bengal, and 2,055,500 were tanned East Indian skins.

The following table shows the sources and number of hides imported into the United Kingdom during 1880:—

River Plate, salted hides	319,745
" dry "	31,057
Rio Grande, salted "	178,897
Cape " "	86,583
" dry "	209,176
Australia	196,140
Brazil	96,246
West Indies	10,584
West Coast of America	15,107
Cape kips and gnus	13,097
North America	5,983
East India kips and buffalo	6,707,142
Horse hides	98,200

The following are the Board of Trade returns of articles connected with tanning exported from the United Kingdom, and imported, during the five years ending 1880:—

Exports.

	1876.	1877.	1878.	1879.	1880.
I. *Quantities.*					
Leather—					
Tanned, unwrought..cwts.	149,911	144,481	160,985	219,890	146,986
Boots and shoes, doz. pairs	443,293	436,166	430,273	433,374	420,189
Other articles..........lb.	1,509,874	1,481,226	1,562,948	1,668,961	1,916,867
Saddlery and harness value £	367,561	352,302	401,443	424,059	436,373
Skins and furs, all sorts " £	851,847	689,275	1,082,007	1,380,132	1,642,847
II. *Values.*					
Leather—	£	£	£	£	£
Tanned, unwrought	1,211,146	1,165,134	1,177,282	1,507,427	1,152,680
Boots and shoes	1,404,675	1,336,478	1,315,731	1,211,298	1,282,221
Other articles	329,773	305,175	305,757	323,364	374,684

Imports.

	1876.	1877.	1878.	1879.	1880.
I. *Quantities.*					
Bark for tanners' use...cwts.	672,319	645,662	587,526	417,554	449,501
Tanning stuffs—					
Cutch and gambier....tons	26,564	32,918	26,613	25,684	32,167
Sumach.............. "	12,797	13,409	13,923	12,131	11,620
Valonia.............. "	34,923	29,969	26,677	34,217	33,773
Galls.............cwts.	25,984	26,425	31,478	16,512	51,066
Hides—					
Raw................ "	1,055,575	1,146,364	1,161,994	1,011,991	1,241,788
Tanned, tawed, curried, or dressed.......lb.	44,768,891	46,917,689	50,871,132	35,125,855	47,653,442
Leather manufactures—					
Boots and shoes, doz. pairs	109,896	99,396	102,689	127,504	96,497
Gloves.......... "	1,497,437	1,242,159	1,080,438	1,063,747	1,455,765
Unenumerated.....value £	233,204	379,006	613,492	261,611	278,753
Skins—					
Sheep and lamb....number	13,165,348	12,977,531	11,321,843	9,402,911	12,331,413
Goat.............. "	8,061,112	8,151,599	7,906,964	10,124,169	11,467,226
Seal.............. "	607,276	763,757	762,772	964,906	653,276
Other sorts........value £	244,396	261,073	221,147	200,122	96,344
II. *Value.*	£	£	£	£	£
Bark for tanners' use	315,278	282,926	268,110	161,573	189,586
Cutch and gambier	610,645	708,905	564,060	476,383	656,861
Sumach	215,263	224,862	231,358	170,692	145,665
Valonia	628,852	666,497	532,855	542,949	520,054
Galls	84,704	76,334	78,963	45,365	136,359
Hides—					
Raw	3,302,283	3,545,891	3,409,065	2,916,577	3,879,562
Tanned, tawed, curried, or dressed	2,977,928	2,958,732	2,871,052	2,209,680	3,055,029
Leather manufactures—					
Boots and shoes	328,479	348,786	370,147	479,498	381,579
Gloves	1,840,956	1,518,557	1,360,633	1,296,090	1,742,591
Skins—					
Sheep and lamb	1,343,042	1,260,135	1,108,928	964,108	1,414,887
Goat	864,879	892,272	890,008	1,145,422	1,277,742
Seal	219,540	246,533	443,784	555,270	623,278

The imports of hides to the United States through the two principal ports, New York and Boston, and the receipts of home hides in these cities for 1878–80, are shown in the following tables:—

New York.

	1878.	1879.	1880.
Brazil	180,382	98,079	89,158
Buenos Ayres	297,328	280,744	449,808
Montevideo	465,202	620,988	981,054
Orinoco	32,886	84,209	81,443
Rio Grande	59,531	127,086	141,168
South America (other states)	112,811	111,357	81,687
Central America	267,028	242,366	496,909
Mexico	121,371	98,901	119,476
West Indies	15,601	51,965	68,908
East Indies (loose)	21,244	706	27,517
Europe	119,583	305,915	328,416
China	...	65,242	171,382
Africa	39,670	126,770	165,091
Sundry	1,862	...	...
Total foreign	1,733,944	2,159,278	3,047,052
" domestic	788,470	860,193	578,098
" foreign and domestic	2,522,414	3,019,471	3,625,150
Calcutta bales buffalo	7,952	5,598	9,634
" " cow	1,453	1,584	4,540

Boston.

	1878.	1879.	1880.
Buenos Ayres	448,860	365,644	422,577
Montevideo	6,500	15,609	14,277
Rio Grande	182,063	221,458	350,607
European ports	...	...	151,177
Other foreign ports	247,081	437,562	348,909
Total foreign	884,004	1,040,273	1,287,547
" domestic	888,508	678,209	794,293
Grand total	1,772,512	1,718,482	2,081,840

Value in Dollars of Leather Exported from the Port of New York during the three Years 1878–80.

	1878.	1879.	1880.
Liverpool	2,172,489	1,943,310	2,922,931
Hamburg	1,522,099	971,147	896,393
Hull	388,673	443,884	786,106
Bristol	152,319	90,474	138,256
Antwerp	153,229	157,962	86,475
London	118,542	39,024	129,752
Rotterdam	91,062	104,598	60,538
Glasgow	85,981	62,340	67,169
Bremen	157,199	170,429	20,133
Havre	3,317	2,350	300
Trieste	31,492	13,500	10,831
Total	4,876,402	3,999,018	5,118,884

The principal leather markets of the United Kingdom are London, where there are quarterly fairs; Leeds, with eight fairs yearly; and Bristol, which has two leather fairs per year. In the United States the commerce centres principally in New York, Boston, and Philadelphia. On the European continent Paris, Marseilles, Vienna, and Berlin are the most important centres of the leather trade, with Antwerp and Havre as great marts for the sale of hides and skins. (J. PA.)

LEATHER, Artificial. Under the name of artificial leather, or of American leather cloth, large quantities of a material having, more or less, a leather-like surface are used, principally for upholstery purposes, such as the covering of chairs, lining the tops of writing desks and tables, etc. There is considerable diversity in the preparation of the material, but most commonly it consists of a web of calico first prepared with a thick paste to fill up the interstices, and thereafter coated with a mixture of boiled linseed oil mixed with dryers and lampblack or other pigment, uniformly spread, smoothed, and compressed on the cotton surface by passing it between metal rollers. When the surface is to possess a glossy enamel-like appearance, it receives a finishing coat of copal varnish. A grained morocco surface is given to the material by passing it between suitably embossed rollers. Another material now largely used for preparing artificial leather consists of gelatin mixed with appropriate coloring material, and such chemical agents as, by their reaction on that body, render it insoluble,—calico being coated with the mixture in the manner indicated above. Such insoluble compounds are obtained by the action of acetate of alumina on gelatin, with exposure to a temperature of about 160° Fahr., or by the addition of about one per cent. of bichromate of potash to gelatin solution and exposure to light. The addition of a proportion of glycerin to the gelatinous mass renders the resulting "leather" softer and more plastic than it would otherwise be. These preparations have a close affinity to cloth water-proofed with India-rubber, and to such manufactures as ordinary waxcloth. An artificial leather has been patented and proposed for use as soles for boots, etc., composed of powdered scraps and cuttings of leather mixed with solution of gutta-percha dried and compressed. In place of the gutta-percha solution, oxidized linseed oil or dissolved resin may be used as the binding medium for the leather powder.

LEAVENWORTH, the largest city in the State of Kansas, and chief town of Leavenworth county, is situated in an amphitheatre formed by the bluffs of the right bank of the Missouri, in the midst of a rich agricultural country. The distance from St. Louis by river is 496 miles, and by rail 309 miles. In 1853 the site of the city was covered with thick hazel brush, without a trace of human habitation. The following year saw the laying out of the first streets, and by 1864 the value of the taxable property, real and personal, amounted to $4,103,562. Among the principal buildings are a large Roman Catholic cathedral, a State penitentiary, and a State normal school. Its position on the river and an extensive railway system have given Leavenworth a flourishing trade. It possesses two practically inexhaustible mines of bituminous coal, and has more large manufacturing establishments than any other town on the Missouri, including grist mills, foundries, and manufactories of wagons, carriages, furniture, and shoes. About 2 miles above the city is Fort Leavenworth, the military headquarters of the department of the Missouri. The Government reservation has a river frontage of 6 miles, with a depth of 1 mile. The population was 7429 in 1860, 17,873 in 1870, 16,546 in 1880. At this last date the reservation contained 1115 individuals.

LEBANON. The name of Mount Lebanon (Heb. לְבָנוֹן), from the Semitic root *laban*, "to be white, or whitish," probably refers, not to the perpetual snow, but to the bare white walls of chalk or limestone which form the characteristic feature of the whole range. Syria is traversed by a branch thrown off almost at right angles from Mount Taurus in Asia Minor, and Lebanon is the name of the central mountain mass of Syria, extending for about 100 miles from north-north-east to south-south-west. It is bounded W. by the sea, N. by the plain Jún Akkár, beyond which rise the mountains of the Nusairieh, and E. by the inland plateau of Syria, mainly steppe-land. To the south Lebanon ends about the point where the river Litány bends westward, and at Banias. A valley narrowing towards its southern end, and now called El-Buká'a, divides the mountainous mass into two great parts. That lying to the west is still called Jebel Libnán; the greater part of the eastern mass now bears the name of the Eastern Mountain (Jebel el-Sharki). In Greek the western range was called Libanos, the eastern Antilibanos.[1] The southern extension of the latter, Mount Hermon (*q. v.*), may in many respects be treated as a separate mountain.

Lebanon and Antilibanus have many features in common; in both the southern portion is less arid and barren than the northern, the western valleys better wooded and more fertile than the eastern. In general the main elevations of the two ranges form pairs lying opposite one another; the forms of both ranges are monotonous, but the coloring splendid, especially when viewed from a distance; when seen close at hand, indeed, only a few valleys with perennial streams offer pictures of landscape beauty, their rich green contrasting pleasantly with the bare brown and yellow mountain sides.

Geology.—The Lebanon strata are generally inclined, curved, and twisted, often vertical, seldom quite horizontal. Throughout the whole of Syria the prevailing line of cleavage runs from north to south; subordinate to this is another at right angles to it. The rocks belong to the Middle Chalk system, and fall into four subdivisions. The first consists of an under hippurite zone about 3000 feet thick. Sometimes light gray dolomites boldly rise to a height of several hundred yards (as in Kesrawán); sometimes masses of marble present equally grand mountain forms (Jezzín); sometimes again friable marl and clay occur, producing rich pasture lands. The last member of this lower zone is a brown oolite containing sponges, corals, and echinoderms, amongst which the best known fossil is *Cidaris glandarius* (Salima). Here also belong the *Radiolaria* of Hakel, above which occurs the famous bed of fossil fishes. The second subdivision of the Middle Chalk consists of a thick sandstone formation, distinguished by the presence of *Trigonia scabra* and *syriaca*, and by a fossil balsam poplar (*Nicolia*). To the period of the formation of this member of the system belong volcanic eruptions of melaphyre and basaltite, and also copious eruptions of ashes, which are now met with as tufa in the neighborhood of the igneous rocks. These eruptive rocks, which everywhere have again been overlaid by the thick sandstone, yield bitumen (mineral oils, asphalt, and dysodil), and have also had a great influence upon the superficial aspect of the country, the sandstone stratum (1300 to 1600 feet thick) having become the centre of its life and fertility, inasmuch as here alone water can gather. In the third subdivision, the Turon strictly so-called, oyster beds (*Ostrea africana*) and a stratum of orbitulites have the widest diffusion. Above the oysters come the ammonites (*Ammonites syriacus*, Von Buch). The fourth subdivision is formed by a light gray chalk of the upper hippurite zone, which begins in the Buká'a, and can be traced as far as to the Red Sea. The latest member is the Eocene nummulite (especially in Antilibanus). Generally speaking the prevailing colors are white in the first district, brown in the second, yellow in the third, and gray in the fourth. Apart from the formations already named, there only remain to be mentioned one or two more recent Tertiaries, which in some cases may go back to the end of the Miocene period, but for the most part are Pliocene. They are met with partly on the coast, being due to the action of the sea (Tripoli), partly in the Buká'a (Zahleh), the result of the action of fresh water. Finally, throughout the whole of the Lebanon district, there are unmistakable traces of ice action in the shape of ground moraines and erratic blocks. The glacier remains may practically be said to be associated with the four chief streams (Nahr Kadísha, Józ, Ibráhím, and Kelb).

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[1] Lat., *Antilibanus*. The popular form Antilebanon is not legitimate

Vegetation.—The western versant has the common characteristics of the flora of the Mediterranean coast, but the eastern portion belongs to the poorer region of the steppes, and the Mediterranean species are met with only sporadically along the water-courses. Forest and pasture land in our sense of the word do not exist: the place of the first is for the most part taken by a low brushwood; grass is not plentiful, and the higher ridges maintain a growth of alpine plants only so long as patches of snow continue to lie. The rock walls harbor some rock plants, but many absolutely barren wildernesses of stone occur. (1) On the western versant, as we ascend, we have first, to a height of 1600 feet, the coast region, similar to that of Syria in general and of the south of Asia Minor. Characteristic trees are the locust tree and the stone pine; in *Melia Azedarach* and *Ficus Sycomorus* (Beyrout) we have an admixture of foreign and partially subtropical elements. The great mass of the vegetation, however, is of the low-growing type (*maquis* or *garrigue* of the western Mediterranean), with small and stiff leaves, and frequently thorny and aromatic, as for example the ilex (*Quercus coccifera*), *Smilax*, *Cistus*, *Lentiscus*, *Calycotome*, etc. (2) Next comes, from 1600 to 6500 feet, the mountain region, which may also be called the forest region, still exhibiting as it does sparse woods and isolated trees wherever shelter, moisture, and the bad husbandry of the inhabitants have permitted their growth. From 1600 to 3200 feet is a zone of dwarf hard-leaved oaks, amongst which occur the Oriental forms *Fontanesia phillyræoides*, *Acer syriacum*, and the beautiful red-stemmed *Arbutus Andrachne*. Higher up, between 3700 feet and 4200 feet, a tall pine, *Pinus Brutia*, Ten., is characteristic. Between 4200 and 6200 feet is the region of the two most interesting forest trees of Lebanon, the cypress and the cedar. The former still grows thickly, especially in the valley of the Kadísha; the horizontal is the prevailing variety. In the upper Kadísha valley there is a cedar grove of about three hundred trees, amongst which five are of gigantic size; it is alleged that other specimens occur elsewhere in Lebanon. The *Cedrus Libani* is intermediate between the *Cedrus Deodara* and the *C. atlantica* (see CEDAR). The cypress and cedar zone exhibits a variety of other leaf-bearing and coniferous trees; of the first may be mentioned several oaks—*Quercus Mellul*, *Q. subalpina* (Kotschy), *Q. Cerris*, and the hop-hornbeam (*Ostrya*); of the second class the rare Cilician silver fir (*Abies cilicica*) may be noticed. Next come the junipers, sometimes attaining the size of trees (*Juniperus excelsa*, *J. rufescens*, and, with fruit as large as plums, *J. drupacea*). But the chief ornament of Lebanon is the *Rhododendron ponticum*, with its brilliant purple flower clusters; a peculiar evergreen, *Vinca libanotica*, also adds beauty to this zone. (3) Into the alpine region (6200 to 10,400 feet) penetrate a few very stunted oaks (*Quercus subalpina*, Kotschy), the junipers already mentioned, and a barberry (*Berberis cretica*), which sometimes spreads into close thickets. Then follow the low, dense, prone, pillow-like dwarf bushes, thorny and gray, common to the Oriental highlands—*Astragalus* and the peculiar *Acantholimon*. They are found up to within 300 feet of the highest summits. Upon the exposed mountain slopes rhubarb (*Rheum Ribes*) is noticeable, and also a vetch (*Vicia canescens*, Lab.) excellent for sheep. The spring vegetation, which lasts until July, appears to be rich, especially as regards corolla-bearing plants, such as *Corydalis*, *Gagea*, *Bulbillaria*, *Colchicum*, *Puschkinia*, *Geranium*, *Ornithogalum*, etc. The flora of the highest ridges, along the edges of the snow patches, exhibits no forms related to our northern alpine flora, but suggestions of it are found in a *Draba*, an *Androsace*, an *Alsine*, and a violet, occurring, however, only in local species. Upon the highest summits are found *Saponaria Pumilio* (resembling our *Silene acaulis*) and varieties of *Galium*, *Euphorbia*, *Astragalus*, *Veronica*, *Jurinea*, *Festuca*, *Scrophularia*, *Geranium*, *Asphodeline*, *Allium*, *Asperula*; and, on the margins of the snow fields, a *Taraxacum* and *Ranunculus demissus*. The alpine flora of Lebanon thus connects itself directly with the Oriental flora of lower altitudes, and is unrelated to the glacial flora of Europe and northern Asia.

Zoology.—There is nothing of special interest about the fauna of Lebanon. Bears are no longer numerous; the panther and the ounce are met with; the wild hog, hyæna, wolf, and fox are by no means rare; jackals and gazelles are very common. The polecat and hedgehog also occur. As a rule there are not many birds, but the eagle and the vulture may occasionally be seen; of eatable kinds partridges and wild pigeons are the most abundant. In some places the bat occasionally multiplies so as actually to become a plague.

Geography.—The district to the west of Lebanon, averaging about six hours in breadth, slopes in an intricate series of plateaus and terraces to the Mediterranean. The coast is for the most part abrupt and rocky, often leaving room for only a narrow path along the shore, and when viewed from the sea it does not lead one to have the least suspicion of the extent of country lying between its cliffs and the lofty summits behind. Most of the mountain spurs run from east to west, but in northern Lebanon the prevailing direction of the valleys is north-westerly, and in the south some ridges also run parallel with the principal chain. The valleys have for the most part been deeply excavated by the rapid mountain streams which traverse them; the apparently inaccessible heights are crowned by numerous villages, castles, or cloisters embosomed among trees. Of the streams which are perennial, the most worthy of note, beginning from the north, are the Nahr Akkár, N. Arka, N. el-Bárid, N. Kadísha, "the holy river" (the valley of which begins far up in the immediate neighborhood of the highest summits, and rapidly descends in a series of great bends till the river reaches the sea at Tripoli), Wády el-Józ (falling into the sea at Batrún), Wády Fidár, Nahr Ibráhím (the ancient Adonis, having its source in a recess of the great mountain amphitheatre where the famous sanctuary Apheca, the modern Afka, lay), Nahr el-Kelb (the ancient Lycus), Nahr Beirút (the ancient Magoras, entering the sea at Beyrout), Nahr Dámúr (ancient Tamyras), Nahr el-'Auwaly (the ancient Bostrenus, which in the upper part of its course is joined by the Nahr el-Barúk). The 'Auwaly and the Nahr el-Zaheráni, the only other streams that fall to be mentioned before we reach the Litány, flow north-east to south-west, in consequence of the interposition of a ridge subordinate and parallel to the central chain. On the north, where the mountain bears the special name of Jebel Akkár, the main ridge of Lebanon rises gradually from the plain. A number of valleys run to the north and north-east, among which must be mentioned that of the Nahr el-Kebír, the Eleutherus of the ancients, which takes its rise in the Jebel el-Abyad on the eastern slope of Lebanon, and afterwards, skirting the district, flows westward to the sea. To the south of Jebel el-Abyad, beneath the main ridge, which as a rule falls away suddenly towards the east, occur several small elevated terraces having a southward slope; among these the Wádi en-Nusúr ("vale of eagles"), and the basin of the lake Yammúna, with its intermittent spring Neb'a el-Arba'ín, deserve special mention. Of the streams which descend into the Buká'a, only the Berdáni need be named; it rises in Jebel Sunnín, and enters the plain by a deep and picturesque mountain cleft at Zahleh. With regard to height, the most elevated summits occur in the north, but even these are of very gentle gradient, and are ascended quite easily. The names and the elevations of the several peaks, which even in summer are covered with snow, have been very variously given by different explorers; according to the most accurate accounts the "Cedar block" consists of a double line of four and three summits respectively, ranged from north to south, with a deviation of about 35°. Those to the east are 'Uyún Urghush, Makmal, Muskíyya (or Naba' esh-Shemaila), and Rás Zahr el-Kazíb; fronting the sea are Karn Saudá or Timárun, Fumm el-Mizáb, and Zahr el-Kandíl. The height of Zahr el-Kazíb, by barometric measurement, is 10,018 feet; that of the others is almost the same. South from them is the pass (8351 feet) which leads from Baalbec to Tripoli; the great mountain amphitheatre on the west side of its summit is remarkable. Further to the south is a second group of lofty summits —the snow-capped Sunnín, visible from Beyrout; its height is 8554 feet, or, according to other accounts, 8895 feet. Between this group and the more southerly Jebel Kuneiseh (about 6700 feet) lies the pass (4700 feet) now traversed by the French post road between Beyrout and Damascus. Among the other bare summits still further south are the long ridge of Jebel el-Barúk (about 7000 feet), the Jebel Níha, with the Tau'amat Níha (about 6100 feet), near which is a pass to Sidon, and the Jebel Ríhán (about 5400 feet).

The Buká'a, the broad valley which separates Lebanon from Antilibanus, is watered by two rivers having their watershed near Baalbec, at an elevation of about 3600 feet, and separated only by a short mile at their sources. That flowing northwards, El-'Ásy, is the ancient Orontes; the other is the Litány. In the lower part of its course the latter has scooped out for itself a deep and narrow rocky bed; at Burghuz it is spanned by a great natural bridge. Not far from the point where it suddenly trends to the west lie, immediately above the romantic valley, at an elevation of 1500 feet, the imposing ruins of the old castle Kal'at esh-Shakíf, near one of the passes to Sidon. In its lower part the Litány bears the name of Nahr el-Kasimíyeh. Neither the Orontes nor the Litány has any important affluent.

The Buká'a used to be known as Cœlesyria (Strabo, xvi. 2, 21), but that word as employed by the ancients had a much more extensive application. At present its full name is Buká'a el-'Azíz (the dear Buká'a) and its northern portion is known as Sahlet Ba'albek (the plain of Baalbec). The valley is from 4 to 6 miles broad, with an undulating surface. It is said to contain one hundred and thirty-seven hamlets or settlements, the larger of which skirt the hills, while the smaller, consisting of mud hovels, stand upon dwarf mounds, the debris of ages. The whole valley could be much more richly cultivated than it is at present; but fever is frequent.

The Antilibanus chain has in many respects been much less fully explored than that of Lebanon. Apart from its southern offshoots it is 67 miles long, while its width varies from 16 to 13½ miles. It rises from the plain of Hasya-Homs, and in its northern portion is very arid and barren. The range has not so many offshoots as occur on the west side of Lebanon; under its precipitous slopes stretch table-lands and broad plateaus, which, especially on the east side looking towards the steppe, steadily increase in width. Along the western side of northern Antilibanus stretches the Khashá'a, a rough red region lined with juniper trees, a succession of the hardest limestone crests and ridges, bristling with bare rock and crag that shelter tufts of vegetation, and are divided by a succession of grassy ravines. On the eastern side the parallel valley of 'Asal el-Ward deserves special mention; the descent towards the plain eastwards, as seen for example at Ma'lúla, is singular, —first a spacious amphitheatre and then two deep very narrow gorges. The perennial streams that take their rise in Antilibanus are not numerous; one of the finest and best watered valleys is that of Helbún, the ancient Chalybon, the Helbon of Ezek. xxvii. 18. The highest points of the range, reckoning from the north, are Halímat el-Kabu (8257 feet), which has a splendid view; the Fatly block, including Tal'at Músa (8721 feet) and the adjoining Jebel Nebi Bárúh (7900 feet); and a third group near Blúdán, in which the most prominent names are Shakíf, Akhyár, and Abu'l-Hín (8330 feet). Of the valleys descending westward the first to claim mention is the Wády Yafúfa; a little further to the south, lying north and south, is the rich upland valley of Zebedáni, where the Baradá has its highest sources. Pursuing an easterly course of several hours, this stream receives the waters of the romantic 'Ain Fíje (which doubles its volume), and bursts out by a rocky gateway upon the plain of Damascus, in the irrigation of which it is the chief agent. It is the Amana of 2 Kings v. 12; the portion of Antilibanus traversed by it was also called by the same name (Cant. iv. 8). The French post road after leaving the Buká'a first enters a little valley running north and south, where a projecting ridge of Antilibanus bears the ruins of the ancient cities Chalcis and Gerrha. It next traverses the gorge of Wády el-Harír, the level upland Sahlet Judeideh, the ravine of Wády el-Karn, the ridge of 'Akabat et-Tín, the descent Daurat el-Billán, and finally the unpeopled plain of Dimás, from which it enters the valley of Baradá. This route marks the southern boundary of Antilibanus proper, where the Hermon group begins (vol. xi. p. 672). From the point where this continuation of Antilibanus begins to take a more westerly direction, a low ridge shoots out towards the south-west, trending further and further away from the eastern chain and narrowing the Buká'a; upon the eastern side of this ridge lies the elevated valley or hilly stretch known as Wády et-Teim. In the north, beside 'Ain Fálúj, it is connected by a low watershed with the Buká'a; from the gorge of the Litány it is separated by the ridge of Jebel ed-Dahr. At its southern end it contracts and merges into the plain of Banias, thus enclosing Mount Hermon on its north-west and west sides; eastward from the Hasbány branch of the Jordan lies the meadow-land Merj-'Iyún, the ancient Ijon (1 Kings xv. 20).

Political Divisions and Population.—The inhabitants of Lebanon have at no time played a conspicuous part in history. There are remains of prehistoric occupation, but we do not even know what races dwelt there in the historical period of antiquity. Probably they belonged partly to Canaanite, but chiefly to the Aramæan group of nationalities; the Bible mentions Hivites (Judg. iii. 3) and Giblites (Josh. xiii. 5). A portion of the western coast land was always, it may be assumed, in the hands of the Phœnician states, and it is possible that once and again their sovereignty may have extended even into the Buká'a. Lebanon was also included within the ideal boundaries of the land of Israel, and the whole region was well known to the Hebrews, by whose poets its many excellences are often praised. In the Roman period the district of Phœnice extended into Lebanon; in the 2d century it, along with the inland districts pertaining to it, constituted a subdivision of the province of Syria, having Emesa (Homs) for its capital; from the time of Diocletian there was a Phœnice at Libanum, with Emesa as capital, as well as a Phœnice Maritima of which Tyre was the chief city. Remains of the Roman period occur throughout Lebanon, and more especially in Hermon, in the shape of small temples in more or less perfect preservation; for the more splendid ruins of Baalbec see that article (vol. iii. p. 153). Although Christianity early obtained a footing in Lebanon, the pagan worship, and even human sacrifice, nevertheless survived for a long time, especially in remote valleys such as Afka. The present inhabitants are for the most part of Syrian (Aramæan) descent; Islam and the Arabs have at no time penetrated very deep into the mountain land. At present the eastern range belongs to the vilayet of Damascus (Soria), of which Damascus itself constitutes the first subdivision (mutasarriflik); the subordinate divisions (kazas) of the government are Damascus, Baalbec, Hasbaya, Rashaya, and Buká'a Gharbi or Western Buká'a. Included within the vilayet of Soria, but with an independent administration, is the government of Lebanon properly so called, a region some 87 miles long, which in virtue of an ordinance published by the Porte in concert with the protecting powers in 1861 and revised in 1864 is ruled by a governor, who must be a Christian, in direct dependence on Constantinople. The seat of the pasha is at present at Ba'abda, 6 miles south-east from Beyrout, his summer residence being at Bteddín. The pashalik is subdivided into the lieutenancies of Jurd, Batrún, Kasrawán, Metn, Zahle, Shúf, and Jezzín. A somewhat different account of the districts is given in the statistical statement (1875) of the English consul at Beyrout:—

District.	Chief Place.	Mohammedans.	Maronites.	Druses.	Orthodox Greek.	Catholic Greek.	Metáwile.	Other Sects.	Total.
Shúf	Baaklin	4,426	14,472	20,274	4,546	3,756	520	292	48,286
Jezzín	Jezzín	170	6,150	46	310	3,042	1,402	...	11,120
Deir el-Kamar	Deir el-Kamar	...	2,342	22	...	352	...	...	2,716
Metn	Behannes	130	27,986	4,746	9,292	3,310	798	34	46,296
Zahle	Zahle	72	1,364	...	1,324	5,892	30	...	8,682
Kesrawán	Ghazír	330	35,366	...	1,004	604	3,436	...	40,790
Batrún	Torsa	...	46,060	...	2,542	356	1,574	...	50,532
Kúra	Beshmessin	1,076	1,996	...	8,962	8	40	...	12,082
	Total	6,254	135,736	25,088	27,980	17,320	7,800	326	220,504

The statistics accompanying the French map of 1862 give the population of Lebanon proper as some 100,000 in excess of these figures, but there can be no doubt of the inaccuracy of this estimate. The same authority gives the districts (taken in order from north to south) as follows:—Akkár, ed-Dunníye, el-Kúra (Upper and Lower), ez-Záwiye, Bsherre, Batrún, Jebiel, Muneitira, el-Fetúh, Kesrawán, el-Metn, Zahle, es-Sáhil, el-Gharb, el-Manásif, Shahar, Jurd, Arkúb, Shúf, Jezzín, Rihán, Kharnúb, Tuffáh, Shakíf, Shumár Beshára, Merj Ayún. Hule and the towns of Sidon, Beyrout, and Tripoli are also reckoned in this account as belonging to Lebanon. It also enumerates the following districts:—

	Maronites.	Orthod. Greek.	Cath. Greek.	Druses.	Metáwile.	Moham.	Total.
Hasbaya	820	4,610	170	5,060	...	3,140	13,820
Rashaya	800	4,000	...	7,000	...	500	12,300
Buká'a	4,100	3,000	2,100	500	2,000	7,500	19,200
Baalbek	6,000	2,000	4,000	...	8,000	1,200	21,200

The Maronites, as the preceding statistics show, are the principal element of the Lebanon population; for the DRUSES, see vol. vii. p. 417. The Metáwile, who enjoy no good reputation, are Shi'ite Mohammedans; their sheikh resides at Jeba'a in South Lebanon. Of late years, Protestantism, through the agency of the American mission at Beyrout, has begun to take some hold of the population, and is daily gaining ground. The Catholic missions also, with Beyrout for their centre, are meeting with some success and the Western schools are indisputably affecting the culture and manners of the country. The present comparative security of life and property are highly favorable to its development. Since the violent outbreak of 1860, the bloody contests between the Maronites and Druses have not been renewed, although the mutual hatred still continues. To what has been already said on this subject (vol. vii. p. 419), it may here be added that the primary object of the Lebanon mountaineers is before everything the maintenance of their national freedom, and that the responsibility for the massacres of 1860 rests chiefly upon the Turkish Government (Ahmet Pasha of Damascus). The property of the Maronites had been promised to the Druses, and the Maronites on the other hand had been persuaded to disarm; as soon as the latter had done so they were attacked by Druses and Turks together. In Deir el-Kamar alone, the chief place of South Lebanon, eighteen hundred Maronites perished. Since the pacification of the country by foreign intervention, particularly on the part of Napoleon III., the Druses have withdrawn more into the inaccessible Hauran. Although every inhabitant of Lebanon still retains his warrior habits, and willingly enough joins the highland troops (six hundred regular soldiers), the situation is now much more pacific, a circumstance due in large measure to the fact that the power of the numerous noble families has been much curtailed. On the other hand the clergy, although for the most part an extremely uneducated body of men, has great influence among the Maronites. The number of Maronite monks in the mountain district is said to reach eight thousand. The monasteries possess a large portion of the best land, which is cultivated by the monks themselves, and is quite exempt from all public burdens. Other land is liable to be taxed annually at the rate of 3s. 6d. upon every £55 of assessed value; there is, besides, a poll tax exigible from every healthy male from the age of fourteen until he becomes unfit for work. The village head (sheikh), for every £8 of taxes, is entitled to exact from the inhabitants 4s. for his own remuneration. Every inhabitant must devote to the public service four days of free labor in the year. The gross revenue of Lebanon, which amounts to about £32,000 per annum, does not cover the expenses of administration.

The Lebanon mountaineers are a fine vigorous set of men. In what relates to dress they show a preference for gay colors. Tattooing is universal in both sexes. Their diligence is worthy of all praise. In the upper regions cattle breeding is the chief occupation; the numerous flocks of sheep and goats are the great obstacle to forestry in these parts. No care is taken to protect the woods. For practical utility the trees which are planted (besides various fruit trees, especially figs) are the white poplar (for building purposes), the walnut, the olive, and above all the mulberry,—silk culture being an important industry with the mountain population, and still remunerative notwithstanding the occasional fall of prices. In 1872 the production amounted to 2,000,000 okes (about 5,000,000 ℔) of fresh cocoons, from which 1,200,000 okes of raw silk and 200,000 okes of silk fabrics were produced, the latter exclusively for home use. The vine is cultivated, and with great care, at an elevation of 3900 to 5200 feet. Unfortunately the wine is simply stored in large stone jars, there being neither barrels nor cellars; the consequence is that it cannot be kept—in point of fact it is seldom more than a year old—and exportation is impossible. The excellent Lebanon white wine known as vino d'oro belongs to the class of sweet wines. Amongst the mineral products coal deserves special mention; the beds are thick, but the presence of iron pyrites prevents it from coming into more general use. Some shafts, from which bitumen is obtained, occur in the neighborhood of Hasbaya; also petroleum wells. The chief food crops are wheat, *Holcus sorghum*, and barley, the last being cultivated as high as 6500 feet above the sea. Tobacco culture is universal.

Throughout the whole of Lebanon, but especially on the slope towards the sea, carefully tended terraces occur. The houses, little four-cornered boxes, generally shaded by a walnut or fig tree, stand as a rule upon the slope; the roof is formed by pine stems upon which other timber, brushwood, and finally a coating of mud clay are laid. Under good government, Lebanon, with its able and vigorous population, would rapidly develop.

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LEBANON, a manufacturing "borough" of the United States, capital of Lebanon county, Pennsylvania, is situated on the Union Canal, 24 miles east of Harrisburg by the Lebanon Valley branch of the Philadelphia and Reading Railway. It is substantially built in brick and stone, and is steadily increasing in importance. Its principal industrial establishments are blast furnaces, rolling mills, car-works, planing mills, foundries, and manufactories of organs, paper, cigars, carriages, and agricultural implements. About 7 miles distant are the Cornwall Ore Banks, three eminences—Grassy, Middle, and Big Hill—consisting almost entirely of iron-ore veined with copper. The town was laid out in 1750, and incorporated as a borough in 1813; gas was introduced in 1857, and in 1872 water was brought into the place by gravitation at an expense of $250,000. The population of Lebanon has increased from 2184 in 1850 to 6727 in 1870, and 8778 in 1880.

LEBDA. See LEPTIS.

LE BEAU, CHARLES (1701-1778), a French historical writer, was born at Paris on October 15, 1701, and was educated at the Collége de Sainte-Barbe and the Collége du Plessis; at the latter he remained as a teacher after the termination of his course as a pupil, until he obtained the chair of rhetoric in the Collége des Grassins. In 1748 he was admitted a member of the Academy of Inscriptions, and in 1752 he was nominated professor of eloquence in the Collége de France. From 1755 he held the office of perpetual secretary to the Academy of Inscriptions, in which capacity he edited fifteen volumes (from the 25th to the 39th inclusive) of the *Histoire* of that institution. He died at Paris on March 13, 1778.

The only work with which the name of Le Beau continues to be associated is his *Histoire du Bas-Empire, en commençant à Constantin le Grand*, in 22 vols. 12mo (Paris, 1756-1779), being a continuation of Rollin's *Histoire Romaine* and Crevier's *Histoire des Empereurs*. Its usefulness arises entirely from the fact of its being a faithful résumé of the Byzantine historians, for Le Beau had no originality or artistic power of his own. Five volumes were added by Ameilhon (1781-1811), which brought the work down to the fall of Constantinople. A later edition, under the care of Saint-Martin and afterwards of Brosset, has had the benefit of careful revision throughout, and has received considerable additions from Oriental sources.

LEBEDIN, a district town of the Kharkoff government in European Russia, 102 miles north-west of the government town, near the Olshana and Buravka, two small tributaries of the Dnieper. Its population has increased from 15,137 in 1863 to 17,019 in 1879. There are four annual fairs, and a good trade in grain and cattle.

Lebedin dates from the middle of the 17th century. In 1709 it was the headquarters of the operations of Peter the Great against Mazeppa, and the scene of the execution of nine hundred of that hetman's followers, whose common grave is still marked by a mound 70 feet square.

LEBEDYAN, a district town of the Tamboff government in European Russia, situated 132 miles west of Tamboff, on the bluffs of the right bank of the Don. It possesses a modern cathedral (Kazanskii) and several churches of architectural and antiquarian interest; and in the immediate vicinity is the great Eletskii Troitskii monastery, which under the name Yablonovoi Pustuin was founded in 1621. The prosperity of the town is closely bound up with that of its three annual fairs, of which the first two continue for a month and the last for six days,—many of the inhabitants deriving the better part of their income from the rents paid by their merchant visitors. The chief fair is held near the monastery, and is known as the Troitskaya. The population, returned in 1863 as 5849 (exclusive of the suburbs, with 3046), was 6010 in 1879.

Lebedyan probably dates from the 15th century. It was reckoned a town in the beginning of the 17th, and about 1678 it became the centre of a district.

LEBRIJA, or LEBRIXA, a town of Spain, in the province of Seville, near the left bank of the eastern arm of the Guadalquivir, and on the eastern edge of the flat fluvial tract known as "Las Marismas," formed by that river. It is 44 miles by rail from Seville, which lies north by east, and about 50 miles from Cadiz. The climate is somewhat unfavorably affected by the proximity of the marshes; but the sierra beneath which it lies protects the town from the hot easterly winds, and it enjoys during the heats of summer the pleasant alternation of land and sea breezes. The parish church, the only building of any note, is a somewhat imposing structure in a variety of styles—Moorish, Gothic, Romanesque—dating from the 14th to the 16th century; it contains some early specimens of the carving of Alonso Cano. The manufactures, which are unimportant, consist chiefly of bricks, tiles, and earthenware, for which a useful clay is found in the neighborhood; there is some trade in the grain, wine, and oil of the surrounding district. The population in December, 1877, was 12,864.

Lebrija is the Nabrissa or Nebrissa, surnamed Veneria, of the Romans; by Silius Italicus (iii. 393), who associates it with the worship of Dionysus, the name is derived from νεβρίς. Nebrishah was a strong and populous place during the period of Moorish domination; it was taken by St. Ferdinand in 1249, but again lost, and became finally subject to the Castilian crown only under Alphonso the Wise in 1264. It was the birthplace of Elío Antonio de Lebrija or Nebrija (1444-1522), better known as Nebrissensis, one of the most important leaders in the revival of learning in Spain, the tutor of Queen Isabella, and a collaborateur with Jimenez in the preparation of the Complutensian Polyglott.

LE BRUN, CHARLES (1619-1690), French painter, was born at Paris 24th February, 1619, and attracted the notice of Chancellor Séguier, who placed him at the age of eleven in the studio of Vouet. At fifteen he received commissions from Cardinal Richelieu in the execution of which he displayed an ability which obtained the generous commendations of Poussin himself, in whose company Le Brun started for Rome in 1642. In Rome he remained four years in the receipt of a pension due to the liberality of the chancellor. On his return to Paris Le Brun found numerous patrons, of whom the celebrated Superintendent Fouquet was the most important. Employed at Vaux le Vicomte, Le Brun, who had an immense amount of worldly tact, ingratiated himself with Mazarin, then secretly pitting Colbert against Fouquet. Colbert also promptly recognized Le Brun's powers of organization, and attached him to his interests. Together they founded the Academy of Painting and Sculpture (1648), and the Academy of France at Rome (1666), and gave a new development to the industrial arts. In 1660 they established the Gobelins, which at first was a great school for the manufacture, not of tapestries only, but of every class of furniture required in the royal palaces. Commanding the industrial arts through the Gobelins, of which he was director, and the whole artist world through the Academy—in which he successively held every post—Le Brun imprinted his own character on all that was produced in France during his lifetime, and gave a direction to the national tendencies which endured even after his death. The nature of his emphatic and pompous talent was in harmony with the taste of the king, who, full of admiration at the decorations designed by Le Brun for his triumphal entry into Paris (1660), commissioned him to execute a series of subjects from the history of Alexander. The first of these, Alexander and the Family of Darius, so delighted Louis XIV. that he at once ennobled Le Brun (December, 1662), who was also created first painter to his majesty with a pension of 12,000 livres, the same amount as he had yearly received in the service of the magnificent Fouquet. From this date all that was done in the royal palaces was directed by Le Brun. The works of the gallery of Apollo in the Louvre were interrupted in 1677 when he accompanied the king to Flanders (on his return from Lille he painted several compositions in the Château of St. Germains), and finally—for they remained unfinished at his death—by the vast labors of Versailles, where he reserved for himself the Halls of War and Peace, the Ambassadors' Staircase, and the Great Gallery, other artists being forced to accept the position of his assistants. At the death of Colbert, Louvois, who succeeded him in the department of public works, showed no favor to Le Brun, and in spite of the king's continued support he felt a bitter change in his position. This contributed to the illness which on 22d February, 1690, ended in his death in the Gobelins. Besides his gigantic labors at Versailles and the Louvre, the number of his works for religious corporations and private patrons is incredible. He modelled and engraved with much facility, and, in spite of the heaviness and poverty of drawing and color, his extraordinary activity and the vigor of his conceptions justify his claim to fame. Nearly all his compositions have been reproduced by celebrated engravers.

LECCE, one of the most important cities of Southern Italy, and the administrative centre of the province of Lecce (formerly Terra d'Otranto), is situated on the railway between Brindisi and Otranto, about 8 miles from the coast of the Adriatic. Down to the middle of the 18th century it was defended by regular fortifications constructed in the 16th century, and it still preserves some of the gateways, as well as a triumphal arch erected in honor of the entry of Charles V. Among its public buildings are the cathedral (dedicated to St. Orontius, traditional first bishop of the city, whose statue, on a lofty column, adorns the principal square), the old convent of the Celestines now occupied by the prefecture, the old convent of the Capuchins, and the marble church of St. Nicholas. Benevolent institutions are specially numerous, and include a hospital dating from 1389, and a communal orphanage from 1608. A public library was founded in 1863. The name of Lecce has long been familiar throughout Italy in connection with the great tobacco factory now located in the Dominican convent; and cotton and woollen goods, lace, artificial flowers, hats, etc., are among the products of the local industry. The population increased from 17,836 in 1861 to 18,460 in 1871.

Lecce is identified with Lupiæ, a city of the Salentines, and, though remains of ancient edifices are no longer to be seen, there is evidence of the existence of extensive substructions as late as the 15th century. The name Lycea, or Lycia, begins to appear in the 6th century. The city was for some time held by counts of Norman blood, among whom the most noteworthy is Bohemond, son of Robert Guiscard. It afterwards passed to the Orsini. The rank of provincial capital was bestowed by Ferdinand of Aragon in acknowledgment of the fidelity of Lecce to his cause. Scipione Ammirato (Florentine historian), Domenico de Angelis, and G. Baglivi the anatomist were natives of the city.

LECCO, a city of Italy, in the province of Como, situated near the southern extremity of the eastern branch of the Lake of Como, which is frequently distinguished as the Lake of Lecco. It is the meeting place of several important roads, and the terminus of a railway from Bergamo, which joins the line from Milan. To the south the Adda is crossed by a fine bridge originally constructed in 1335, and rebuilt in 1609 by Fuentes. Lecco, in spite of its real antiquity, presents quite a modern appearance; and it is the seat of no small industrial activity. Besides the iron-works, which are particularly important, there are brass foundries and oil-works; and silk spinning, cotton spinning, and wood carving are successfully prosecuted. The annual cattle fair lasts fifteen days. In the neighborhood of the town is Caleotto, the residence of Manzoni, who in his *Promessi Sposi* has left a full description of the district. The population of Lecco was 6815 in 1871.

In the 11th century Lecco, which had previously been the seat of a marquisate, was presented to the bishops of Como by Otto II.; but in the 12th century it passed to the archbishops of Milan, and in 1127 it assisted the Milanese in the destruction of Como. During the 13th century it was struggling for its existence with the metropolitan city; and its fate seemed to be sealed when the Visconti drove its inhabitants across the lake to Valmadrera, and forbade them to raise their town from its ashes. But in a few years the people returned; and Azzone Visconti made Lecco a strong fortress, and united it with the Milanese territory by a bridge across the Adda. During the 15th and 16th centuries the rock of Lecco was an object of endless contention. In 1647 the town with its territory was made a countship. The fortifications were finally sold by Joseph II. to Count Serponti. Merlinis, one of the first Italian printers, and Morone, Charles V.'s Italian chancellor, were born in Lecco. See Apostolo, *Lecco e suo territorio*, Lecco, 1855.

LE CLERC, JEAN (1657–1736), or CLERICUS, theologian and man of letters, was born March 19, 1657 (o. s.), at Geneva, where his father Stephen Le Clerc was professor of Greek. The family had originally belonged to the neighborhood of Beauvais in France, and several of its members have acquired some name in literature. On the completion of his grammar school course (in which he made himself remarkable for his omnivorous reading), he applied himself to the study of philosophy under Chouet the Cartesian, and from his nineteenth to his twenty-first year he attended the theological lectures of Mestrezat, Turretin, and Louis Tronchin. In 1678–79 he spent some time at Grenoble as tutor in a private family; on his return to Geneva he passed his examinations and received ordination. Soon afterwards he went to Saumur, where in 1679 were published *Liberii de Sancto-Amore Epistolæ Theologicæ* (Irenopoli: Typis Philalethianis), usually attributed to his pen; they deal with such subjects as the doctrine of the Trinity, the hypostatical union of the two natures in Jesus Christ, original sin, and the like, in a manner sufficiently far removed from that of the conventional orthodoxy of the period. From Geneva, which he still continued to regard as his home, Le Clerc in 1682 went to London, where he remained six months, preaching on alternate Sundays in the Walloon church and in the Savoy chapel. Passing over to Amsterdam he was introduced to Locke and Limborch; the acquaintance with the latter soon ripened into a close friendship, which naturally strengthened his preference for the Remonstrant theology, already favorably known to him by the writings of his granduncle Curcellæus, and by those of Episcopius. A final attempt to live at Geneva, made at the request of his relatives there, satisfied him of the unwholesomeness of its stifling theological atmosphere, and in 1684 he finally settled at Amsterdam, first as a moderately successful preacher until ecclesiastical jealousy shut him out from that career, and afterwards as professor of philosophy, belles-lettres, and Hebrew in the Remonstrant seminary. This appointment, which he owed to his friend Limborch, he held from 1684 till 1712, when on the death of the latter he was called to occupy the chair of church history also. His suspected Socinianism was the cause, it is said, of his exclusion from the chair of dogmatic theology. Apart from its varied and immense literary labors, his life at Amsterdam was quite uneventful. His marriage to the daughter of Gregorio Leti took place in 1691. In 1728 and following years repeated strokes of paralysis gradually reduced him to a state of mental imbecility, from which he was released by death on January 8, 1736.

A full catalogue of the publications of Le Clerc will be found, along with adequate biographical material, in Haag's *France Protestante* (where seventy-three works are enumerated), or in Chauffepié's *Dictionnaire*. Only the most important of these can be mentioned here. In 1685 he published *Sentimens de quelques théologiens de Hollande sur l'Histoire Critique du Vieux Testament composée par le P. Richard Simon*, in which, while pointing out what he believed to be the faults of that author, he undertook to make some positive contributions towards a right understanding of the Bible. Among these last may be noted his argument against the Mosaic authorship of the Pentateuch, his views as to the manner in which the five books actually were composed, his opinions (singularly free for the time in which he lived) on the subject of inspiration in general, and particularly as to the inspiration of Job, Proverbs, Ecclesiastes, Canticles. Simon's *Réponse* (1686) elicited from Le Clerc a *Défense des Sentimens* in the same year, which was followed by a new *Réponse* (1687). In 1692 appeared his *Logica sive Ars Ratiocinandi*, and also *Ontologia et*

Pneumatologia; these, with the *Physics* (1695), are incorporated with the *Opera Philosophica* which have passed through several editions. In 1693 his series of Biblical commentaries began with that on Genesis; it was not completed until 1731. The portion relating to the New Testament books included the paraphrase and notes of Hammond. Le Clerc's commentary had a great influence in breaking up traditional prejudices and opening men's eyes to the necessity for a more scientific inquiry into the origin and meaning of the Biblical books. It was on all sides hotly attacked,—often for opinions which now seem innocent to the most orthodox. Le Clerc's new edition of the *Apostolic Fathers* of Cotelerius, published in 1698, marked an advance in the critical study of these documents. But the greatest literary influence of Le Clerc was probably that which he exercised over his contemporaries by means of the serials, or, if one may so call them, reviews, of which he was editor. These were the *Bibliothèque universelle et historique* (Amsterdam, 25 vols. 12mo, 1686–93), begun along with De la Croze; the *Bibliothèque choisie*, Amsterdam, 28 vols. 18mo, 1703–13, and the *Bibliothèque ancienne et moderne*, 29 vols., 18mo, 1714–26. See Le Clerc's *Parrhasiana ou Pensées sur des matières de critique, d'histoire, de morale, et de politique: avec la défense de divers ouvrages de M. L. C. par Théodore Parrhase*, Amsterdam, 1699; and *Vita et opera ad annum MDCCXI., amici ejus opusculum, philosophicis Clerici operibus subjiciendum*, also attributed to himself. The supplement to Hammond's notes was translated into English in 1699, *Parrhasiana, or Thoughts on Several Subjects*, in 1700, and the *Harmony of the Gospels* in 1701. *Twelve Dissertations out of M. Le Clerc's Genesis* appeared in 1696.

LECTION, Lectionary, Lector. The Jewish custom of reading the books of Moses in the synagogues every Sabbath day was already ancient in the apostolic age, and we learn from Luke iv. 16, 17, that portions were also read from the prophets, though the system of prophetic lessons at least had not yet reached the fixity of the later ritual. For obvious reasons the reading of Scripture at public worship was continued by the Christian Church with certain modifications (1 Thess. v. 27; Col. iv. 16). An authority so early as Justin Martyr (*Apol.*, i. 67) states that in the Christian assemblies of his day "the memoirs of the apostles, or the writings of the prophets, are read as long as time permits." What we are precisely to understand by these "memoirs of the apostles" is doubtful; but the evidence we have, fragmentary though it is, may be said to make it certain that neither in his day, nor for many years afterwards, was the canon of sacred books to be read in public worship rigidly fixed, and still less were definite portions of Scripture appointed to be read on particular days of the ecclesiastical year. Traces of the office of reader as distinct from that of deacon begin to appear in Tertullian (*De Præscr.*, 41), who makes frequent allusions to the public reading of both Old and New Testament Scriptures (*Apol.*, 39; *De Præscr.*, 36; *De An.*, 9), but says nothing that can be construed as implying anything like a fixed table of lessons. Towards the end of the 4th century, however, indications of a widely spread custom of reading the Scriptures according to a uniform and rigid scheme became frequent; and the practice even then was spoken of as ancient. Thus Chrysostom and Augustine both show incidentally that the Acts of the Apostles were publicly read between Easter and Pentecost and then laid aside, while Genesis was read in Lent. In the *Apostolical Constitutions* (ii. 57) a very methodical service is enjoined; it prescribes two lessons from the Old Testament by a reader; the Psalms of David are then to be sung, next the Acts of the Apostles and the epistles of Paul, and finally (by a deacon or presbyter) the gospels, are to be read. The labors of Scholz and Tischendorf have brought to light a large body of MS. Greek lectionaries ranging between the 7th and the 10th century, from which, when fully collated, it will probably be possible to ascertain with precision the order of yearly lections contemplated within the circles to which the documents respectively belong. Most of them contain gospel lessons only; the rest lessons from the Acts and the epistles. The *Evangelion* and *Apostolos* of the modern Greek Church has a proper gospel and epistle, not only for every Saturday and Sunday, but for every day of the week. The order of (continuous) lessons for the five ordinary week days cannot be traced with certainty further back than to the 10th century, but those for the Sundays, also for the most part continuous, can be traced, so far as the gospels at least are concerned, to the 8th, and large coincidences with the Armenian lectionary lead to the inference that much had been already fixed before 595. Of Western lectionaries the earliest is probably the *Liber Comitis sive Lectionarius*, which used to be attributed to Jerome. On the whole it does not observe a *lectio continua*, but is characterized rather by free selection of suitable passages for each Sunday. Next in chronological order is the *Tabula*, drawn up by Victor of Capua (546); it was printed by Gerbert in his *Monum. Vet. Liturg. Alem.* in 1777. It also has no trace of *lectio continua*. The same remark applies to the Luxueil lectionary, edited by Mabillon in the *De Liturgia Gallicana* (Migne, *Patr.*, lxxii.); it is assigned by Mabillon to the end of the 7th century, and certainly is not later than the time of Charlemagne; besides the usual gospel and epistle, it prescribes a lesson from the Old Testament.

The earliest allusion seeming to imply an order of lectors or readers as one of the standing orders of the church occurs, as already mentioned, in a solitary passage in Tertullian. In Cyprian, allusions much less ambiguous are frequent. The *Apostolic Constitutions* give a form of prayer to be used at the ordination of lectors by the imposition of hands. In the modern Greek Church the functions of the Anagnostes are strictly confined to the reading of the epistle, that of the gospel being reserved for the deacon. In the old Catholic Church, the ordination of lectors was by publicly placing the Bible in their hands, with some such formula of exhortation as is prescribed in can. 8 of the fourth council of Carthage. By the council of Trent the order of lector was recognized as one of the minor orders of the Roman Catholic Church, but it has no actual independent existence, being regarded merely as a necessary step in promotion to a higher office.

LEDA. See Castor and Pollux.

LEDRU-ROLLIN, Alexandre Auguste (1807 1874), was the grandson of a celebrated quack-doctor of the reign of Louis XV., who took the name of Comus, and made a large fortune in curing or attempting to cure epilepsy by magnetism. He himself was born in the house of Scarron at Fontenay-aux-Roses, on February 2, 1807, was educated at Paris, and had just been entered at the Paris bar, when the revolution of July, 1830, broke out. He soon made himself a great name as an advocate, and was engaged on the republican side in all the great political trials of the next ten years. He also wrote many political tracts, and edited more than one republican newspaper, so that when he was elected as deputy for Le Mans in 1841 he was expected to take up an advanced republican position in the chamber. From this time to the outbreak of the revolution of February, 1848, he was regarded as the chosen leader of the working men of France, and spoke and wrote in favor of liberty of labor and universal suffrage. It was in the speeches of himself and his friends Lamartine and Louis Blanc at Lille, Dijon, and Chalons at working men's banquets during the latter months of 1847 that the revolution of 1848 was most clearly foreshadowed and prepared. When it did actually break out, it was Ledru-Rollin who overthrew the project of making the duchess of Orleans regent, and obtained the nomination of a provisional government. In this provisional government he was clearly pointed out by his influence among the working men for the ministry of the interior. When he resigned on June 24, 1848, he found that his four months of office had lost him his old leadership, as the conscientious performance of such an office inevitably would, but he had the credit of having for the first time established a working system of universal suffrage. He tried to regain his old influence, but in vain, and at the election of president in December had but 370,000 votes. The earlier months of 1849 he spent in protesting against the policy, especially the Roman policy, of the president Louis Napoleon Bonaparte and his ministry, which culminated in his moving their impeachment. His motion being defeated on June 12 by 289 to 8, he on June 13 headed what he called a peaceful demonstration, and his enemies an appeal to arms, which was soon dispersed. Ledru-Rollin himself escaped to London, where he signed the manifestoes of the revolutionary committee of Europe with Kossuth, Mazzini, Rüge, and sometimes Desatz. He also employed his leisure in writing a work on the *Décadence d'Angleterre*, in which he attempted to deduce the necessary fall of England from its aristocratic form of government and the misery of the lower classes. In 1870 he returned to Paris, but though elected in three departments he refused to sit in the national assembly of 1871. In 1874 he consented to sit for the department of Var, and spoke at length on June 3 on an electoral scheme, upholding the one great aim and achievement of his life, universal suffrage. The effort was too much for his health; he steadily grew weaker and weaker, and died on December 31, 1874. Perhaps the best succinct description of his character and political position in the sixteen short months of his real power is to be found in the speech of Victor Hugo at the unveiling of his bust in Père La Chaise: "Louis Blanc was the apostle of the revolution of February, Lamartine the orator, and Ledru-Rollin the tribune."

The *Discours politiques et écrits divers* of Ledru-Rollin were published by his widow in 1879; his *Décadence d'Angleterre* was published in 1850; and an account of his political position is to be found in all histories of the revolution of 1848.

LEDYARD, JOHN (1751–1789), traveller, was born in Groton, Connecticut, U. S., in 1751. After vainly attempting to settle down to the study of law and theology, Ledyard adopted the life of a seaman, and, finding his way to London, was engaged in 1776 as a corporal of marines by Captain Cook, for his third voyage of discovery. On his return in 1778 Ledyard had to give up to the Admiralty the copious notes he had kept, but was nevertheless able to publish a somewhat meagre narrative of his experiences (Hartford, U. S., 1783). He continued in the British service till 1782, when, his ship being off Long Island, he managed to escape. Ledyard returned to Europe again in 1784, his purpose being to obtain the means of fitting out an expedition to the north-west coast of America. Having failed in his attempts, he decided to reach his goal by travelling across Europe and Asia. On his arrival in Stockholm (1786) he attempted to cross to Abo in Finland on the ice; but, meeting with open water, he turned back, walked all the way round the head of the gulf, down through Finland, and on to St. Petersburg, where he arrived in March, 1787, without shoes or stockings, and penniless. He made friends, however (among others Pallas), and got permission from the Government to accompany Dr. Brown, a Scotch physician in the Russian service, to Siberia. Ledyard left Dr. Brown at Barnaul, went on to Tomsk and Irkutsk, then visited Lake Baikal, and, reaching the Lena, sailed down to Yakutsk, where he arrived on September 18. With a Captain Billings he returned to Irkutsk, where on February 14, 1788, he was suddenly arrested, hurried across Siberia and Europe to the frontier of Poland, and ordered not to return under pain of death. On reaching London, Ledyard was befriended by Sir Joseph Banks, who engaged him on behalf of the African Association to carry on their work of exploration in Africa. His career was, however, cut short at Cairo, where he died on January 17, 1789. Ledyard was a born explorer, and, had he fallen into good hands in good time, and his energies been properly directed, would probably have done good work. As it was, no results of permanent value came of his wide and aimless wanderings. His life, with extracts from his journals, was written by Jared Sparks for the Library of American Biography (1828), and is also published separately.

LEE, NATHANIEL (c. 1650–1692), dramatist, was the son of Dr. Lee, incumbent of Hatfield, Hertfordshire. He studied at Westminster School and Trinity College, Cambridge. After essaying the profession of an actor with very slight success, he wrote several tragedies, the best known of which are *The Rival Queens*, 1677, and *Theodosius*, 1680. He also assisted Dryden in producing *Œdipus* and *The Duke of Guise*. From 1684 to 1688 he was an inmate of Bedlam, and afterwards until his death he was subject to intermittent attacks of insanity. Though he wrote the *Princess of Cleve* in 1689, and the *Massacre of Paris* in 1690, he was in his later years dependent chiefly on charity. He died in London in 1692, not in 1690 as is usually stated, the register of St. Clements Danes church giving the date of his burial as the 6th May. The dramas of Lee are of course written in the artificial style characteristic of the period, and they also display occasionally a tendency to wild extravagance, but they nevertheless contain many passages of true poetic tenderness and grace.

LEE, RICHARD HENRY[1] (1732–1794), an American statesman and orator, born in Westmoreland county, Virginia, U. S., January 20, 1732, was one of six distinguished sons of Thomas Lee, a descendant of an old Cavalier family. After obtaining the foundation of a liberal education in England, and spending a little time in travel, he returned to Virginia in 1752, coming into possession of a fine property left him by his father, and for several years applied himself to varied studies. At the age of twenty-five he was appointed justice of the peace, and soon after was chosen a delegate to the house of burgesses. He kept a diffident silence during two sessions, his first speech being in strong opposition to slavery, which he proposed to discourage, and eventually to abolish, by imposing a heavy tax on all further importations. In 1764 Lee had applied for a collectorship under the Stamp Act, which afterwards roused the determined hostility of the colonies, but on reflection he regretted doing so, and became an outspoken promoter of the most extreme democratic ideas. In February, 1766, he organized an association in Westmoreland, in accordance with Patrick Henry's famous resolution against the Act. At the winter session of the burgesses in 1766, Lee, with the aid of Patrick Henry, succeeded in carrying the house upon a test question against the united aristocratic elements of the colony. In 1767 he spoke eloquently against the acts levying duties upon tea and other articles, and in 1768, in a letter to John Dickinson of Pennsylvania, he made the suggestion of a private correspondence among the friends of liberty in the different colonies. Lee is said also to have originated, in a conversation with fellow burgesses in 1773, the plan of an inter-colonial or so-called continental congress, which was carried into effect next year. At this first congress in Philadelphia in 1774, Lee is said to have penned the address to the king, and is known to have prepared that to the people of British America, together with the second address to the people of Great Britain, directed by congress in 1775, both of which are among the most effective papers of the time. On June 7, 1776, instructed by the Virginia house of burgesses, he introduced in congress the resolution declaring "that these united colonies are, and of right ought to be, free and independent states, that they are absolved from all allegiance to the British crown, and that all political connection between them and the state of Great Britain is, and ought to be, totally dissolved." Lee was in congress in 1778–80 and 1784–85, and was one of the first senators chosen from Virginia after the adoption of the federal constitution. Though strongly opposed to the adoption of that constitution, owing to what he regarded as its dangerous infringements upon the independent power of the States, he accepted the place of senator in hope of bringing about amendments. He became a warm upholder of Washington's administration, and his prejudices against the constitution were largely removed by its working in practice. He retired from public life in 1792, and died at Chantilly, in Westmoreland county, June 19, 1794.

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[1] [His brother, Francis Lightfoot (1734–96), signed the Declaration of Independence. Another brother, Arthur (1740–92), studied medicine in Edinburgh, was admitted to the bar in London, colonial agent of Massachusetts in England, commissioner with Franklin and Deane to treat for the French alliance.—AM. ED.]

See *Memoirs*, by his grandson R. H. Lee, 2 vols., 1825.

LEE, **Robert Edward** (1807–1870), general of the Confederate States army, and one of the greatest of modern commanders, was born at Stratford, in Westmoreland county, Virginia, on January 19, 1807. His father, General Harry Lee, better known in the War of Independence as "Light-Horse Harry Lee," and afterwards governor of Virginia, was the son of a cousin of the subject of last article. Robert Lee entered the military academy at West Point in 1825, and graduated in 1829, when he received a commission in the corps of engineers. When the Mexican war broke out, Lee, who was then captain, served in the army under General Scott. He distinguished himself greatly throughout the campaign, and was brevetted as colonel for his conduct at the siege of Chapultepec, where he was wounded. In 1852 he was appointed superintendent of the academy at West Point, and in 1855 he was promoted lieutenant-colonel of the second regiment of cavalry, with which he served in Texas. In March, 1861, he was made colonel of the first regiment of cavalry, but in the following month, learning that his native State had withdrawn from the Union, he resigned as an officer of the United States army, and was forthwith put in command of the Virginian forces. When Virginia joined the Confederacy he was the third of five generals appointed by the Southern Congress. No adequate opportunity of gaining distinction was afforded him, however, until the beginning of June, 1862, when he received command of the army of northern Virginia, and commenced the series of operations the result of which before the month had closed was to compel M'Clellan to abandon the siege of Richmond. Following up this advantage and Jackson's victory at Cedar Run on August 9, Lee advanced in person to lead the army that was being formed on the south bank of the Rapidan; after crossing that river he inflicted upon Pope at Manassas the disastrous defeat by which the Federal army was compelled to retire within the fortified lines of Washington. Lee now decided on the invasion of Maryland, and advanced to Frederick city, but, being compelled to divide his forces, he sustained a check in the passes of South Mountain (September 16, 17)[1] which compelled him to recross the Potomac. After a few weeks' breathing time he found himself again face to face with the Federal army near Fredericksburg early in November; on December 13 the enemy, having crossed the Rappahannock on the previous day, assailed his position in strength, but was defeated with great loss. In the following spring the hostile armies still faced one another on the Rappahannock, but the brilliant strategy of Lee, as exhibited in the battles at Chancellorsville (May 2–4), against vastly superior forces, resulted in the retreat of the enemy, while Lee was left free to resume his old policy of throwing the Federal forces on the defensive by an advance into Pennsylvania. He encountered the enemy near Gettysburg on July 1, and decided advantages were gained, but the struggle was renewed on the two following days with disastrous consequences to him; he retreated, however, in good order, and reached Virginia on the 12th, when the campaign of the year practically closed. That of 1864 began on May 4, when Grant crossed the Rapidan; the passage itself was unresisted, but his subsequent progress was hotly contested in a series of well-fought battles which did not prevent the Federal general from reaching the south side of the Appomattox. The siege of Petersburg began in June, and lasted until April 2, 1865. A week afterwards Lee surrendered with his whole army, thus virtually terminating the war. In the same year he was elected president of Washington and Lee university at Lexington, Virginia, which office he retained until his death on October 12, 1870.

The events of Lee's military career briefly indicated in this notice belong to the history of the United States, and will call for further notice in that connection. To do justice to his extraordinary ability as a general, displayed under circumstances of extreme difficulty, when his movements were continually hampered by political necessities, as well by the lack of material resources, would require an elaborate military biography; it was never more nobly displayed than in the last hopeless stages of the fatal struggle. The personal history of Lee is lost in the history of the great crisis of America's national life; political friends and foes alike acknowledged the disinterestedness and purity of his motives, his self-denying sense of duty, and the unrepining loyalty with which he accepted the ruin of his party.[2]

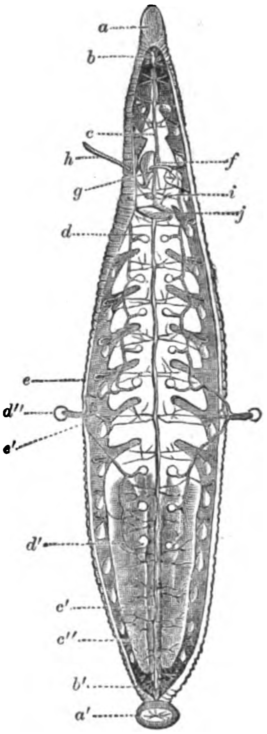

Fig. 1.—Medicinal Leech (*Hirudo medicinalis*, L.), after Moquin-Tandon and Rolleston. *a*, anterior sucker; *a'*, posterior sucker; *b*, first and second pairs of ganglia — closely approximated; *b'*, last ganglion; *c*, first diverticulum of the alimentary canal; *c'*, small intestine (gastroiléal of Gratiolet); *c''*, eleventh pair of cæca (long and large); *d*, first pair of the nine testes; *d'*, last pair of testes; *d''*, sixth testis displaced outward so as to show its connection with the vas deferens; *e*, *e'*, segmental organs; *f*, muscular ductus ejaculatorius of the left side, leading from the vesicula seminalis to the base of the flask-shaped intromittent organ; *g*, club-shaped end of the intromittent apparatus; *h*, penis; *i*, ovary of the left side; *j*, muscular vagina.

LEECH. The medicinal leech (*Hirudo medicinalis*, L.) is a species grouped under the family *Gnathobdellidæ* (with a dental apparatus composed of armed muscular ridges) of the discophorous *Annelida*. The body of a leech is spindle-shaped, and flattened dorsally and ventrally so as to be elliptical in transverse section. It is somewhat pointed in front except when the mouth is in action, while posteriorly it is terminated by a disk or sucker. The surface is marked by a series of annulations reaching from ninety-five to one hundred, but such are only cutaneous, as indicated by the ganglia, the segmental organs, the white spots on each side, and even by the arrangement of the two outer yellowish stripes, for the primary segments of the body comprise from three to five of these. The anterior sucker (fig. 1, *a*) is composed of four incomplete annuli and another surrounding the mouth, while the posterior (*a'*) has seven. The color of the dorsum is generally dull olive or olive-brown, with six yellowish, rusty, or greenish-yellow bands more or less interrupted with black, the spots of the latter being somewhat symmetrically arranged in the two outer rows. The ventral surface is speckled with black spots on a grayish ground. Several varieties occur, according as the dorsum is lighter or darker brownish or olive, and the ventral surface with or without spots. Thus Moquin-Tandon, Diesing, and others indicate six or seven, each of which again has various subvarieties, ranging from two to five. Externally the body is invested by a thin translucent chitinous cuticle, which is perforated, apparently with some regularity, by the apertures of the glands. This coat is shed at intervals. Beneath is the hypoderm (epidermis of some), which is much firmer and thinner than in the Nemerteans. It contains the pig-

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[1] [The battle of South Mountain was fought on the 14th, and the engagements of the 16th and 17th constitute the battle of Antietam, or Sharpsburg.—Am. Ed.]

[2] [His sons, George W. C., who succeeded him at the University in Lexington, and William H. F., became major-generals in the Confederate army.—Am. Ed.]

ment, though part of the latter intrudes into the subjacent layer, and is composed as usual of columnar granular cells, a horizontal section presenting a somewhat regularly areolated aspect. Rawlins Johnson alludes to the vascularity of the surface of the leech, and Ray Lankester notes the extension of the capillaries into this layer. The latter has not been verified, even in the hypoderm of the snout, though preparations presenting such appearances are not uncommon. The hypoderm is closely united to the subjacent muscular layer, though it can hardly be said with Gegenbaur that it is continued into the parenchyma of the body. It is this layer and the cuticle which are marked by the superficial annulations. Various unicellular glands occur underneath the hypoderm, in particular two chief sets —superficial and deep. The former are situated amongst the outer (circular) muscular fibres and pigment, while the latter lie amongst the connective tissue, muscular fibres, and vessels that constitute the "parenchyma" between the muscular layers of the body-wall and the alimentary canal. It has been suggested that the former secrete the ordinary mucus, the latter the cocoons. Both open by ducts on the surface of the cuticle, and it is stated that those in the neighborhood of the genital segments are enlarged at the time of oviposition. In the Nemerteans it is the homologue of the leech's hypoderm which secretes the envelopment of the ova.

The muscular layers consist of external circular fibres in several strata, between which the hypodermic glands, pigment-cells, and vessels intrude. When this coat is examined in thin superficial (horizontal) sections the fasciculi are observed to be separated by intervals. Other circular fibres occur within the longitudinal layer. The latter muscles form the great mass of the body-wall, and are grouped into various bands by the connective tissue and radiating muscles. The latter pass directly from the dorsal to the ventral surface laterally, and thus become vertical fibres; and they are very well seen in *Nephelis*, where they form four or five conspicuous bands between the circular layer dorsally and ventrally, and thus appear to have a considerable influence in determining the shape of the body. The extensible snout presents a muscular structure analogous to that of the tongue in the higher animals, and it is capable of even more extensive and varied movements. A complex series of muscles (circular, radial, and longitudinal) exists in connection with the posterior sucker. The muscles of the leech are nonstriated, and are formed of long spindle-cells with nuclei. The locomotion of the leech is effected by the alternate attachment of the suckers, or by swimming through the water like an eel. It is fond of waving its body to and fro in the water when attached by its posterior sucker, and this would certainly aid the aëration of the blood in the superficial vessels.

There is no special body-cavity, the blood-vessels and connective tissue alone occurring between the muscles and the digestive chamber. Rolleston speaks of dissepiments between the digestive diverticula, that between the last two not being prolonged to the ganglia. In the histology of the leech an important part is played by the connective tissue, which envelops all the organs, traverses the muscles, and is filled in certain places and in its cellular elements by brown granules. Moreover, certain of these cells are stated by Ray Lankester to form the walls of the blood-vessels.

Suctorial apparatus.

The inferior surface of the snout constitutes a spoon-shaped cavity leading into the mouth, which thus with its marginal lip is capable of forming a most efficient sucker. At the junction of the buccal with the pharyngeal region are a median dorsal and two lateral prominent semicircular or sometimes slightly hatchet-shaped elevations, which in contraction fit into pits in the wall. On the free edge of each of these muscular cushions the chitinous buccal lining is furnished with a closely arranged and microscopic series of transverse processes (eighty or ninety in number), each of which somewhat resembles the middle valve of a *Chiton* or the upper jaw of *Physa*. They are arranged indeed after the manner of the ridge-tiles of a roof, the lateral pieces sloping downward on each side from the prominent median point. These angular transverse plates are separated by a well-marked interval, and they commence as small processes. They are distinctly calcified. It is these organs, mounted on the three muscular cushions, which cause the somewhat triradiate wounds, and which may pass through the true skin to the cellular tissue, a feat which Poupart's notion of suction could hardly accomplish. Great ambiguity seems to run throughout text-books on this subject, and yet the figures of Brandt and Moquin-Tandon represent the condition very fairly, though some appear to have mistaken the lateral view of the muscular cushion for a "horny jaw." These teeth can only act *en masse* with the muscular pad on which they rest, and have not the individual movement seen for instance in the long hook-rows of certain polychætous Annelids. As Leuckart and others have shown, each of these muscular cushions has a most complex structure. The superficial fibres are for the most part oblique, the central vertical (that is, at right angles to the teeth) and cut into lamellæ by transverse fibres. The whole forms a very efficient motor apparatus for both cushion and teeth in all their varied functions.

Organs of digestion.

The mouth opens into the pharynx, the structure of which, as in other *Gnathobdellidæ*, differs essentially from that of the *Rhynchobdellidæ*. In ordinary contracted preparations the central canal in front is either triangular or triradiate. Internally it is covered by the cuticular and the tough hypodermic layers, from which the radiating muscles pass to the body-wall, the space between the hypoderm and the strong circular fibres of the organ being occupied by irregularly arranged longitudinal fibres clasped by the radial fibres. The mixed muscular layer of the body-wall occurs outside the foregoing. The entire arrangement is well adapted for dilating, shortening, and lengthening the canal, and performing all the complex actions of a powerful suctorial apparatus. In the *Rhynchobdellidæ*, on the other hand, the protrusible proboscis, with its intricate structure and its sheath, presents little in common with the foregoing. The pharynx terminates in the stomach, an elongated chamber having eleven lateral diverticula (*c* to *c*′′), which form short pouches directed backward on each side, with the exception of the posterior pair (*c*′′), which are so large and long as to be almost in apposition when distended, and nearly to reach the termination of the body. From the point of bifurcation the canal proper (*c*′) is continued as a somewhat small tube—to end in an anus on the dorsum, immediately in front of the posterior sucker. The inner surface of the alimentary canal is lined by a minutely granular epithelium. Salivary glands have been described by various authors as situated in the parenchyma outside the pharnyx, and the number of large granular glands in this region is certainly great. Digestion seems to be slow in leeches, and breeders feed them with blood only once in six months. It is well to remember that the alimentary canal contains blood in those brought direct from their native marshes.

Nerves and sense-organs.

The nervous system consists of twenty-three pairs of ventral ganglia, the first being connected by commissures (between which the gullet passes) with the supra-œsophageal or cephalic ganglia. An intermediate stomato-gastric ganglion sends branches to the central muscular cushion for the teeth, and another on each side gives twigs to the lateral cushions. The cephalic mass supplies the eyes and the cup-shaped sense-organs. The former, to the number of ten, are situated on the three anterior segments and on the fifth and eighth segments, the whole forming an ellipse, and their structure has been carefully investigated by Leydig and others. Dr. R. M.

Gunn observes that in the leech they are formed of cup-shaped or bell-shaped depressions of the skin, surrounded by numerous pigment-cells. The fundus is furnished with large clear cells having peculiar nuclei. They are merely altered epithelial cells, and are found to be continuous with them. Between these in the axis of the cup is a space traversed by a nervous filament which pierces the fundus. According to Leydig this nerve-filament ends in a freely exposed papilliform elevation at the mouth of the cup-shaped eye. No connection has been found between the nerve and the cells. Milne-Edwards, again, suggests that these refracting cellules are very like the primordial cellules of the refracting cone of the retinal composite eye of insects. Near the mouth of the cup Ranke figures retinal cones (Glaskörperkugeln), which are arranged like nerve end-organs in a mosaic, on a flat extension of the optic ganglion. These cones are very like those of the vertebrate eye, consisting of a somewhat rounded granular body, connected at the base with a nerve-filament, and having a clear, stiff, rod-like projection on its outer part. Dr. Gunn has been unable to see these cones or the termination of the optic nerve. The wall of the clear cell is very thick, and the "nucleus" is generally seen to be an inward projection of this wall ending in a knob-like enlargement. Where it appears free, that is probably due to the plane of section, the side or end of the knob being severed from its connection. Besides the cells having this inward projection of the wall there are others containing highly refractive spherules like oil globules. Ranke observes how little these "optic cups" differ from the touch or taste organs scattered on the snout and sides of the animal, and he is of opinion that they probably serve equally for the three kinds of sensory perception (sight, taste, and touch). If Ranke's account is correct, and if the cone-mosaic situated at the mouth of the cup be directly stimulated by the rays of light, it is difficult to account for the function of the large clear cells, and more especially the pigment around. From the position of the pigment it cannot serve for the isolation of Ranke's elements, and it can hardly be required for the prevention of the confusion of images. Yet by its presence the eye of the leech is distinguished from the adjacent and very similar touch-organs. Dr. Gunn is of opinion that the light acts on the pigment, and develops some form of energy which affects the contents of the cell, whence a stimulus is communicated to the nerve. Unfortunately a nervous connection with these cells has not been found.

The three anterior pairs of ventral ganglia (b) coalesce into a single mass, and in the same way the last large ganglion (b') is composed of seven. The ordinary ventral ganglia give off two branches on each side, one of which has a small ganglion developed on it. The penultimate ganglion sends off only a single branch on each side, while the last gives off from seven to nine for the supply of the posterior sucker. The nerve cells, as usual in these ganglia, are chiefly external, and the fibrous region internal, while the whole is surrounded by a neurilemma. This system has been the subject of many elaborate researches, amongst which those of Leydig and Hoffmann are conspicuous. A sympathetic or azygos nerve discovered by Brandt runs along the ventral surface of the digestive tract. In development it is found that in many leeches the long cords are originally separate, but afterwards come close together so as to resemble a single connecting cord.

Circulation.

The circulatory system presents a median dorsal, a median ventral, and two large lateral longitudinal trunks, all anastomosing with each other, and giving off numerous branches to the muscular layer of the mesoderm and various internal organs. The median sinus in the head surrounds the ganglia and œsophageal ring. It has a ventral development in the rest of the body, where it encloses the alimentary canal and the gangliated nerve-cord. The blood-vessels have a well marked systole and diastole—from eight to ten times per minute. The fluid is red, and devoid of corpuscles. Old observers noticed the finely reticulated condition of the integuments when the vessels were injected, but, as formerly noticed, vessels could not be seen in the hypoderm proper. The active to and fro waving movements of leeches in the water when attached by the posterior sucker are probably connected with cutaneous respiration.

Segmental organs.

No part of the leech has caused more discussion than the series of seventeen pairs of segmental organs (e, e') which occur in a line external to the testes, and alternating in position with them. Some considered them respiratory, others excretory, while a few connected them with the reproductive system. They consist of a muscular saccate ciliated organ which communicates with the exterior near the posterior part of each primary segment, and externally of a loop-shaped gland, labyrinthine in structure, one end of which opens into the former sac, while a cæcal process is prolonged on each of the testes in their region. In minute structure it has been found that the cells which constitute the gland are all penetrated by ductules, which, however, do not communicate with the large duct in the axis of all the lobes (Bourne). The gland is surrounded by an elaborate plexus of blood-vessels. These organs are in the embryo preceded, in the posterior region of the body, by three pairs of looped canals, which disappear before the permanent ones are developed.

Reproduction.

The leech is hermaphrodite, but congress of different individuals is necessary for reproduction, and thereafter spermatophores, which have a special covering, are found in the respective vagina. The male organs consist of an intromittent apparatus (h) with a muscular and glandular basal structure (g), and a duct (f) on each side from the *vesicula seminalis*. The latter has a *vas deferens* connecting it with the nine globular testes (d, d', d'', etc.) ranged along each side of the body, one of which is displaced outward at d''. The intromittent organ reaches the exterior at the junction of the first and second sixth of the body (between the twenty-fourth and twenty-fifth rings). The female apparatus is placed in the segment between the seminal vesicles and the first testis, four annuli intervening between the respective sexual apertures. The external opening of this system (between the twenty-ninth and thirtieth rings) leads into an oval sac (j), the vagina—furnished with thick muscular walls. A coiled oviduct passes from its apex through glandular tissue, which probably secretes the albuminous matter surrounding the eggs, and divides into branches, one leading to each ovary (i). In *Hæmopis* the ovaries form a coiled filament, and on this the ovarian germs are budded. The ova are connected with the filament by a thin envelope which is drawn out into a stalk. There is no cord in *Nephelis*, but the ovarian germs form groups of cells.

Three or four days after congress the leech may be observed to be contracted above and below the genital apertures, and an abundant secretion is poured out so as to surround this region of the body, as in the Nemerteans. Into this investment the contents of the female organs and their opaline gelatinous envelopment are forced. The animal elongates the anterior part of its body, withdraws its head, and the structure just mentioned slips off as a cocoon containing from five to eighteen ova, and frequently showing slight elevations at the points through which the body passed. The cocoons are deposited in cavities in the mud during the summer and autumn, and some seem also to deposit them during the winter. The ovoid cocoons consist of a network of spongy fibres, and indeed have been mistaken for a sponge. The older authors considered the leech viviparous until Noble and Rawlins Johnson observed the foregoing phenomena.

Leech breeding.

There is little difficulty in rearing leeches in confinement if a proper method is followed, and accordingly various leech tanks and ponds have been constructed. One of the largest schemes of the kind is a leech farm of 13 acres near Newtown, Long Island, U. S. The breeding ponds are in oblongs, each of 1½ acres in extent, and 3 feet or more in depth. The bottom is composed of clay, and the margins of peat. The cocoons are deposited in the soft peat from June onward, the chief enemies being musk-rats, water-rats, and water-shrews, which dig the cocoons out of the peat. The adult leeches are fed every six months on fresh blood placed in linen bags suspended in the water. It is also the opinion of some that leeches which have been filled with blood make good breeders.

Development. In regard to the development of the *Gnathobdellidæ*, *Nephelis*, perhaps, has been more completely worked out than *Hirudo* (though the observations of Weber, Leuckart, Robin, and others on the latter are important), and, as the former very much resembles the latter, except in the presence of cilia in the embryo anteriorly, a brief notice of it will suffice. Butschli describes the usual divisions of the eggs, which need not be given in detail, especially as an excellent summary is to be found in Balfour's *Comparative Embryology*. According to these authors the cells which constitute the epiblast give origin to others which form the hypoblast and vitelline spheres. Two patches of epiblast gradually spread over the vitelline spheres. Then the hypoblast cells increase and fill up a space bounded behind by three vitelline spheres and in front by the epiblast of the anterior end. At the sides of the hypoblast the mesoblast has become established, probably as two lateral bands. The hypoblast cells range themselves round a central cavity, increase, and become filled with food-yolk. The mouth and thick-walled œsophagus are then developed, probably by epiblastic invagination. The mesoblast now forms two lateral curved bands at the sides of the body. The three vitelline spheres become covered with the flattened cells of the epiblast. The cephalic region becomes ciliated, and the cilia enter the œsophagus. The epiblast develops the cuticle, which is raised into transverse rings, without, however, having any relation to the true segments of the mesoblast. The nervous system is probably derived from the epiblast, the ventral cord breaking up into a series of ganglia, which correspond with the true somites, except that the first and last, as already mentioned, are composed of several. The supra-œsophagal ganglia arise independently. The mesoblast probably takes its origin from the two mesoblastic bands, and the segments formed by it grow upward and meet in the dorsal line, and septa are formed between the somites. The somatic layer of the mesoblast gives rise to the muscles. The mesoblast also gives origin to the excretory (segmental) and generative organs, and the vascular system. A delicate musculature, however, would appear to be developed independently of the mesoblastic bands. The mouth and pharynx are formed by the epiblast, the rest of the canal by the hypoblast, which from the first has a sac-like shape. The posterior sacculation of the stomach in *Hirudo* is originally unpaired. The dental pads are formed about the same time as the eyes as protuberances of the oral cavity. The anus is developed very late above the posterior sucker. In the embryo of *Hirudo* Leuckart found three pairs of segmental organs at the posterior end of the body, consisting of an enlargement from which a convoluted tube is continued for some distance backwards, and then bends forwards to open on the exterior. The anterior part is broken up into a labyrinthic network. These organs disappear in the adult. The recent researches of Whitman on *Clepsine* and of Hoffmann have greatly extended our information with regard to the histology and morphology of the parts in the embryos of the leeches.

The time between the deposition of the ova and their hatching is variable, and probably depends, as in the ova of the *Salmonidæ*, on temperature and other causes. It is said to range from twenty-five to forty days. The young arrive at perfect coloration when two years old, and become sexually mature at three years, about which age they become fit for medicinal use; their food consists at first of microscopic organisms, and afterwards, when the mouth has attained more complete development, of the larvæ of insects and other small animals,

There is no annelid that has been more prominently brought under notice than the leech, both on account of its use in medicine from very early times, and its fitness for anatomical and other investigations. The number of treatises, inaugural, historical, and structural, that have been devoted to it is very considerable; of these the voluminous article in Brandt and Ratzeburg's *Medicinische Zoologie* may be taken as a type.

Medicinal use. The leech is the *βδέλλα* of Herodotus, Theocritus, Nicander, and other Greek authors and the *Hirudo* and *Sanguisuga* of Plautus, Cicero, Horace, Pliny, and other Roman writers. Cælius Aurelianus mentions its use, and Galen and his successors recommend its application. Appian also alludes to the latter, and describes very graphically the process by which it fills itself with blood. It was sufficiently familiar to naturalists both before and after the time of Linnæus, though occasionally there has been considerable ambiguity in regard to species. The use of the leech is mainly for local blood-letting, but in modern times the practice has greatly diminished; indeed, in some cities the druggists chiefly use them with doubtful efficiency in cases of incipient gumboil and in facial ecchymosis. They may be applied to any part of the adult skin, and to the mouth, fauces, and other available inlets by the aid of a leech-glass, which consists of a tube with a slightly contracted aperture, and provided (or not) with a glass piston to push the leech onward. In China a piece of bamboo serves the same purpose. For such functions the most active specimens should be chosen (and, as Sir Robert Christison states, these contract firmly when squeezed in the hand) and kept for an hour out of water, and then applied to a perfectly clean surface of skin. They may also be made to bite by smearing the skin with cream or blood, or by immersing the leech for a minute in porter or tepid water. Each fills in about fifteen minutes, and draws from 40 to 85 grains of blood, or, including that afterwards obtained by fomenting the wound, about half an ounce. In young children they should never be placed on parts where firm pressure cannot be applied. It was formerly the practice to prepare the leeches that had been used for further action by sprinkling a few grains of salt on the snout, and stripping them gently between the fingers so as to cause them to eject the blood. This plan is not now adopted, and rightly so, since various diseases might thus be communicated. They certainly can be applied four and five times in succession by placing them in vinegar and water, and afterwards in a vessel (which the French call a domestic marsh) with turfy earth; but they draw less blood on the fifth occasion. Should the hæmorrhage from the wounds (as in certain constitutions) prove severe, it may be stanched by the application of vinegar, solid nitrate of silver, a hot wire, or a hot solution of alum, or by acupuncture. If a leech by accident be swallowed, a pretty strong solution of common salt, or a glassful or two of wine may be taken. Instead of the actual leech an instrument called an artificial leech is now sometimes used. This consists of a small sharp steel cylinder (worked by a spring) with which a circular incision can be made through the skin, and a glass cylinder capable of being exhausted by a piston worked by a screw. Care must be taken to move the piston at about the same rate as the blood flows, and the edge of the glass cylinder should not press too tightly, else the flow is arrested.

Leeches are imported from France and Hungary, and also through Hamburg from Poland and the Ukraine; they likewise come from Turkey, Wallachia, Russia, Egypt, and Algeria. They are found in Britain—both in Scotland and England, but especially in the latter. In the French trade Bordeaux leeches are preferred; Polish, Swedish, and Hungarian are those most commonly met with in Britain. It is difficult to estimate the number of leeches now used. In 1846 Moquin-Tandon calculated that there were from twenty to thirty millions used in France; and Leuckart mentions in 1863 that in London seven millions, and in the Parisian hospitals five to six millions, were annually employed. At the great American leech-farm the average sale is one thousand per day. There cannot be a doubt, however, that the use of leeches at the present time is greatly restricted—indeed, the younger generation of British medical men seldom or never prescribe them—so that scarcely one will now be employed where one hundred were a quarter of a century ago. This is very well shown in a note from Messrs. Duncan, Flockhart & Co. of Edinburgh, from which it appears that the account for leeches supplied during three months in 1844 to the Royal Infirmary, Edinburgh, was £45. This steadily decreased until about 1868 it amounted for the same period only to 5s. 6d. Sir Robert Christison mentions that the price of the best leeches in 1845 ranged from £4 to £8 per thousand; twenty years ago they were from £10 to £15 per thousand; and at the present time good leeches cost about 10s. per hundred, or £5 per thousand.

They inhabit ditches and ponds, with pure running water, weeds for shelter, and muddy banks and bottom. They are captured by nets after attracting them by baits, or by wading into the water, and then stripping them off the legs on coming to land. Leeches are preserved in loose turf or moss constantly moistened, or in earthenware or glass vessels half full of water, covered with glass or linen-gauze; and some place a rusty nail, others a clean sponge in the vessel, which can be exposed to the light. In transporting them the French "domestic marsh," a vessel with small perforations inferiorly and filled with moist turfy earth or peat made into a stiff mud, is excellent. Sometimes an exterior vessel with a few inches of water is placed round the former. The mouth of the vessel is closed with a coarse linen cloth. Leeches, like many other annelids, live for several years without food in vessels of pure water.

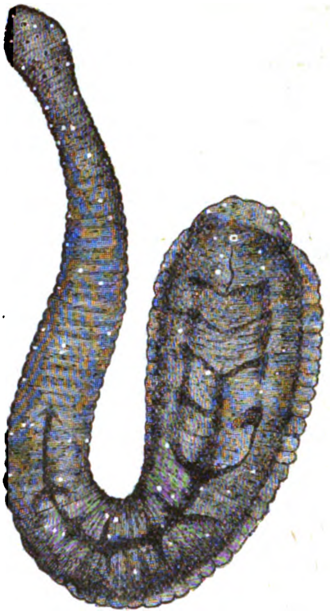


Fig. 5.

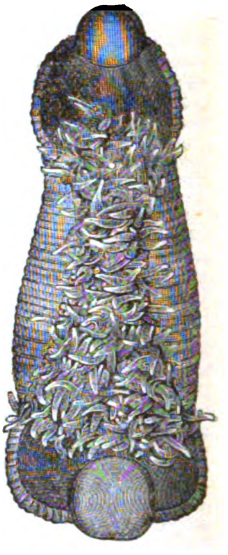


Fig. 6.

Fig. 5.—*Clepsine tessulata*, O. F. Müller. Dorsal view. Somewhat enlarged.

Fig. 6.—*Clepsine tessulata*, O. F. Müller. With a swarm of young adhering to the ventral surface. Slightly enlarged, as adhering to a glass vessel.

Classification. The group (*Hirudinei* or *Discophori*) may be divided into three families, viz., *Rhynchobdellidæ*, *Gnathobdellidæ*, and *Branchiobdellidæ*.

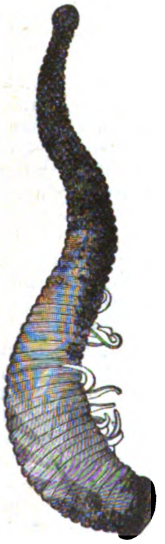


Fig. 2.

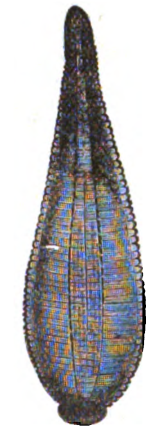


Fig. 3.

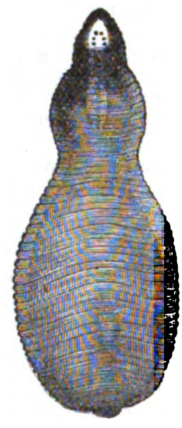


Fig. 4.

Fig. 2.—*Clepsine bioculata*, Sav., and young. Dorsal view. Enlarged.

Fig. 3.—*Clepsine complanata*, Sav. Dorsal view. Enlarged.

Fig. 4.—*Clepsine heteroclita*, L. Dorsal view. Enlarged.

The **Rhynchobdellidæ** are those leeches furnished with a protrusible proboscis (which is often exserted if the animal is removed from the water and placed on a dry surface). This family includes the fish-leeches (*Ichythyobdellidæ*), which have an anterior and posterior sucker, a simple intestine, and mostly two pairs of eyes. Amongst these are *Piscicola geometra*, L., found on freshwater fishes, *P. hippoglossi* on the halibut, and *P. respirans*, in which the body has lateral sacs into which the blood enters. The first-mentioned (*P. geometra*) is a somewhat beautiful species, and full of activity, waving its body to and fro, and floating by aid of the expanded posterior sucker on the surface of the water. Another well-known genus (*Pontobdella*) is characterized by its thick warty skin, and four rings to each segment. The best-known example is the skate-leech (*P. muricata*, L.), which is olive-colored and dusted with whitish grains. The anterior sucker is furnished with papillæ round its edge. It adheres to the skin of the skate, and deposits the curious pedicled horny capsules, containing a single egg, inside shells. In the same group is the remarkable genus *Branchellion*, which has a narrow nuchal region with the sexual orifice at its posterior part, and a series of frilled lateral appendages, the function of which has been supposed to be branchial. Its stomach is sacculated. One species (*B. torpedinis*, Sav.) is a messmate of the torpedo or electric ray of the Mediterranean; this has been the subject of very interesting papers by Leydig and De Quatrefages. The next subfamily—the *Clepsinidæ*—have somewhat broad bodies capable of being curved downward at the margins so as to form a hollow ventral groove for the lodgment of the eggs and the young, while the snout is pointed. They have from one to four pairs of eyes, and three rings to each segment. The dorsal bloodvessel is rhythmically contractile, and the median blood-sinus envelops the digestive canal and the ventral nerve-cord. The stomach is branched, and the anus opens above the posterior sucker. The skin in many is warty, and in the *Clepsine echinulata* of Grube, from Lake Baikal, the dermal papillæ are furnished with soft pointed processes, so that in outline they are spinulose. The oviducts have no common tract or vagina, but open at the female pore. The genital apertures occur between the twenty-fifth and twenty-sixth, and between the twenty-seventh and twenty-eighth rings. The ova are in some kept under the body till hatched. Several species abound in the freshwater lakes and ponds of Britain, and their remarkable and beautiful anatomical structure is yet in need of elucidation. Amongst those most commonly met with is *Clepsine bioculata*, Sav. (fig. 2), which is about an inch in length, generally has a greenish-gray hue, and is much tapered anteriorly. Two closely approximated eyes occur in front. There is a reddish-brown body on the eleventh ring, marking an aperture described by O. F. Müller, and a whitish opacity in front of it. It often fixes itself by the posterior sucker, and waves its body to and fro in the water, and it swims actively like a Nemertean or horse-leech. The ova and young are carried in groups on the abdominal surface. It contracts itself into a ball on irritation. Its food consists of fluviatile and lacustrine mollusks, especially of *Physæ* (bubble-shells). *Clepsine complanata*, Sav. (fig. 3), again, is distinguished by its grayish-green or pale brown appearance, often with two (sometimes four) interrupted dark brown bands along the middle of the dorsum, in which are pale papillæ, four rows of the latter being generally present. The eyes are six in number, in parallel series. The body is firm, and the crenatures at the sides are never obliterated. There are six gastric sacs on each side; and in the young the rectum is ciliated. The proboscis is a cylindrical organ slightly narrowed anteriorly and posteriorly, and finely barred with transverse striæ, a feature in *C. bioculata* due to the arrangement of the granular nucleated glands on its inner surface. It feeds on *Planorbis* and *Limnæus* (coil and mud-shells). *Clepsine heteroclita*, L. (fig. 4), a somewhat smaller form, is characterized by its translucent yellowish aspect. The dorsum is rather regularly dotted with pale brownish, so as to give it a checkered appearance. The snout is acute, and is furnished with six eyes, the anterior pair being closely approximated, while the two succeeding are separated by an interval from the foregoing, and the eyes in each pair are at a greater distance from each other. The digestive cæca are beautiful objects from their regularity and complexity. The ova are carried on the under surface of the body. It is less active than *C. complanata*. Another form very abundant under flat stones in similar lakes and ponds in certain places is *Clepsine tessulata*, O. F. Müller (fig. 5), a large and conspicuously tinted form. It reaches the length of three inches, and is of various shades of green, brownish, or olive, with six rows of yellowish or whitish specks, the marginal in all cases being the largest, while the four internal occupy papillæ. The eyes are eight in number in two series approximated in front. The soft, mobile, and almost gelatinous body is capable of assuming endless shapes, and is sometimes like a cordate leaf. It is gregarious in confinement. When a specimen is detached from its own adherent mass of ova, it occasionally selects another group and fixes itself to the glass to nurse them. The young are borne on the ventral surface (fig. 6). The genus *Hæmentaria* has two eyes, a bifid anterior sucker with the mouth in front, a long pointed proboscis, and five rings in each segment. The species (*e. g.*, *H. mexicana* and *H. officinalis*) occur in the Mexican lakes and South America, the latter being used medicinally, since it is capable of penetrating the skin with its pointed proboscis.

The second family, **Gnathobdellidæ**, includes the medicinal leech, besides *Hirudo interrupta* (M. Tand.) from Algiers, *H. javanica* from Java, *H. sinica* (Blainv.) from China, *H. quinquestriata* (Schm.) from Sidney, and others to be subsequently mentioned. *H. decora* (Say), the native leech of North America, is used in the same way as *H. medicinalis*. It is bluish, with about twenty-two reddish points on the dorsum and a lateral series of black touches of the same number. The ventral surface is ruddy with black points. It also comprises the genera *Bdella*, without denticles, and *Hæmopis*, the best-known example of which is *H. vorax*, M. Tand., a kind of horse-leech which is very troublesome to horses, cattle, and camels, by entering their nostrils when drinking; and the same disagreeable accident occurred to the French soldiers in Egypt. The common horse-leech (*Aulastomum gulo*, Moq. Tand.), with very slightly developed lateral cæca of the stomach, but with two long posterior cæca, is abundant in British ponds and lakes, as also is *Nephelis vulgaris*, L. (fig. 7), a species about 3 inches in length. Its dorsum is brownish-yellow, often with a conspicuously tesselated appearance, while the under surface is pale olive. The eyes are eight—four being placed somewhat in a semicircle, and four a short distance behind, wider apart, and at a different angle. It is active and restless, keeping up an undulating motion of its body when attached by the posterior sucker, apparently as in the *Phyllodocidæ*, to promote respiration. It also swims on edge through the water like an eel. The skin is exceedingly sensitive to the vapor of chloroform, while the contact of a single drop causes tetanic convulsions, and the annelid dies, quite rigid. The digestive canal is nearly simple, and there are no buccal teeth. The dorsal blood-vessel is absent. The ova are deposited in a horny capsule fixed horizontally to subaquatic structures, and it is curious that Linnæus described it as a hemipterous insect under the name of *Coccus aquaticus*. On Bergmann's paper in which the error was corrected the great Swede wrote "*Vidi et obstupui.*" *Nephelis* feeds on earthworms, larvæ, mollusks, and other organisms. *Trocheta subviridis*, Dutrochet, is a large European form (7 inches in length), which frequents the marshes and ditches of France and Algeria (and also rarely, apparently from introduction, of England). It leaves the water to follow the earthworms on which it feeds. There are no buccal teeth, and the alimentary tube is only slightly camerated. In Ceylon the *Hirudo tagalla* or *ceylanica*, a land-leech about an inch in length, is a great annoyance to travellers, especially in the rainy season, attacking men and horses when journeying through the woods and jungles, and causing considerable irritation from its bites. They come in troops out of the grass and dead leaves, and one cannot leave the gravel in the gardens in some places without being attacked. Leech-gaiters, therefore, are worn by many residents for protection. A similar form occurs at an elevation of 4000 feet in the Philippines, and others in Java and Sumatra; and Sir Joseph Hooker found them at a height of 11,000 feet on the Himalayas. Land-leeches also exist in Australia, Japan, and Chili,—where very few occur in the water. They frequent plants, trunks of trees, and shrubs, as well as grass. An eyeless leech, called *Typhlobdella*, inhabits the subterranean waters of the Baradla cave in Hungary. An allied eyeless form, *Cyliobdella lumbricoides*, Grube, which was found by Fritz Muller in Brazil, lives in damp earth. It has a slender spindle-shaped outline. The exact position of the gigantic *Macrobdella valdiviana* of Filippi, a South American leech measuring about 2½ feet, is uncertain. It is eyeless, and has neither lips nor teeth. It probably lives in damp earth, and feeds on earthworms.

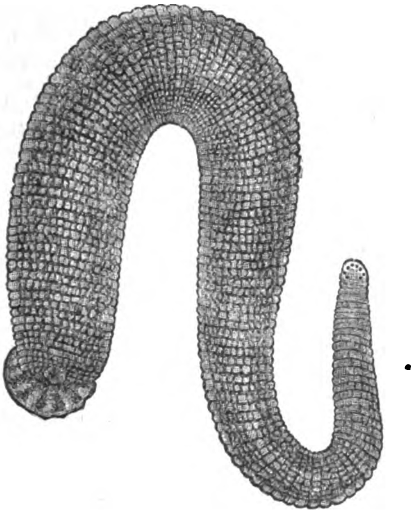


FIG. 7.—*Nephelis vulgaris*, L. Dorsal view. Slightly enlarged.

In the third family, **Branchiobdellidæ**, the irregularly annulated body is elongated, somewhat cylindrical, with a bilobed eyeless snout, and a sucker at the posterior end. There is no proboscis, but the pharynx has two flattened edentate pads (dorsal and ventral). The body is provided with a cœlom or body-cavity, an unusual feature in the leeches. The alimentary canal is simple. There are only two longitudinal vascular trunks—a dorsal and a ventral, the former showing a dilatation behind the cephalic branches, sometimes termed a heart. Two pairs of segmental organs are present, the posterior pair of which are modified for the conveyance of the ovarian products to the exterior; for the ovaries, which are situated far back, discharge their contents into the body-cavity. The best known are *Branchiobdella astaci*, Odier, and *B. parasita*, Henle, which occur as ectoparasites—the former (smaller) on the branchiæ, the latter under the tail and on the antennæ and eyes, of the crayfish. *Myzobdella*, Leidy, and *Temnocephala*, Gay, are allied forms. The latter is a curious Chilian leech having five digitate processes attached to its anterior end, behind which a pair of eyes and the mouth are situated. A sucker exists posteriorly. In the same family are placed the aberrant types *Acanthobdella* and *Histriobdella*. The former is characterized by a somewhat flattened spindle-shaped body resembling a Gephyrean, bluntly pointed in front, furnished with minute hooks near the anterior end, and a posterior sucker. The *A. paledina*, Grube, a fish-parasite from Sicily, is an example. The latter (*Histriobdellidæ*) are remarkable in the group in being diœcious instead of hermaphrodite, and somewhat resemble in outline grotesque insect-larvæ. The peculiar beak-like head fitted for suction, the jointed body, and the pair of posterior suckers are characteristic. They are ectoparasites on marine crustacea; thus *Histriobdella homari*, Van Beneden, occurs on the lobster, and *Saccobdella* on other decapods.

Formerly *Udonella* and *Entobdella* were included under the leeches, but they seem to be more correctly located amongst the *Trematoda*. Until lately *Malacobdella* was also considered one of the group, but its ciliated skin, separate nerve-cords, proboscis, and development point it out as an intermediate type allied to the Nemerteans.

The following works amongst others may be referred to for more detailed accounts of the order:—Noble, *On the Medicinal Leech*, 1822; Rawlins Johnson, *On the Medicinal Leech*, 1825; Brandt and Ratzeburg, *Medicinische Zoologie*, 1829; Moquin-Tandon, *Monographie de la Fam. des Hirudinées*, 2d ed., Paris, 1846; R. Luckart, *Parasiten des Menschen*, vol. i., 1863; Sir J. G. Dalzell, *Powers of the Creator*, vol. ii., 1853; G. Johnston, *Catalogue of Worms*, British Museum, 1865. Also the various memoirs of Carena, M. Thomas, Delle Chiaje, Gratiolet, H Rathke, Van Beneden, F. Leydig, E. Grube, Kinberg, Robin, Vaillant, Dorner, Kennel, Schneider, Hoffmann, Hermann, Whitman, Bourne, Ray Lankester, and Ranke. (W. C. M.)

LEECH, JOHN (1817–1864), the most genial of the humorous draftsmen of our century, was born in London on the 29th of August, 1817. His father, a native of Ireland, was the landlord of the London Coffee House on Ludgate Hill, "a man," on the testimony of those who knew him, "of fine culture, a profound Shakespearian, and a thorough gentleman." His mother was descended from the family of the famous Richard Bentley. It was from his father that Leech inherited his skill with the pencil, which he began to use at a very early age. When he was only three, he was discovered by Flaxman, who had called on his parents, seated on his mother's knee, drawing with much gravity. The sculptor pronounced his sketch to be wonderful, adding, "Do not let him be cramped with lessons in drawing; let his genius follow its own bent; he will astonish the world,"—an advice which was strictly followed. One of his early productions, a mail-coach, done when he was six years old, is already full of surprising vigor and variety in its galloping horses. Leech was educated at Charterhouse, where Thackeray, his lifelong friend, was his schoolfellow, and at the age of sixteen he began to study for the medical profession under Mr. Stanley at St. Bartholomew's Hospital, where he won praise for the accuracy and beauty of his anatomical drawings. He was then placed under a Mr. Whittle, an eccentric practitioner, the original of "Rawkins" in Albert Smith's *Adventures of Mr. Ledbury*, and afterwards under Dr. John Cockle; but gradually the true bent of the youth's mind asserted itself, and he drifted into the artistic profession. He was eighteen when his first designs were published, a quarto of four pages, entitled *Etchings and Sketchings by A. Pen, Esq.*, comic character studies from the London streets. Then he drew some political lithographs, did rough sketches for *Bell's Life*, produced an exceedingly popular parody on Mulready's postal envelope, and, on the death of Seymour, applied unsuccessfully to illustrate the *Pickwick Papers*. In 1840 Leech began his contributions to the magazines with a series of etchings in *Bentley's Miscellany*, where Cruikshank had published his splendid plates to *Jack Sheppard* and *Oliver Twist*, and was illustrating *Guy Fawkes* in sadly feebler fashion. In company with the elder master Leech designed for the *Ingoldsby Legends* and *Stanley Thorn*, and till 1847 produced many independent series of etchings. These, however, cannot be ranked with his best work; their technique is exceedingly imperfect; they are rudely bitten, with the light and shade out of relation; and we never feel that they express the artist's individuality, the *Richard Savage* plates, for instance, being strongly reminiscent of Cruikshank, and "The Dance at Stamford Hall" of Hablot Browne. In 1845 Leech illustrated *St. Giles and St. James* in Douglas Jerrold's newly started *Shilling Magazine*, with plates more vigorous and accomplished than those in *Bentley*, but it is in subjects of a somewhat later date, and especially in those lightly etched and meant to be printed with color, that we see the artist's best powers with the needle and the acid. Among such of his designs are four charming plates to Dickens's *Christmas Carol*, 1844, the broadly humorous etchings in the *Comic History of England*, 1847–48, and the still finer illustrations to the *Comic History of Rome*, 1852,—which last, particularly in its minor woodcuts, shows some exquisitely graceful touches, as witness the fair faces that rise from the surging water in "Clœlia and her Companions Escaping from the Etruscan Camp." Among the other etchings which deserve very special reference are those in *Young Master Troublesome or Master Jacky's Holidays*, and the frontispiece to *Hints on Life, or How to Rise in Society*, 1845—a series of minute subjects linked gracefully together by coils of smoke, illustrating the various ranks and conditions of men, one of them —the doctor by his patient's bedside—almost equalling in vivacity and precision the best of Cruikshank's similar scenes. Then in the fifties we have the numerous etchings of sporting scenes, contributed, along with woodcuts, to the *Handley Cross* novels.

Turning to Leech's lithographic work, which succeeded the early political caricatures already mentioned, we have, in 1841, the *Portraits of the Children of the Mobility*, an important series dealing with the humorous and pathetic aspects of London street Arabs, which were afterwards so often and so effectively to employ the artist's pencil. Amid all the squalor which they depict, they are full of individual beauties in the delicate or touching expression of a face, in the graceful turn of a limb. The book is scarce in its original form, but in 1875 two reproductions of the outline sketches for the designs were published,—a lithographic issue of the whole series, and a finer photographic transcript of six of the subjects, which is more valuable than even the finished illustrations of 1841, in which the added light and shade is frequently spotty and ineffective, and the lining itself has not the freedom which we find in some of Leech's other lithographs, notably in the *Fly Leaves*, published at the *Punch* office, and in the inimitable subject of the nuptial couch of the Caudles, which also appeared, in woodcut form, as a political cartoon, with Mrs. Caudle, personated by Brougham, disturbing by untimely loquacity the slumbers of the lord chancellor, whose haggard cheek rests on the woolsack for pillow.

But it was in work for the wood-engravers that Leech was most prolific and individual. Among the earlier of such designs are the illustrations to the *Comic English* and *Latin Grammars*, 1840, to *Written Caricatures*, 1841, to Hood's *Comic Annual*, 1842, and to Albert Smith's *Wassail Bowl*, 1843, subjects mainly of a small vignette size, transcribed with the best skill of such woodcutters as Orrin Smith, and not, like the larger and later *Punch* illustrations, cut at speed by several engravers working at once on the subdivided block. It was in 1841 that Leech's connection with *Punch* began, a connection which subsisted till his death on the 29th of October, 1864, and resulted in the production of the best known and most admirable of his designs. His first contribution appeared in the issue of 7th August, a full-page illustration—entitled "Foreign Affairs"—of character studies from the neighborhood of Leicester Square. His cartoons deal at first mainly with social subjects, and are rough and imperfect in execution, but gradually their method gains in power and their subjects become more distinctly political, and by 1849 the artist is strong enough to produce the splendidly humorous national personification which appears in "Disraeli Measuring the British Lion." About 1845 we have the first of that long series of half-page and quarter-page pictures of life and manners, executed with a hand as gentle as it was skilful, containing as Mr. Ruskin has said, "admittedly the finest definition and natural history of the classes of our society, the kindest and subtlest analysis of its foibles, the tenderest flattery of its pretty and well-bred ways," which has yet appeared,—a series far too popular and too voluminous to require or admit of particular description here. In addition to his work for the weekly issue of *Punch*, Leech contributed largely to the *Punch* almanacs and pocket-books, to *Once a Week* from 1859 till 1862, to the *Illustrated London News*, where some of his largest and best sporting scenes appeared, and to innumerable novels and miscellaneous volumes besides, of which it is only necessary to specify *A Little Tour in Ireland*, 1859, which is noticeable as showing the artist's treatment of pure landscape, though it also contains some of his daintiest figure-pieces, like that of the wind-blown girl, standing on the summit of a pedestal, with the swifts darting around her, and the breadth of sea beyond.

In 1862 Leech appealed to the public with a very successful exhibition of some of the most remarkable of his *Punch* drawings. These were enlarged by a mechanical process, and colored in oils by the artist himself, with the assistance and under the direction of his friend Mr. J. E. Millais.

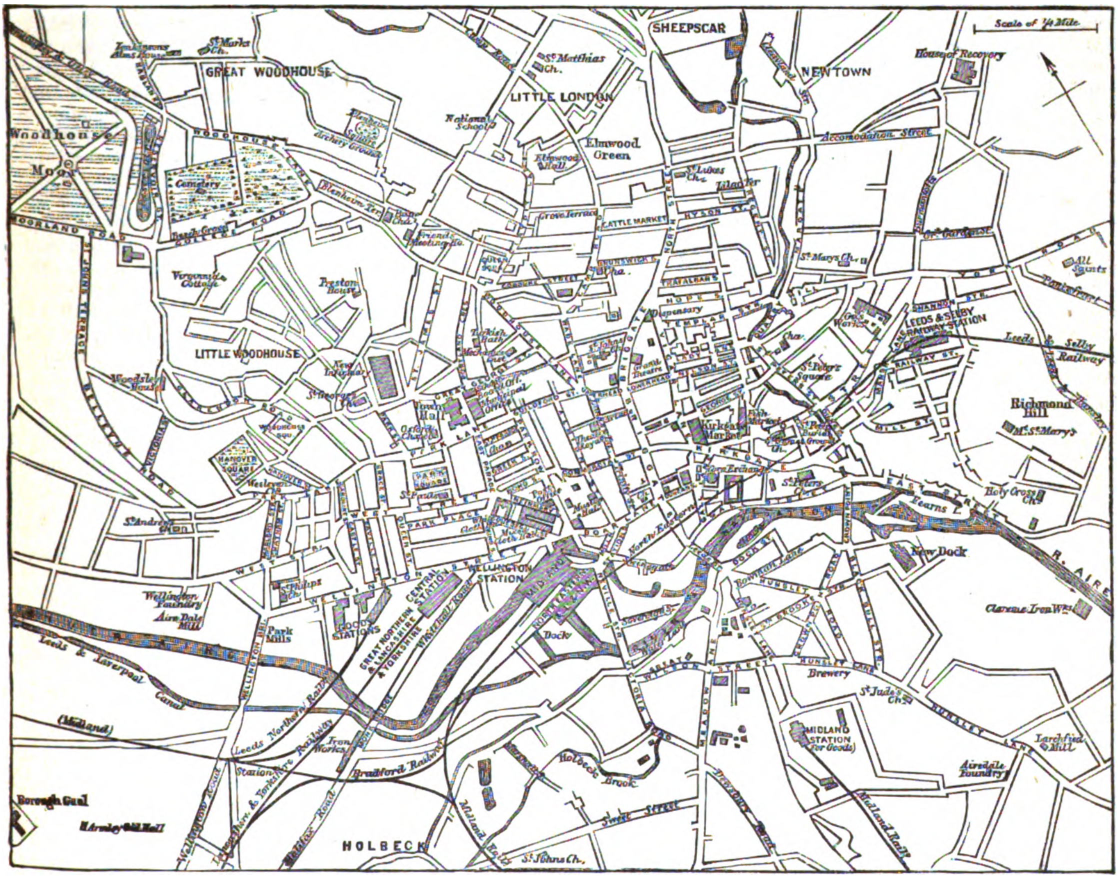
After even such a necessarily incomplete enumeration as we have made of Leech's main designs, it goes without saying that he was a singularly rapid and indefatigable worker. Canon Hole tells us, when he was his guest, "I have known him send off from my house three finished drawings on the wood, designed, traced, and rectified, without much effort as it seemed, between breakfast and dinner." The best technical qualities of Leech's art, his unerring precision, his unfailing vivacity in the use of the line, are seen most clearly in the first sketches for his woodcuts, and in the more finished drawings made on tracing-paper from these first outlines, before the chiaroscuro was added and the designs were transcribed by the engraver. Turning to the mental qualities of his art, it would be a mistaken criticism which ranked him as a comic draftsman. Like Hogarth he was a true humorist, a student of human life, though he observed humanity mainly in its whimsical aspects,

> "Hitting all he saw with shafts
> With gentle satire, kin to charity,
> That harmed not."

The earnestness and gravity of moral purpose which is so constant a note in the work of the last century master is indeed far less characteristic of Leech, but there are touches of pathos and of tragedy in such of the *Punch* designs as the "Poor Man's Friend," 1845, and "General Février turned Traitor," 1855, and in "The Queen of the Arena" in the first volume of *Once a Week*, which are sufficient to prove that more solemn powers, for which his daily work afforded no scope, lay dormant in their artist. The purity and manliness of Leech's own character are impressed on his art. We find in it little of the exaggeration and grotesqueness, and none of the fierce political enthusiasm, of which the designs of Gillray are so full. Compared with that of his great contemporary George Cruikshank, his work is restricted both in compass of subject and in artistic dexterity.

No formal biography of Leech has yet appeared, but interesting particulars regarding his life and works will be found in the following articles:—"John Leech's Pictures of Life and Character," by Thackeray, *Quarterly Review*, December, 1854; "John Leech," by Dr. John Brown, *North British Review*, March, 1865, republished, with additional chapters by Canon Hole, in new edition of Dr. Brown's essays (1882); letter by John Ruskin, *Arrows of the Chace*, vol. i. p. 161; *Cornhill Magazine*, December, 1864; *Scribner's Monthly*, vol. xvii. p. 553; "Un Humoriste Anglais," by Ernest Chesneau, *Gazette des Beaux Arts*, 1875. (J. M. G.)

LEEDS, a town of England, in the West Riding of Yorkshire, the metropolis of the woollen manufacture, and in point of population only exceeded by London, Liverpool, Manchester, and Birmingham. Leeds is situated nearly in the centre of the West Riding, in the wapentake of Skyrack, and in the pleasant and well cultivated valley of the river Aire. The surrounding country possesses much cheerful beauty; and the view from Woodhouse Moor, one of the most elevated parts of the borough, is not excelled in any part of the Riding. For manufacturing and commercial purposes, the situation of Leeds is highly advantageous. It is distant from London by the Great Northern Railway 185 miles, from Edinburgh 225, from Liverpool 74, from Manchester 42½, and from Birmingham 113, and may be said to occupy a central position in the railway system of England. It has also communication with Liverpool by the Leeds and Liverpool Canal, and with Hull by the Aire and Calder navigation, and through these means of transit has the highest facility for the transmission to the principal seaports of England of its various manufactures, and for receiving raw material at the lowest rate of charge. It is, moreover, the centre of an extensive coal and iron district. All the advantages for the successful working of machinery are therefore within its reach, and hence it has become the seat of several important industries, especially the woollen and linen manufactures, iron working, and machine-making.



Plan of Leeds.

Though regarded as the capital of the great manufacturing district of the West Riding, Leeds is not in its centre, but on its border. Eastward and northward the country is wholly agricultural, while to the west and south-west the populous villages resound with the shuttle and the steam-engine. In this district are carried on a woollen manufacture of great extent and of considerable antiquity and a worsted manufacture of extraordinary vigor (a graft on the woollen manufacture); to these have latterly been added the iron manufacture and that of machines and steam-engines, and the making of boots and ready-made clothing, besides a manufacture of flax, which now constitutes one of the staple trades of Leeds.

Cloth is the staple trade of the town, although the manufacture itself is not the leading one within the borough, being carried on, to a large extent, in townships out of the parish and borough of Leeds. In the town, however, the trade centres, and there the cloth is finally prepared for the market by what is technically termed finishing or dressing—a department quite distinct in Leeds from that of the manufacturer. In this respect the Yorkshire cloth trade differs essentially from that of the west of England, where the manufacturer conducts the two operations of making and finishing the cloth within the same premises. Several Leeds firms conduct their business on the west of England model; but, as the rule, the order of the trade is as follows. The great bulk of the cloths sold in Leeds are produced either in the out-townships of the borough, or in the villages lying west of Leeds, and principally in Pudsey, Farsley, Rawden, Yeadon, Horsforth, and Guiseley, which are all in other parishes, within an extreme radius of 10 miles from Leeds. The cloths so manufactured are sold in the unfinished or *balk* state to the merchants of Leeds, by whom they are put out to the cloth-dressers or finishers, whose special craft it is to raise the pile or nap on the face of the cloth, and to complete it for the purposes of the tailor and the final consumer. In former times a considerable proportion of the business between the manufacturer and the merchant was conducted in the cloth halls, which are two in number. In these the manufacturers formerly took their stand and waited the custom of the merchants, but within the last twenty or thirty years a great change has taken place in the mode of transacting business, and the cloth halls have practically fallen into disuse. The merchant now orders his goods direct from the manufacturer, specifying the weight, color, and quality of the articles he wants, and these are delivered to him without passing through the halls. Thus a picturesque and characteristic feature of life in Leeds seems likely at no distant date to become extinct. At one period it seemed probable that the business of the cloth trade would assume the west of England type. Mr. William Hirst, a very skilful manufacturer, introduced goods of superior texture and quality, and by his success induced many capitalists to erect mills on a large scale, in which all the processes of the manufacture and finishing were conducted. The change was, however, only temporary. Many of these mills are now occupied for finishing only, and some have been devoted to other branches of the local manufactures. The spinning of flax by machinery was commenced in the township of Holbeck (in the borough of Leeds) more than one hundred years since, by Mr. John Marshall, who was one of the first to apply the principle of Sir Richard Arkwright's water frame, invented for the cotton manufacture, to the spinning of linen yarn. The works of Messrs. Marshal & Company are very extensive, and one portion of them is an object of attraction to all strangers visiting the town. It is a vast room 400 feet by 220, filled with machinery, all of which is turned by shafting which requires two coupled engines of 350 horse-power to impel it. Light is admitted by glass cupolas. The whole building is held together by a double series of iron ties, uniting the iron pillars which sustain the many-arched roof. The external form is Egyptian.

The spinning of worsted yarn and the weaving of worsted goods were formerly carried on to a considerable extent in Leeds, but have now nearly died out, Bradford, Bingley, and Keighley, with the villages immediately adjoining, having attracted almost the entire trade. Amongst the smaller branches of the textile manufactures carried on in Leeds must be enumerated those of silk and carpeting, neither of them unimportant, though falling far short of the flax and woollen trades.

It is probable that the iron trade in its different branches, including the casting of metal, and the manufacture of steam-engines, of steam-ploughs, of machinery of every kind, and of mechanical tools, now gives employment to a larger number of persons within the borough of Leeds than any other branch of industry. The great works founded by the late Sir Peter Fairbairn, as well as those of Messrs. Kitson & Co. and of Messrs. John Fowler & Co., in the last-named of which the Fowler steam-plough is the staple article of manufacture, occupy places in the front rank of such establishments in the country; while Messrs. Greenwood & Batley and other tool-makers give employment to a large number of hands, and export the goods they produce to all parts of the globe.

Leeds was at one time famed for the production of artistic pottery, and very fine specimens of old Leeds ware are still occasionally to be discovered among the residences of the poor in the town. This branch of manufacture, however, became extinct about eighty years ago. Within the last three years it has been revived, and once more attention has been directed to the high artistic merit which the pottery of the town has attained.

In addition to these particular branches of industry, the manufacture of ready-made clothing has become one of great importance. In some of the establishments for this purpose, such as that of Messrs. John Barrow & Sons, the number of hands employed is so large that from a thousand to twelve hundred suits of clothing can be produced daily. Machinery is now used in all the departments in these places, and the work is conducted with a rapidity and at a price which would have seemed incredible thirty years ago. Leeds has in recent years become famous as the chief seat of the cap manufacture in the United Kingdom. The leather trade is also one of great importance in the borough, many large tanning establishments being erected on the outskirts, while the wholesale manufacture of boots and shoes for army and other purposes is carried on in workshops which are the largest of their kind in the United Kingdom.

No religious census has been taken in Leeds since that of 1851. There are, however, 181 places of worship in the town, these being divided as follows:—Church of England, 46; Wesleyan Methodist, 40; Primitive Methodist, 30; United Methodist Free Church, 12; Congregational, 12; Baptist, 11; Methodist New Connection, 10; Catholic, 6; Unitarian, 3; Presbyterian, 2; Friends, 2; various, 5. The Leeds school board, which was established immediately after the passing of the Education Act in 1870, has now (1882) 47 schools under its control within the limits of the borough, and these accommodate 30,000 children. In addition to these there are 34 national and parochial schools, 8 Roman Catholic schools, and 6 Wesleyan schools. The educational institutions of a higher order in the town are numerous and important. Of these the principal is the Yorkshire College, established in 1875 for the purpose of supplying instruction in the arts and sciences which are applicable to the manufactures, engineering, mining, and agriculture of the county. It has a staff of 19 professors, instructors, and assistant lecturers, and upwards of 350 day and 160 evening students. The college, which has carried on its operations hitherto in temporary premises, will shortly remove to permanent buildings designed by Mr. Waterhouse, A. R. A. These buildings, which when completed will cost upwards of £100,000, will occupy a site of about 3½ acres, and will comprise extensive laboratories and workshops, large lecture theatres, and a college library and museum. The Leeds Public Library, established under the Public Libraries' Act, now takes the first place amongst similar institutions in the borough. The reference library contained 26,000 volumes at the close of 1881, and the lending libraries 83,000 volumes, the expenditure for the year being £4150. The issue of volumes during the year reached the large total of 639,616. The Leeds Old Library, a private institution, founded in 1768 by Dr. Priestley, who was at that time minister at the Unitarian chapel in the town, contains a very valuable selection of books, numbering about 75,000 volumes, and is in possession of commodious premises in Commercial Street. The Philosophical and Literary Society, established in 1820, possesses a handsome building in Park Row, containing a laboratory, a lecture room, and a museum, with many fine specimens in natural history, geology, and archæology. The society also possesses a library of upwards of 16,000 volumes, chiefly rare scientific works. During the winter months, lectures on scientific and literary subjects are given in the lecture hall by men of eminence. The Leeds Mechanics' Institute in Cookridge Street is a striking building in the Italian style. It comprises a large circular lecture room, with gallery, capable of seating 1500 persons, besides a library, reading, committee, and class rooms. The foundation stone was laid in 1865, and the total cost of the building has been nearly £30,000. Day and evening classes and an art school are carried on within the building, and are largely frequented. The Young Men's Christian Association, another educational institute of importance, occupies the building in South Parade formerly used as a mechanics' institute. The Grammar School, a handsome building, erected at Woodhouse Moor, has endowments producing over £3000 yearly. There are six exhibitions of £50 a year, each tenable for four years at Oxford, Cambridge, and Durham. It provides education for about 280 scholars. There is also a large training college for students purposing to enter the Wesleyan Methodist ministry at Headingley, one of the suburbs of Leeds. The principal charitable institution of the town is the general infirmary in Great George Street, a Gothic building, built of brick, with stone dressings, from designs by Sir Gilbert Scott. It is arranged upon the pavilion system, each ward being isolated from the rest of the building, and has a highly ornamental exterior, whilst the internal accommodation is suited to the requirements of the patients and the medical staff. The total cost of the erection was more than £100,000. The house of recovery for fever patients, founded in 1802, now occupies a handsome building at Burmantofts. There are also a large building used as a public dispensary in North Street, an institution for the blind, deaf and dumb in Woodhouse Lane, a school of medicine and other hospitals and charitable institutions.

The town and borough of Leeds was incorporated by letters patent, 2 Charles I., but this charter was cancelled or surrendered. A new charter was granted, 13 Charles II., under the style of mayor, aldermen, and burgesses of the borough of Leeds. The corporation consisted of a mayor, 12 aldermen, 24 assistants, and a staff of 13 officials. The Municipal Act of 1834 gave Leeds a corporation of 16 aldermen and 48 councillors, which has effected great improvements in the management of local matters. In addition to the powers granted to it by the Municipal Reform Act, the town council has acquired, through successive Improvement Acts, complete control over the paving and construction of the streets within the borough, as well as considerable powers for enforcing the consumption of smoke. It has also acquired the whole of the water supply of Leeds, and it controls the public markets, the lighting and watching of the streets, the execution of the Public Health Acts, etc. The supply of water for Leeds is now derived from the valley of the Washburn, one of the tributaries of the Wharfe, where very extensive reservoirs have been provided, at a cost of £1,400,000. The gas supply of the town is also in the hands of the corporation, which purchased the whole of the gas works from the two companies then in existence in 1870, at the cost of nearly £1,000,000. The entire suite of markets, comprising the corn exchange, the Smithfield cattle market, and the produce markets, have been acquired at different periods, and the corporation has expended upon this property £240,000. The ratable value of the municipal borough is £1,122,000, and the income of the borough derived from the borough rate £88,106. The debt of the town amounted in 1881 to £3,884,000. Of the places of recreation in Leeds, the principal is the Grand Theatre, a handsome building erected from the designs of Mr. Corson, in Upper Briggate, in 1879. Large assembly rooms adjoin this theatre. There is another theatre in King Charles Croft, and there are one or two music halls. Some years ago the corporation acquired, at a large expenditure, Roundhay Park, an estate of great beauty in the neighborhood of the town. After a portion of the ground had been laid out as building sites, the central part of the estate, comprising splendid lawns, woods of great extent, and a lake covering 40 acres, were reserved as a place of public recreation, and the park is now a favorite resort of the people of Leeds, and also of the inhabitants of the surrounding country. It is under the management of a committee of the corporation, and, though situated at an inconvenient distance from the centre of the town, is largely frequented during the summer months. Woodhouse Moor, a common occupying an elevated position north-west of the town, has been planted with trees and provided with walks within the last ten years; and in other parts of the town the corporation have laid out pieces of land, which had long been left bare and neglected, as recreation grounds.

The external appearance of the town has been greatly improved within the last twenty years. The event which had the greatest influence in promoting the erection of more handsome buildings than those of which Leeds was formerly constituted was the opening of the town-hall by the Queen in the year 1858. This is a noble building in the Grecian style. It is 250 feet long and 200 broad, and is crowned by a tower 225 feet high. The principal apartment in it is the Victoria Hall, a richly ornamented chamber 161 feet long, 72 feet wide, and 75 feet high. The building, which cost, including the site and fittings, more than £130,000, is adorned with statues and portraits of local celebrities. The municipal offices, including school board offices and buildings for the public library, are now in course of erection in the immediate neighborhood of the town-hall, and will cost when completed upwards of £100,000. The other public buildings of importance in the town are the royal exchange, in Perpendicular Gothic, the foundation of which was laid in 1872, the corn exchange, a fine oval edifice, and the bank of Messrs. Beckett & Co., one of the best works of Sir Gilbert Scott.

Leeds has long been distinguished for the activity of its political and public life. It has taken a leading part in many of the great questions which have agitated the country during the present century, and among its successive representatives in parliament have been Lord Macaulay, Sir William Molesworth, Mr. Marshall, three members of the Baines family, and other men whose names are familiar in the annals of the Liberal party, to which upon the whole the borough has given a consistent support since its enfranchisement in 1832. The newspapers published in the town are the *Leeds Mercury*, daily, Liberal, established in 1718; the *Yorkshire Post and Leeds Intelligencer*, daily, Conservative, established in 1754; the *Leeds Express*, evening, Radical; the *Leeds Daily News*, evening, Conservative; and the *Leeds Times*, weekly, Liberal. The *Leeds Mercury* for eighty years has been the property of Messrs. Edward Baines & Sons, and has long been considered one of the most influential of provincial journals.

The area of the municipal and parliamentary borough is 21,572 acres. In addition to the township of Leeds some ten out-townships are included in this area. The population (207,165 in 1861 and 259,212 in 1871) in 1881 was 309,126, the number of inhabited houses being 65,034. Leeds is one of the boroughs which under the Reform Act of 1867 return three members of parliament.

The name of Leeds has been attributed to a chief named Leod. Traces of Roman workmanship have at various times been discovered in the town, and in the parish church several very interesting Anglo-Saxon crosses, discovered when the church was rebuilt in 1838, are preserved. The castle of Leeds occupied a site on Mill Hill, and is supposed to have been built by Ilbert de Laci at the time of the Conquest, but no traces of it remain.

For the history of Leeds, see Ralph Thoresby, *Ducatus Leodiensis*, 1715, 2d ed., 1816, with notes and additions by T. D. Whitaker, who published the same year a companion volume, *Loidis and Elmete;* Parsons, *History of Leeds, Bradford, and Wakefield*, 1840; Wardell, *The Antiquities of the Borough of Leeds*, 1853. (T. W. R.)

LEEK, the *Allium Porrum* of botanists, a plant which is now considered as a mere variety of *Allium Ampeloprasum* produced by cultivation. It was formerly regarded as being a native of Switzerland, and the year 1582 has been set down as the date of its introduction to England. Both these assumptions are, however, erroneous. The plant is probably of Eastern origin, since it was commonly cultivated in Egypt in the time of the Pharaohs, and is so to the present day; while as regards its first appearance in England both Tusser and Gerard—two of our earliest writers on this class of subjects, the former of whom flourished in the early part and the latter in the later part of the 16th century—speak of it as being then commonly cultivated and used.[1] The Romans, it would appear, made great use of the leek for savoring their dishes, as seems proved by the number of recipes for its use referred to by Celsius. Hence it is more than probable that it was brought to England by the Romans during the period of their occupation. Italy was celebrated for leeks in the time of Pliny (*H. N.*, xix. c. 6), according to whom they were brought into great notice and esteem through the emperor Nero, derisively surnamed "Porrophagus," who used to eat them for several days in every month to clear his voice. The leek is very generally cultivated in Great Britain as an esculent, but more especially in Scotland and in Wales, being esteemed as an excellent and wholesome vegetable, with properties very similar to those of the onion, but of a milder character. In America it is not much cultivated except by market gardeners in the neighborhood of large cities. The whole plant, with the exception of the fibrous roots, is used in soups and stews. The sheathing stalks of the leaves lap over each other, and form a thickish stem-like base, which is blanched, and is the part chiefly preferred. These blanched stems are much employed in French cookery. They form an important ingredient in Scotch winter broth, and particularly in the national dish *cock-a-leekie*, and are also largely used boiled, and served with toasted bread and white sauce, as in the case of asparagus. Leeks are sown in the spring, earlier or later according to the soil and the season, and are planted out for the summer, being dropped into holes which are made with a stout dibble and left unfilled in order to allow the stems space to swell. When they are thus planted deeply the holes gradually fill up, and the base of the stem becomes blanched and prepared for use, a process aided by drawing up the earth round about the stems as they elongate. The leek is one of the most useful vegetables the cottager can grow, as it will supply him with a large amount of produce at a season when it will prove very welcome, namely, during the winter and spring. It is extremely hardy, and presents no difficulty in its cultivation, the chief point, as with all succulent esculents, being that it should be grown quickly upon well-enriched soil. The plant is of biennial duration, flowering the second year, and perishing after perfecting its seeds. The leek is the national symbol or badge of the Welsh, who wear it in their hats on St. David's Day. The origin of this custom has received various explanations, all of which are probably more or less speculative.

LEEK, a market-town of Staffordshire, England, is situated on a fine eminence above the river Churnet, and on the Churnet Valley branch of the North Staffordshire Railway, 24 miles east-north-east of Stafford. Its streets are wide and regular, and its sanitary and water arrangements are very complete. The church, dedicated to Saint Edward the Confessor, is in the Early English style. Much of the old building, erected in 1180, remains, but it has been frequently repaired, and in 1867 and 1875 underwent extensive restoration. In the vicinity of the town are the ruins of the Cistercian abbey De la Croix (known as Dieulacres), erected in 1214 by Ranulf de Blondeville, sixth earl of Chester. The grammar school was built in the beginning of last century by the earl of Macclesfield. The other principal buildings are the memorial cottage hospital for the county of Stafford, erected in 1870 from a private bequest, and the new town and market hall erected on the site of the old building. There is an important silk manufacture, and also agricultural implement works. The population of the urban sanitary district in 1881 was 12,865.

British and Roman remains have been found in the vicinity of Leek at various periods, and the town itself is of very great antiquity. For some centuries after the Conquest it was the property of the earls of Chester, but afterwards it was bestowed on the monks of the abbey De la Croix. It received a market from King John. On the 3d of December, 1745, it was entered by the troops of the Pretender, and again on the 7th of the same month.

LEER, a seaport and the chief town of a circle in the province of Hanover, Prussia, lies on the right bank of the Leda near its confluence with the Ems, 16½ miles south of Aurich in 53° 13′ N. lat., and 7° 27′ E. long. The aspect of the town is generally pleasing, the streets being broad, well-paved, and adorned with many elegant buildings, among which are Roman Catholic, Lutheran, and Calvinist churches, and several public schools. The principal manufactories are for linen and woollen fabrics, hosiery, paper, cigars, soap, vinegar, and earthenware. There are, moreover, two iron-foundries, several distilleries, tanneries, and ship-building yards, besides many large warehouses. The transit trade from the regions traversed by the Westphalian and Oldenburg railways is considerable. The principal exports are cattle, horses, cheese, butter, honey, wax, flour, paper, hardware, and Westphalian coal. Vessels drawing 16 feet of water can approach the quays. The population in 1880 was 10,074.

LEEUWARDEN, or **Leuwarden** (in Frisian *Liwerd*, and Latinized as *Leovardia*), a town of Holland, at the head of the province of Friesland, 17 miles inland from Harlingen and 32 west of Groningen. It is one of the most prosperous of the secondary towns in the country, and, thanks in great measure to the opening of the railway to Harlingen (1863) and Groningen (1866), full of life and enterprise. To the name of the Frisian Hague it is entitled as well by similarity of history as by similarity of appearance. As the Hague grew up round the court of the counts of Holland, so Leeuwarden round the court of the Frisian stadtholders; and, like the Hague, it is an exceptionally clean, tasteful, and attractive town, with parks, pleasure grounds, and drives. The old gates have been somewhat ruthlessly cleared away, and the site of the town walls on the north and west competes with the Prince's Garden as a public pleasure ground. Besides the town-house (dating from 1715, and interesting mainly for the value of the archives admirably arranged by the Dutch antiquarian Eekhoff), the Prince Frederick barracks, capable of containing one thousand men, the corn exchange, and the beautiful weighhouse (dating from 1546), Leeuwarden contains a royal palace, originally the residence of the Frisian stadtholders; the provincial courts, erected in 1850; the so-called chancery (Kanselarij), a fine red brick mansion built in 1502 for the chancellor of Duke George of Saxony, and now used as a house of detention; the penitentiary, rebuilt since 1870, and the largest establishment of the kind in Holland; and, somewhat oddly, the communal buildings of the neighboring commune of Leeuwarderadeel. The church of the Jacobins deserves mention as perhaps the largest monastic church in the country, and as the burial-place of the Frisian stadtholders (Louis of Nassau, Anne of Orange, etc.), whose splendid tombs, however, were destroyed in the revolution of 1795. Unlike the Hague, Leeuwarden is by nature and tradition the centre of an extensive and flourishing trade (in grain, cattle, flax, chicory, etc.). Its present distance from the sea is made up for by abundant means of communication by road, railway, and canal. The canal to Dokkum opens up the rich clay districts of the province; the canal to Harlingen (dating from 1507) furnishes a channel for the trade with England; and other canals give access to the province of Groningen and the Zuyder Zee, and so to Amsterdam and the provinces of Holland. And, though the industrial development is far from keeping pace with the commercial, Leeuwarden possesses large timber and boat-building yards, iron foundries, copper-works, and lead-works; manufactures sewing machines, safes, organs, cardboard, oil, and tobacco; and enjoys a wide reputation for its gold and silver wares. The population of the town in 1869 was 24,862; that of the commune increased from 15,686 in 1714 to 27,003 in 1875 (5217 Roman Catholics, 1124 Jews).

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[1] Tusser, in his verse for the month of March, writes:—

"Now leckes are in season, for pottage ful good,
And spareth the milck cow, and purgeth the blood;
These hauving with peason, for pottage in Lent,
Thou spareth both otemel and bread to be spent."

Leeuwarden, or that part of it which was called Nijehove, appears as early as 1149, and received the rank of a town in 1190. At that time it had free command of the sea; but the estuary of the Middlesee on which it stood had already silted up by about 1300. In 1398 we find the town bestowed by Duke Albert of Holland on Gerrolt Camminghs, whose family residence is still one of the notable mansions of the place. During the 15th and 16th centuries it plays a considerable part in Frisian history. The year 1499 saw the erection of a stronghold in the town, which enabled Albert of Saxony to bring the country under, and which made Leeuwarden a place of military importance till it was destroyed in 1580. When in 1559 Utrecht was raised to the rank of an archbishopric, Leeuwarden was made a bishopric, but only one occupant of the see was actually consecrated before the Reformation got mastery of the town in 1580.

LEEUWENHOEK, or LEUWENHOEK, ANTHONY VAN (1632–1723), a microscopist of remarkable scientific ability, was born at Delft, in Holland, in 1632. He does not seem to have had the advantage of a liberal education, but was probably brought up as a glass-grinder, early acquiring a reputation for the excellent lenses with which he furnished the microscopists who were then turning their attention to the minute structure of organized bodies. He appears soon to have found that single lenses of very short focus were preferable for this purpose to the compound microscopes then in use; and it is clear from the discoveries he made with these that they must have been of very excellent quality.[1] These discoveries were for the most part originally given to the world in the *Philosophical Transactions* of the Royal Society, to the notice of which learned body he was first introduced by De Graaf in 1673. He was elected a fellow in 1680, and was chosen in 1697 a corresponding member of the Academy of Sciences in Paris. He died at his native place in 1723; and Sir Martin Folkes, then vice-president of the Royal Society, says in the eulogium he pronounced: "We have seen so many and those of his most surprising discoveries, so perfectly confirmed by great numbers of the most curious and judicious observers, that there can surely be no reason to distrust his accuracy in those others which have not yet been so frequently or so carefully examined."

His capital discovery was undoubtedly that of the capillary circulation of the blood, first announced in 1690, which afforded the link still wanting for the completion of the doctrine of Harvey, by showing that the blood passes from the arteries into the veins through a network of extremely minute vessels, the thin walls of which allow the fluid plasma to transude into the tissues it traverses, so as to serve for their nutrition. He first sought to discern this in the comb of a young cock, then in the ear of a white rabbit, and then in the membrane of a bat's wing; but, though in the last he was able to follow an artery to its ultimate subdivision, he found that, as soon as "it became so small as only to admit one or two globules to pass through it at a time, he then lost sight of it," partly in consequence of "the membrane of the wing being covered with a kind of scale" (epidermis). His first success was obtained with the tail of a newly-hatched tadpole, in which, he says, "I could distinctly perceive the whole circuit of the blood, in its passage to the extremities of the vessels, and in its return towards the heart,"—its movement being made apparent by that of the globules carried along in its current. These corpuscles, which had been previously discovered by Malpighi, were correctly described by Leeuwenhoek as flattened circular disks in man, and as oval disks in tadpoles. He afterwards observed the capillary circulation in the tail-fins of small fishes, and recognized the ellipticity of the corpuscles in that class also. He even made out the capillary circulation in the broad thin extremities of the two smallest or hind feet of small crabs about an inch in diameter, and correctly remarked that the corpuscles of their blood were colorless and far fewer than those of fishes or tadpoles, "the globules in red blood being (I am well assured) twenty-five times more in number than those, in the same space, in the blood of a crab." To us it seems not a little surprising that his assertions in regard to the capillary circulation were deemed incredible by some of his scientific contemporaries. It is recorded, however, that Peter the Great, when passing through Delft in 1698, requested Leeuwenhoek to pay him a visit, and to bring his microscope with him, and that the czar was particularly impressed by the spectacle of the circulation in the tail of a small eel.

Among Leeuwenhoek's discoveries in the minute anatomy of man and the higher animals may be specially mentioned the tubules of teeth, the fibrous structure of the crystalline lens, the solidity of the human hair (which had been previously represented as tubular), the structure of the epidermis, and the parallel tubules of the medullary substance of the brain,—which last, however, he supposed to be vessels conveying fluid substance from the highly vascular cortical layers, for the support and nourishment of the spinal marrow and nerves. He was also an independent discoverer of the spermatozoa, although anticipated by a few months by Ludwig Hamm, a student at Leyden.

As might be expected, he made many observations on the anatomy of insects; and among the most interesting of these are his discovery of the composite structure of the eyes (which he recognized also in the eyes of the shrimp), the scales on the wings not only of moths but of the gnat, and the annular (really spiral) structure in the walls of the "vessels" (*tracheæ*) of their wings. He also proved that cochineal, which had been supposed to be "the fruit of some tree," is really the dried body of an insect, which he not unnaturally supposed to be allied to the ladybird. He likewise gave a very good account of the spinnerets and poison-claws of spiders, and of the comb-like appendages to their feet. He made a special study, also, of the anatomy of the flea,—besides following out its reproduction with great care, as will presently appear.

In examining the stomachs of shrimps, he found in them some minute shells, of which he figured a specimen so exactly that it can be at once recognized as a *Nonionina*,—probably the first recent foraminifer that had been distinctly noticed. But one of his most interesting observations is that which he made upon a small *Balanus* attached to a mussel-shell; for he not only gives a good figure of the animal, but describes the way in which it retreats into its shell, and closes its orifice by two shelly valves.—His figure most distinctly shows its *articulate* character, which has only in modern times caused its removal from the molluscous to the annulose sub-kingdom.

Not less admirable were his observations on the structure of plants. He made very careful sections of stems of the oak, elm, beech, willow, fir, and other trees, in different directions, of which he gave careful figures and descriptions,—specially noting the horizontal arrangement of the cells in the "medullary rays," and the peculiar "pitting" of the woody fibre of the fir, as well as the absence of large vessels in the latter. He also examined the structure of various germinating seeds, and gave accurate descriptions of the relation of the embryo to the cotyledons.

Although, when he adventured into physiological speculation, Leeuwenhoek's ideas (like those of the best physiologists of his time) were often very crude, his reasonings upon the facts actually observed by him are often remarkably cogent and sagacious. Thus, to estimate the insensible perspiration, he placed his hand within a dry glass jar, closed the space between its neck and his wrist by stuffing his handkerchief into it, and carefully collected and weighed the moisture which accumulated in its interior during a given time; and by a computation based on the ratio of the surface of the hand to that of the entire body he concluded that about 28 oz. of fluid are daily lost by transpiration, which is not far from the truth. So, again, he triumphantly refuted the chemical theories which then reigned in medicine, and which assumed that the blood undergoes a fermentation like that of wine or beer, by the statement that he had never seen in the blood-vessels the bubbles of gas which must be generated in them if this doctrine were correct. In one important point, however, he allowed his imagination to supplement the necessary imperfection of his observations, maintaining that each blood-disk is made up of six coherent particles, an idea probably suggested by the crenated appearance which the blood-disks often present.

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[1] It is much to be regretted that a cabinet which he bequeathed to the Royal Society of London,—containing twenty-six of these single microscopes, each mounted with a suitable object, and accompanied by a magnified drawing of it, the whole being the work of his own hands,—is no longer in its possession. Baker, in his *Treatise on the Microscope*, affirms, from personal and careful examination, that (contrary to the statements of some writers who represented Leeuwenhoek as having worked with globules of glass) "every one of the twenty-six microscopes is a double-convex lens, and not a sphere or globule;" and he states that their magnifying powers range from 40 to 160 diameters.

It is to Leeuwenhoek that we owe the refutation of the then current biological doctrine that animals of high organization can be "produced spontaneously, or bred from corruption." This doctrine had been previously attacked by Redi, who showed that the putrefaction of meat will not engender maggots, if the access of blow-flies be prevented. But even Redi, while upholding the doctrine "Omne vivum ex *vivo*," believed that the insects found within the galls of plants, and the parasitic worms by which the human body is sometimes infested, are generated by a peculiar modification of the living vegetable or animal substance. It was Leeuwenhoek who first explicitly took up the position that every living organism reproduces its like, no type originating in any other way than by the ordinary generative process of its kind: "Omne vivum ex *ovo*." This he established by careful and prolonged observation, in a great variety of cases in which "spontaneous generation" had been reputed to take place; and he further continually adduced the great complexity of organization which his microscopic researches had revealed in what had been previously regarded as creatures of the lowest grade, as an argument against the doctrine that they are "bred from corruption." Thus he followed out the whole history of oak-galls, and showed that they are a product of a peculiar vegetable growth, excited by the insertion of an egg by the winged insect, and supplying the maggot, when hatched, with food. So, again, he showed that the weevils of granaries, then commonly supposed to be bred *from* wheat, as well as *in* it, are nothing else than grubs hatched from eggs deposited by winged insects; and he practically applied this conclusion, by recommending that granaries thus infested should be repeatedly fumigated with sulphur at the time when these insects come forth, so as to kill them before they deposit eggs. His chapter on the flea, in which he not only describes its structure, but traces out the whole history of its metamorphoses from its first emergence from the egg, is full of interest,—not so much for the exactness of his observations, as for its incidental revelation of the extraordinary ignorance then prevalent in regard to the orgin and propagation of "this minute and despised creature," which some asserted to be produced from sand, others from dust, others from the dung of pigeons, and others from urine, but which he showed to be "endowed with as great perfection in its kind as any large animal," and proved to breed in the regular way of winged insects. He even noted the fact that the pupa of the flea is sometimes attacked and fed upon by a mite,—an observation which suggested the well-known lines of Swift.

Although Bonnet is usually credited with the discovery of the viviparous propagation of the *Aphides*, this had been really made by Leeuwenhoek half a century previously. For, his attention having been drawn to the blighting of the young shoots of fruit-trees, which was commonly attributed to the ants found upon them, he was the first to find the *Aphides* that really do the mischief; and, upon searching, after his wont, into the history of their generation, he observed the young within the bodies of their parents. He carefully studied also the history of the ant, and was the first to show that what had been commonly reputed to be "ants' eggs" are really their pupæ, containing the perfect insect nearly ready for emersion, whilst the true eggs are far smaller, and give origin to "maggots" or larvæ.

Of the sea-mussel, again, and other shell-fish, he argued (in reply to a then recent defence of Aristotle's doctrine by Bonami, a learned Jesuit of Italy) that they are not generated out of the mud or sand which is found on the seashore or the beds of rivers at low water, but from spawn, by the regular course of generation. "For my part," he says, "I hold it equally impossible for a small shell-fish to be produced without generation as for a whale to have its origin in the mud."[1] And he maintained the same to be true of the fresh-water mussel (*Unio*), whose ova he examined so carefully that he saw in them the rotation of the embryo, a phenomenon supposed to have been first discovered long afterwards. "This uncommonly pleasing spectacle," he says, "was enjoyed by myself, my daughter, and the engraver for three whole hours, and we thought it one of the most delightful that could be exhibited." Not only was he the first discoverer of the rotifers, but he showed "how wonderfully nature has provided for the preservation of their species," by their tolerance of the drying-up of the water they inhabit, and the resistance afforded to the evaporation of the fluids of their bodies by the impermeability of the casing in which they then become enclosed. "We can now easily conceive," he says, "that in all rain-water which is collected from gutters in cisterns, and in all waters exposed to the air, animalcules may be found; for they may be carried thither by the particles of dust blown about by the winds." Although Baker is usually credited with the first careful study of the "wheel-animalcule," yet he really added very little to the account long previously given of it by Leeuwenhoek. In the same spirit he investigated the generation of eels, which were at that time supposed, not only by the ignorant vulgar, but by "respectable and learned men," to be produced from dew (!) without the ordinary process of generation. He was rewarded by the discovery of their viviparous propagation,—his careful and prolonged observations on which point, though since called in question, have never been refuted. The spectacle of the minute eels lying together in a transparent liquid within the body of the female gave him, he says, great pleasure,—affording a complete answer to those who said behind his back, "Since Mr. Leeuwenhoek is endeavoring to establish the regular generation of all animals, let him show us in what manner eels are bred."

Altogether it does not seem too much to affirm that Leeuwenhoek is well entitled to be considered, not only as "the father of scientific microscopy," but as having contributed more than any other naturalist to the overthrow of the doctrine of "spontaneous generation," and as having set a most admirable example of scientific method in the prosecution of biological research.

Leeuwenhoek's contributions to the *Philosophical Transactions* amounted to one hundred and twelve. He also published twenty-six papers in the *Memoirs of the Paris Academy of Sciences*. Two collections of his works appeared during his life, one in Dutch, and the other in Latin,—the most complete edition having been published at Leyden shortly before his death in 4 vols. (1719–22). A selection from this, translated into English by S. Hoole, was published in London (1778–81), 2 vols. 4to. (W. B. C.)

LEEWARD ISLANDS. See West Indies.

LEFÈVRE D'ÉTAPLES. See Faber, Jacobus.

LEGATE, one of the special names of a messenger or ambassador of the pope. The first four centuries present us with no actual recorded instances of recognized delegation of the papal authority; for that Hosius acted as papal legate at the council of Nice is nothing more than an assertion of Gelasius of Cyzicus, who wrote about the end of the 5th century, and no Western prelate took any part, either personally or otherwise, in the first council of Constantinople. The fifth (sometimes called the seventh) canon of the council of Sardica, in 343, however, shows that the possibility of such delegation had already begun to be discussed, and suggests that it may actually have been exemplified before that date. This canon provides that, in case of an appeal by a deposed bishop to Rome, if the pope is inclined to grant a new trial, it shall be competent for him to write to the bishops of the neighboring province, but if the appellant wishes the pope to send priests from his own side ("ut de latere suo presbyteros mittat"), it shall be free to the pope to do so, and give them due rank and dignity in the court thus constituted (Hefele, *Conc.*, i. 568). Instances of delegation of the papal authority in various degrees become numerous in the course of the 5th century, especially during the pontificate of Leo I. Thus Leo writes in 444 (*Ep.* 6) to Anastasius of Thessalonica, appointing him his vicar for the province of Illyria; the same arrangement, he informs us, had been made by Pope Siricius in favor of Anysius, the predecessor of Anastasius. Similar vicarial or legatine powers had been conferred in 418 by Zosimus upon Patroclus, bishop of Arles. In 449 Leo was represented at the "Robber Synod," from which his legates hardly escaped with life; at Chalcedon, in 451, they were treated with singular honor. Again, in 453 the same pope writes to the empress Pulcheria, naming Julianus of Cos as his representative in the defence of the interests of orthodoxy and ecclesiastical discipline at Constantinople (*Ep.* 112); the instructions to Julianus are given in *Ep.* 113 ("hanc specialem curam vice mea functus assumas"). The designation of Anastasius as vicar apostolic over Illyria may be said to mark the beginning of the custom of conferring, *ex officio*, the title of *legatus* upon the holders of important sees, who ultimately came to be known as *legati nati*, with the rank of primate; the appointment of Julianus at Constantinople gradually developed into the long permanent office of *apocrisiarius* or *responsalis*. Another sort of delegation is exemplified in Leo's letter to the African bishops (*Ep.* 12), in which he sends Potentius with instructions to inquire in his name, and to report (vicem curæ nostræ fratri et consacerdoti nostro Potentio delegantes qui de episcopis, quorum culpabilis ferebatur electio, quid veritas haberet inquireret, nobisque omnia fideliter indicaret). Passing on to the time of Gregory the Great, we find Augustine of Canterbury sometimes spoken of as legate, but it does not appear that in his case this title was used in any strictly technical sense, although the archbishop of Canterbury afterwards attained the permanent dignity of a legatus natus. Boniface, the apostle of Germany, was in like manner constituted, according to Hincmar (*Ep.* 30), a legate of the apostolic see by Popes Gregory II. and Gregory III. According to Hefele (*Conc.*, iv. 239), Rodoald of Porto and Zecharias of Anagni, who were sent by Pope Nicolas to Constantinople in 860, were the first who are actually called *legati a latere*. The policy of Gregory VII. naturally led to a great development of the legatine as distinguished from the ordinary episcopal function. According to the *Nova Compilatio Decretalium* of Gregory IX., under the title "De officio legati" the canon law recognizes two sorts of legate, the *legatus natus* and the *legatus datus* or *missus*. The *legatus datus* (*missus*) may be either (1) *delegatus*, or (2) *nuncius apostolicus*, or (3) *legatus a latere* (*lateralis*, *collateralis*). The rights of the *legatus natus*, which included concurrent jurisdiction with that of all the bishops within his province, have been much curtailed since the 16th century; they were altogether suspended in presence of the higher claims of a *legatus a latere*, and the title is now almost quite honorary. It still attaches to the sees of Seville, Toledo, Arles, Rheims, Lyons, Gran, Prague, Guesen-Posen, Cologne, Salzburg, among others. The commission of the *legatus delegatus* (generally a member of the local clergy) is of a limited nature, and relates only to some definite piece of work. The *nuncius apostolicus* (who has the privilege of red apparel, a white horse, and golden spurs) possesses ordinary jurisdiction within the province to which he has been sent, but his powers otherwise are restricted by the terms of his mandate. The *legatus a latere* (almost invariably a cardinal, though the power can be conferred on other prelates) is in the fullest sense the plenipotentiary representative of the pope, and possesses the high prerogative implied in the words of Gregory VII., "nostra vice quæ corrigenda sunt corrigat, quæ statuenda constituat." He has the power of suspending all the bishops in his province, and no judicial cases are reserved from his judgment. Without special mandate, however, he cannot depose bishops or unite or separate bishoprics. At present *legati a latere* are not sent by the holy see, but diplomatic relations, where they exist, are maintained by means of nuncios, internuncios, and other agents. According to the congress of Vienna, the diplomatic rank of a papal nuncio corresponds to that of an ambassador. The pope at present has nuncios at the courts of Bavaria, Austria-Hungary, Belgium, Chili, Spain, France, and Portugal. Inferior in rank and less numerous are the internuncios (Holland, Brazil).

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[1] Leeuwenhoek's argument in this instance was partly based on false premises. For he imagined the *Lepraliæ* with which mussel-shells are often encrusted to be the eggs of the mussels, and the contained *Polyzoa*, whose sixteen tentacles he figures, to be the young mussels.

LEGENDRE, Adrien Marie (1752–1833), French mathematician, a contemporary of Laplace and Lagrange, with whom he deserves to be ranked,[1] was born at Paris (or, according to some accounts, at Toulouse) in 1752. He was brought up at Paris, where he completed his studies at the Collége Mazarin. His first published writings consist of some articles forming part of the *Traité de Mécanique* (1774) of the Abbé Marie, who was his professor; Legendre's name, however, is not mentioned. Soon afterwards he was appointed professor of mathematics in the École Militaire at Paris, and he was afterwards professor in the École Normale. In 1782 he received the prize from the Berlin Academy for his "Dissertation sur la question de balistique," a memoir relating to the paths of projectiles in resisting media. He also, about this time, wrote his "Recherches sur la figure des planètes," published in the *Mémoires* of the French Academy, of which he was elected a member in succession to D'Alembert in 1783. He was also appointed a commissioner for connecting geodetically Paris and Greenwich, his colleagues being Méchain and Cassini; General Roy conducted the operations on behalf of England. The French observations were published in 1792 (*Exposé des opérations faites en France in 1787 pour la jonction des observatoires de Paris et de Greenwich*). During the Revolution, when the decimal system had been decreed, he was one of the three members of the council established to introduce the new system, and he was also a member of the commission appointed to determine the length of the metre, for which purpose the calculations, etc., connected with the arc of the meridian from Barcelona to Dunkirk were revised. He was also associated with Prony in the formation of the great French tables of logarithms of numbers, sines, and tangents, and natural sines, called the *Tables du Cadastre*, in which the quadrant was divided centesimally; these tables have never been published (see Logarithms). He also served on other public commissions. He was examiner in the École Polytechnique, but held few important state offices, and he seems never to have been much noticed by the different Governments; it has indeed been generally remarked that the offices he held were not such as his reputation entitled him to. Not many facts with regard to his personal life seem to have been published, but in a letter to Jacobi of June 30, 1832, he writes—"Je me suis marié à la suite d'une révolution sanglante qui avait détruit ma petite fortune; nous avons eu de grands embarras et des moments bien difficiles à passer, mais ma femme m'a aidé puissamment à restaurer progressivement mes affaires et à me donner cette tranquillité d'esprit nécessaire pour me livrer à mes travaux accoutumés et pour composer de nouveaux ouvrages qui ont ajouté de plus en plus à ma réputation, de manière à me procurer bientôt une existence honorable et une petite fortune dont les débris, après de nouvelles révolutions qui m'ont causé de grandes pertes, suffisent encore pour pourvoir aux besoins de ma vieillesse, et suffiront pour pourvoir à ceux de ma femme bien-aimée quand je n'y serai plus."

He died at Paris on January 10, 1833, in his eighty-first year, and the discourse at his grave was pronounced by Poisson. He was engaged in mathematical investigations almost up to the time of his death. The last of the three supplements to his *Traité des Fonctions Elliptiques* was published in 1832, and Poisson in his funeral oration remarked—"M. Legendre a eu cela de commun avec la plupart des géomètres qui l'ont précédé, que ses travaux n'ont fini qu' avec sa vie. Le

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[1] Besides Laplace and Lagrange, with whom it is most natural to associate Legendre, the names of Poisson, Cauchy, Fourier, and Monge should be mentioned as contemporaries. The number of French mathematicians of the highest rank who were living at the same time, at the beginning of the century, has often been the subject of remark.

dernier volume de nos mémoires renferme encore un mémoire de lui, sur une question difficile de la théorie des nombres; et peu de temps avant la maladie qui l'a conduit au tombeau, il se procura les observations les plus récentes des comètes à courtes périodes, dont il allait se servir pour appliquer et perfectionner ses méthodes."

Legendre was the author of separate works on elliptic functions, the integral calculus, the theory of numbers, and the elements of geometry, besides numerous papers which were published chiefly in the *Mémoires* of the French Academy; and it will be convenient, in giving an account of his writings, to consider them under the different subjects which are especially associated with his name.

Elliptic Functions.—This is the subject with which Legendre's name will always be most closely connected, and his researches upon it extend over a period of more than forty years. His first published writings upon the subject consist of two papers in the *Mémoires* of the French Academy for 1786 upon elliptic arcs. In 1792 he presented to the Academy a memoir on elliptic transcendents. The contents of these memoirs are included in the first volume of his *Exercices de Calcul Intégral* (1811). The third volume (1816) contains the very elaborate and now well-known tables of the elliptic integrals which were calculated by Legendre himself, with an account of the mode of their construction. In 1827 appeared the *Traité des fonctions elliptiques* (2 vols., the first dated 1825, the second 1826); a great part of the first volume agrees very closely with the contents of the *Exercices;* the tables, etc., are given in the second volume. Three supplements, relating to the researches of Abel and Jacobi, were published in 1828-32, and form a third volume. Legendre had pursued the subject which would now be called elliptic integrals alone from 1786 to 1827, the results of his labors having been almost entirely neglected by his contemporaries, but his work had scarcely appeared in 1827 when the discoveries which were independently made by the two young and as yet unknown mathematicians Abel and Jacobi placed the subject on a new basis, and revolutionized it completely. The readiness with which Legendre, who was then seventy-six years of age, welcomed these important researches, that quite overshadowed his own, and included them in successive supplements to his work, does the highest honor to him. The sudden occurrence, near the close of his long life, of these great discoveries relating to a subject which Legendre had so completely made his own and apparently exhausted, and their ready acceptance by him, form one of the most striking episodes in the history of mathematics. A very full account of the contents of Legendre's work and of the results obtained by Abel and Jacobi has been given in the article INFINITESIMAL CALCULUS, vol. xiii., pp. 68-79. See also Leslie Ellis's report "On the Recent Progress of Analysis," in the *Report of the British Association* for 1846 (pp. 44 *sq.*)

Eulerian Integrals and Integral Calculus.—The *Exercices de Calcul Intégral* consist of three volumes, a great portion of the first and the whole of the third being devoted to elliptic functions. The remainder of the first volume relates to the Eulerian integrals and to quadratures. The second volume (1817) relates to the Eulerian integrals, and to various integrals and series, developments, mechanical problems, etc., connected with the integral calculus; this volume contains also a numerical table of the values of the gamma function. The latter portion of the second volume of the *Traité des Fonctions Elliptiques* (1826) is also devoted to the Eulerian integrals, the table being reproduced. Legendre's researches connected with the gamma function are of importance, and are well known; the subject was also treated by Gauss in his memoir *Disquisitiones generales circa series infinitas* (1816), but in a very different manner. The results given in the second volume of the *Exercices* are of too miscellaneous a character to admit of being briefly described. In 1788 Legendre published a memoir on double integrals, and in 1809 one on definite integrals.

Theory of Numbers.—Legendre's *Théorie des Nombres* and Gauss's *Disquisitiones Arithmeticæ* (1801) are still the standard works upon this subject. The first edition of the former appeared in 1798 under the title *Essai sur la Théorie des Nombres;* there was a second edition in 1808; a first supplement was published in 1816, and a second in 1825. The third edition, under the title *Théorie des Nombres*, appeared in 1830 in two volumes. To Legendre is due the theorem known as the law of quadratic reciprocity, the most important general result in the science of numbers which has been discovered since the time of Fermat, and which was called by Gauss the "gem of arithmetic." It was first given by Legendre in the *Mémoires* of the Academy for 1785, but the demonstration that accompanied it was incomplete. The symbol $\left(\frac{a}{p}\right)$ which is known as Legendre's symbol, and denotes the positive or negative unit which is the remainder when $a^{\frac{1}{2}(p-1)}$ is divided by a prime number p, does not appear in this memoir, but was first used in the *Essai sur la Théorie des Nombres.* Legendre's formula $x : (\log. x - 1{\cdot}08366)$ for the approximate number of forms inferior to a given number x was first given by him also in this work (2d ed., p. 394).

Attractions of Ellipsoids.—Legendre was the author of four important memoirs on this subject. In the first of these, entitled "Recherches sur l'attraction des sphéroides homogènes," published in the *Mémoires* of the Academy for 1785, but communicated to it at an earlier period, Legendre introduces the celebrated expressions which, though frequently called Laplace's coefficients, are more correctly named after Legendre. The definition of the coefficients is that if $(1-2h\cos\phi+h^2)^{-\frac{1}{2}}$ be expanded in ascending powers of h, and if the general term be denoted by P_nh^n, then P_n is of the Legendrian coefficient of the nth order. In this memoir also the function which is now called the potential was, at the suggestion of Laplace, first introduced. Legendre shows that Maclaurin's theorem with respect to confocal ellipsoids is true for any position of the external point when the ellipsoids are solids of revolution. Of this memoir Todhunter writes—"We may affirm that no single memoir in the history of our subject can rival this in interest and importance. During forty years the resources of analysis, even in the hands of D'Alembert, Lagrange, and Laplace, had not carried the theory of the attraction of ellipsoids beyond the point which the geometry of Maclaurin had reached. The introduction of the coefficients now called Laplace's, and their application, commence a new era in mathematical physics." Legendre's second memoir was communicated to the Academy in 1784, and relates to the conditions of equilibrium of a mass of rotating fluid in the form of a figure of revolution which does not deviate much from a sphere. The third memoir relates to Laplace's theorem respecting confocal ellipsoids. Of the fourth memoir Todhunter writes, "It occupies an important position in the history of our subject. The most striking addition which is here made to previous researches consists in the treatment of a planet supposed entirely fluid; the general equation for the form of a stratum is given for the first time and discussed. For the first time we have a correct and convenient expression for Laplace's nth coefficient." See Todhunter's *History of the Mathematical Theories of Attraction and the Figure of the Earth* (1873), the twentieth, twenty-second, twenty-fourth, and twenty-fifth chapters of which contain a full and complete account of Legendre's four memoirs. For the theory of the Legendrian coefficients and the analysis connected with them, the reader is referred to Heine's *Handbuch der Kugelfunctionen* (Berlin, 1878), to Todhunter's *Treatise on Laplace's Functions, Lamé's Functions, and Bessel's Functions* (1875), or to Ferrers's *Spherical Harmonics* (1877). It should be mentioned that Legendre's coefficients have been recently termed zonal harmonics by some writers.

Geodesy.—Besides the work upon the geodetical operations connecting Paris and Greenwich referred to above, and of which Legendre was one of the authors, he published in the *Mémoires* of the Academy for 1787 two papers on trigonometrical operations depending upon the figure of the earth, containing many theorems relating to this subject. The best known of these, which is called Legendre's theorem, is usually given in treatises on spherical trigonometry; by means of it a small spherical triangle may be treated as a plane triangle, certain corrections being applied to the angles. Legendre was also the author of a memoir upon triangles drawn upon a spheroid. Legendre's theorem is a fundamental one in geodesy, and his contributions to the subject are of the greatest importance.

Method of Least Squares.—In 1806 appeared Legendre's *Nouvelles Méthodes pour la détermination des orbites des Comètes*, which is memorable as containing the first published suggestion of the method of least squares. In the preface Legendre remarks, "La méthode qui me paroît la plus simple et la plus générale consiste à rendre minimum la somme des quarrés des erreurs, . . . et que j'appele méthode des moindres quarrés;" and in an appendix in which the application of the method is explained his words are, "De tous les principes qu'on peut proposer pour cet objet, je pense qu'il n'en est pas de plus général, de plus exact, ni d'une application plus facile que celui dont nous avons fait usage dans les recherches précédentes, et qui consiste à rendre minimum la somme des quarrés des erreurs." The method was proposed by Legendre only as a convenient process for treating observations, without reference to the theory of probability. It had, however, been applied by Gauss as early as 1795, and the method was fully explained, and the law of facility for the first time given by him in 1809. Laplace also justified the method by means of the principles of the theory of probability; and this led Legendre to republish the part of his *Nouvelles Méthodes* which related to it in the *Mémoires* of the Academy for 1810. Thus, although the method of least squares was first formally proposed by Legendre, the theory and algorithm and mathematical foundation of the process are due to Gauss and Laplace. Legendre published two supplements to his *Nouvelles Méthodes* in 1806 and 1820.

The Elements of Geometry.—Legendre's name is most widely known on account of his *Éléments de géométrie*, the most successful of the numerous attempts that have been made to supersede Euclid as a text-book on geometry. It first appeared in 1794, and went through very many editions, and has been translated into almost all languages. An English translation, by Sir David Brewster, from the eleventh French edition, was published in 1823, and is well known in England. The earlier editions did not contain the trigonometry. In one of the notes Legendre gives a proof of the irrationality of π. This had been first proved by Lambert in the Berlin *Memoirs* for 1768. Legendre's proof is similar in principle to Lambert's, but much simpler. On account of the objections urged against the treatment of parallels in this work, Legendre was induced to publish in 1803 his *Nouvelle Théorie des parallèles*. His *Geometry* gave rise in England also to a lengthened discussion on the difficult question of the treatment of the theory of parallels.

It will thus be seen that Legendre's works have placed him in the very foremost rank in the widely distinct subjects of elliptic functions, theory of numbers, attractions, and geodesy, and have given him a conspicuous position in connection with the integral calculus and other branches of mathematics. He published a memoir on the integration of partial differential equations and a few others which have not been noticed above, but they relate to subjects with which his name is not especially associated. A good account of the principal works of Legendre is given in the *Bibliothèque Universelle de Genève* for 1833, pp. 45–82.

(J. W. L. G.)

LEGERDEMAIN, PRESTIDIGITATION, or SLEIGHT OF HAND, as it is variously called, is the art of deceiving the eye of the spectator by adroit movements of the hand of the operator so as apparently to cause an object either to be changed, produced, or made to disappear. The term "legerdemain" is extended in meaning to include all sorts of "conjuring" by means of mechanical and other contrivances, although it properly applies to tricks performed with the hand alone. Even in ancient times two distinct branches of magic existed—the impostures of divination and necromancy, and the amusing exhibition of jugglery and sleight of hand. Judging from the accounts which history has handed down to us, the marvels performed by the thaumaturgists of antiquity were very skilfully produced, and must have required a considerable practical knowledge of the art. The Romans were in the habit of giving conjuring exhibitions, the most favorite feat being that of the "cups and balls," the performers of which were called *acetabularii*, and the cups themselves *acetabula*. The balls used, however, instead of being the convenient light cork ones employed by modern conjurors, were simply round white pebbles which must have added greatly to the difficulty of performing the trick. The art survived the barbarism and ignorance of the Middle Ages; and the earliest professors of the modern school were Italians such as Jonas, Androletti, and Antonio Carlotti. In England legerdemain has always found professors and patrons; Chaucer, in describing a motley assemblage, says:—

> "There I saw playenge jongeleurs,
> Magiciens, tregeteours,
> Phetonysses, charmeresses,
> Old witches, sorceresses;"

and in another place (*House of Fame*, bk. iii.) he records a startling feat of prestidigitation:—

> "There I saw Coll Tregetour
> Upon a table of sycamour
> Play an uncouthe thynge to tell;
> I saw him cary a wyndemell
> Under a walnot shale."

But there is no reason for supposing that the ancient magicians were more proficient in the art than their modern successors; and, as Robert-Houdin, the greatest of modern conjurors, has pithily observed, "if antiquity was the cradle of magic, it is because the art was yet in its infancy." Towards the close of the reign of Elizabeth the profession had fallen very low in England, and the performers were classed with "ruffians, blasphemers, thieves, vagabonds, Jews, Turks, heretics, pagans, and sorcerers." In 1840 a German physicist named Döbler devised an entertainment which gave an entirely new development to the science, and was in effect the same as the conjuring entertainments which have since become so popular and familiar. The most eminent conjurors of the modern school have been Robert-Houdin, Wiljalba Frikell, Hermann, and Buatier de Kolta.

The secrets of legerdemain were for a long time jealously guarded by its professors, but in 1793 a work appeared in Paris entitled *Testament de Jérome Sharpe, Professeur de Physique Amusante*, which gives a very fair account of the methods then in vogue. Its author was M. Decremps. In 1858 a still more important and accurate book was published—*Sorcellierie ancienne et moderne expliquée*, by J. N. Ponsin; and ten years later J. E. Robert-Houdin issued his *Secrets de la Prestidigitation et de la Magie*, which is a masterly exposition of the entire art and mystery of conjuring. The last-mentioned book has been translated into English by "Professor Hoffman," the author of *Modern Magic*, the best English treatise on the subject. Modern magic calls to its aid all the appliances of modern science,—electricity, magnetism, optics, and mechanics; but the most successful adepts in the art look down upon all such succedaneous aids and rely upon address and sleight of hand alone. Confederacy is never resorted to except by the merest tyros. The prestidigitator's motto is "The quickness of the hand deceives the eye;" but this very phrase, which is always in a performer's mouth, is in itself one of the innocent frauds which the conjuror employs as part and parcel of his exhibition. The truth is that it is not so much upon the quickness with which a feat is performed as upon the adroitness with which the time and means of performing it are concealed that its success depends. "A prestidigitator," says Robert-Houdin, "is not a juggler; he is an actor playing the part of a magician, an artist whose fingers should be more clever than nimble. I would even add that, in the practice of legerdemain, the calmer the movements are the more easy is it to produce an illusion on the spectators." Professor Hoffman corroborates this statement, and says, "The effects of magic are produced by successive adroit substitutions, and the whole magic of the trick consists in the concealment of the particular moment at which each substitution is effected." The right opportunity for executing the required movement is technically called a *temps*. This is defined to be any act or movement which distracts the attention of the audience while something is being "vanished" or "produced." Experiment will readily convince any one that it is absolutely impossible to move the hand so quickly as to abstract or replace any object without being perceived, so long as the eyes of the audience are upon the performer. But it is very easy to do so unnoticed, provided the audience are looking another way at the time; and the faculty of thus diverting their attention is at once the most difficult and the most necessary accomplishment for a conjuror to acquire. It does not suffice to point, or ask them to look in another direction, because they will obviously suspect the truth and look with all the more persistence. The great requisite is to "have a good eye"—in French conjuring parlance *avoir de l'œil;* an earnest, convinced look of the performer in a particular direction will carry every one's glances with it, while a furtive glance at the hand which is performing some function that should be kept secret will ruin all.

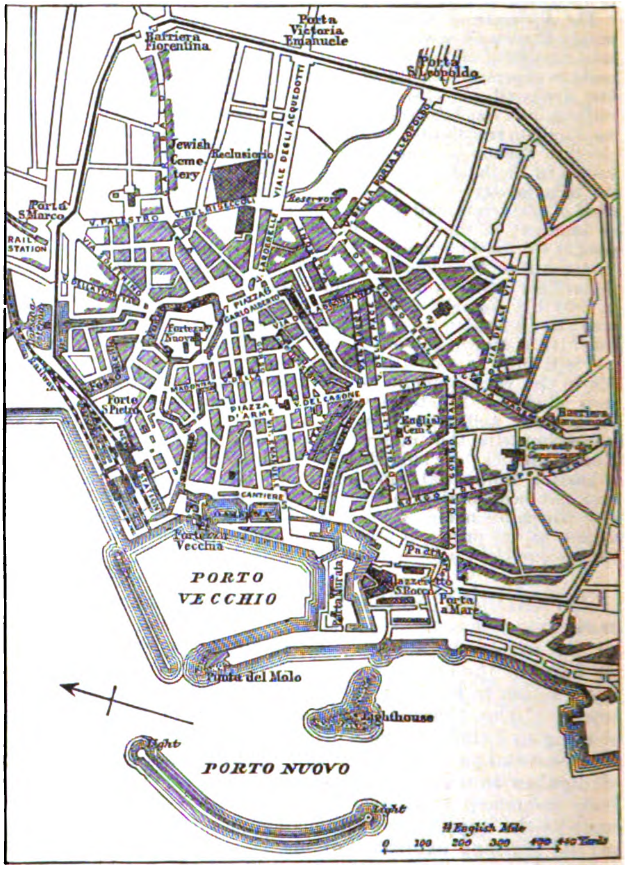
Robert-Houdin may be considered the actual founder of the modern school of legerdemain. This celebrated conjuror, who was originally a watchmaker and mechanician, possessed a remarkably inventive genius, and, having early turned his attention to legerdemain, he concentrated all his efforts upon the development and improvement of that art. Discarding the clumsy tricks of what he calls the "false-bottomed school," as well as the gaudy paraphernalia with which his predecessors used to encumber their stage, he produced in 1845, at a little theatre in the Palais Royal, a number of entirely new illusions, in which all the resources of mechanical and electrical science were combined with manual dexterity and personal address. His entertainments, which he called *Soirées Fantastiques*, made a great sensation in Paris, and placed him at once at the head of his profession. His skill and success were so great that the French Government sent him on a sort of roving commission to Algeria, in order that he might, by his exhibitions of natural magic, destroy the prestige of the *marabouts*—wonder-workers who had obtained a great and dangerous influence over the Arabs by their pretended miracles. The motto prefixed by Robert-Houdin to his chapter on the "Art of Conjuring" is—"to succeed as a conjuror, three things are essential: first, dexterity; second, dexterity; and third, dexterity;" and this is not a mere trick of language, for triple dexterity is required, not only to train the hand to the needful adroitness, but to acquire the requisite command of eye and tongue.

Besides the legitimate application of legerdemain to the purpose of amusement, it serves another and less innocent purpose, being employed by card sharpers in their nefarious profession. The successful card sharper must have qualities which, if applied in a legitimate direction, would ensure distinction in almost any profession. He must be observant, dexterous, cool; but above all he must have impudence. If it requires a considerable share of this quality to perform an ordinary feat of legerdemain with all the advantages of scenic effects and stage arrangements, how much more must it need to effect a trick under the very eyes of a vigilant adversary, and when the consequences of failure are so extremely unpleasant? As in legitimate conjuring, too, it is not so much that actual dexterity or the quickness of the hand deceives the eye as that the attention is diverted by some ingenious but unperceived device at the moment when the operation is performed.

Legerdemain as applied to cheating at cards may be divided into the following branches:—(1) marking the cards; (2) abstracting certain cards during the game for clandestine use; (3) previously concealing cards about the person; (4) packing the cards; (5) substituting marked or prepared packs; (6) confederacy; (7) false shuffles. All these methods are thoroughly exposed in Robert-Houdin's work *Les tricheries des Grecs*.

In addition to the works on conjuring already mentioned, reference may be made to *Sleight of Hand*, by Edwin Sachs. (E. H. P.)

LEGHORN (Italian, *Livorno*), a city of Italy, the chief town of the province of Leghorn (which includes the island of Elba), the see of a bishop, and next to Genoa and Naples the greatest commercial port in the kingdom, is situated on the coast of the Ligurian Sea, in 43° 33′ N. lat. and 10° 16′ E. long., 15 miles southwest of Pisa, with which it is connected by a branch from the main west coast line. It is built on low-lying ground backed by a ridge of hills, of which the most striking though not the highest is Monte Nero, with its ancient monastery. In some respects one of the least Italian of Italian cities, Leghorn owes its prosperity as a port not so much to any special advantages of situation as to wise legislation and labor. Broad and well-kept streets, spacious squares, and large substantial houses are the general characteristics of the city, which has room enough within the circuit of its walls (built 1835–37), though it has scattered its villas on the neighboring hills and coast. Of note among the buildings are the old cathedral (a Latin cross with a single nave—the façade designed by Inigo Jones), the town-hall, the great oil warehouses erected by Cosmo III. in 1705, the reservoir (a subterranean structure dating from the time of Ferdinand III.), and the Jewish synagogue, which ranks next to that of Amsterdam. Near the port stands the statue of Ferdinand I. by Giovanni dell' Opera, with four slaves in bronze, by Pietro Tacca, chained to the pedestal; and the Piazza Carlo Alberto is adorned with statues of the grand dukes Ferdinand III. and Leopold II. The old English cemetery (closed 1839), which was up to the present century the only Protestant burial-place in Italy, contains the tombs of Smollett and Francis Horner. The Torre del Marzocco, or "Tower of the Sculptured Lion," is one of the leading landmarks of the city from the sea, and almost the only relic of the republican period. Among the public institutions are the "Chambers of Public Payments," similar to the London clearing-house, a large naval academy opened in 1881, a chamber of commerce dating from 1801, a public library of 40,000 volumes, and a technical and nautical institute. Great changes have been effected in the port of Leghorn since the middle of the century. The "new port" is formed by a breakwater finished in 1863, which extends north and south for 3300 feet, at a distance of 6 furlongs from the



Plan of Leghorn.

1. Duomo (S. Francisco d'Assisi).
2. S. Maria del Soccorso.
3. English Church.
4. Jewish Synagogue.
5. Monument to Ferdinand I.
6. Monument to Ferdinand III.
7. Monument to Leopold II.

shore. It has a general depth of from 24 to 32 feet. Vessels moored to the breakwater are sheltered from all winds, but those in the open part of the basin are exposed to the southerly gales. The inner or old port, formed by a pier projecting half a mile in a north-northwest direction from the shore, measures 1800 by 1500 feet, and is perfectly secure on all sides. To the south and east lie a number of docks, which in turn are connected with a system of canals complex enough to justify the name Little Venice applied to part of the city. The Canale dei Navicelli extends north to the Arno. Dredging operations for deepening the harbor having been carried on between 1868 and 1878 with little permanent result, a much more extensive and effective series of improvements (including the construction of a new breakwater from the shore south of the town to the old lighthouse, and the lengthening of the dry dock so as to take in the largest ships now obliged to dock at Marseilles), received the government sanction in 1881. Shipbuilding is the principal local industry, and even ironclads have been sent out from the dockyards. The following table shows the foreign trade of the port to have declined since 1860, but a counterbalancing increase to have taken place in the coasting trade:—

	Foreign Trade.		Coasting Trade.			Foreign Trade.		Coasting Trade.	
	Ships.	Tonnage.	Ships.	Tonnage.		Ships.	Tonnage.	Ships.	Tonnage.
1861	4,597	980,357	10,108	692,862	1871	1,904	624,312	7,953	1,218,831
1862	5,273	1,066,360	9,929	803,628	1872	1,891	566,284	8,079	1,248,250
1863	3,977	1,012,829	11,597	1,125,176	1873	1,922	616,862	8,858	1,205,297
1864	3,786	857,861	8,562	1,031,054	1874	1,545	382,384	9,518	1,880,118
1865	3,800	881,805	9,016	1,111,921	1875	1,425	379,845	9,105	1,995,324
1866	3,260	800,636	8,988	1,138,681	1676	1,448	383,493	7,787	2,047,348
1867	2,357	612,135	7,729	965,053	1877	1,411	405,771	7,576	1,866,829
1868	2,348	587,471	7,865	999,956	1878	1,379	386,510	7,125	1,828,189
1869	2,856	788,525	7,120	952,126	1879	1,481	459,884	7,308	1,891,490
1870	2,151	644,897	7,443	1,070,542	1860	1,361	466,313	7,694	1,991,183

In the early part of the century Leghorn became a great depôt of British commerce with the Levant, and about twenty British firms were settled in the town. It was a free port, and had an excellent bonding system. But about 1833 the increase of direct intercourse between Britain and her customers began to tell on the trade, and it gradually disappeared altogether. At present the activity of the port is due to exportation of Italian produce (especially from Tuscany), and the importation of iron, coal, fish, and general goods. Marseilles, Cardiff, and Newcastle are the three ports with which the dealings are most extensive. A considerable trade is also maintained with the United States. The population of Leghorn city increased from 33,000 in 1807 to 83,543 in 1861; but in 1871 it was 80,948, and in 1881 only 77,781,—a decrease due mainly to the distribution of the population beyond the city limits, especially along the coast. The communal population was 97,096 in 1871, and 97,615 in 1881. Between the city and the village of Ardenza are many seaside residences, occupied mostly by foreign visitors during the bathing season.

The earliest mention of Leghorn occurs in a document of the year 891 relating to the first church; in 1017 it is called a castle. In the 13th century the Pisans tried to attract a population to the spot, but it was not till the 14th that Leghorn began to be the rival of Porto Pisano, which it was destined ultimately to supplant. It was at Leghorn that Urban V. and Gregory XI. landed on their return from Avignon. When in 1405 the king of France sold Pisa to the Florentines he kept possession of Leghorn; but he afterwards (1407) sold it for 26,000 ducats to the Genoese, and from the Genoese the Florentines purchased it in 1421. In 1496 the city showed its devotion to its new masters by a successful defence against Maximilian and his allies. With the rise of the Medici came a rapid increase of prosperity; Cosmo, Francis, and Ferdinand erected fortifications and harbor works, warehouses and churches, with equal liberality, and the last especially gave a stimulus to trade by inviting "men of the East and the West, Spanish and Portuguese, Greeks, Germans, Italians, Hebrews, Turks, Moors, Armenians, Persians, and others," to settle and traffic in the city. Declared free and neutral in 1691, Leghorn was permanently invested with these privileges by the Quadruple Alliance in 1718; but in 1796 Napoleon seized all the hostile vessels in its port. It ceased to be a free city by law of 1867.

LEGION OF HONOR, ORDER OF THE. This order of merit was instituted by Napoleon in 1802, all previously existing French military or religious orders—those of St. Michael, the Holy Ghost, St. Louis, and Military Merit, as well as the united orders of St. Lazarus and Our Lady of Mount Carmel—having been abolished at the Revolution. All soldiers on whom sabres of honor had been already conferred were forthwith declared to be members, and all citizens of sufficient merit were declared to be eligible for admission, whatever their birth, rank, religion, or social position might be. At their reception they were required to swear upon their honor to employ all just, reasonable, and lawful means for the service of the republic, the maintenance of its territory, the support of the government, the law, and the public property, and to withstand every effort towards the restoration of the feudal system and its various accompaniments—in short, to co-operate as much as in them lay for the assertion of the principles of freedom and equality. The grand master was Napoleon himself; under him were 105 grand officers, 300 commanders, 450 officers, and 3665 chevaliers. To the members of the various classes yearly allowances, ranging from 5000 francs in the case of a grand officer to 200 in that of a chevalier, were assigned. Some unimportant modifications in details were made when the empire was introduced. Between 1805 and 1814 about 48,000 nominations were made, 1400 only being in favor of civilians. Shortly after the accession of Louis XVIII. considerable changes took place. The old military and religious orders were restored, and that of the Legion of Honor reduced to the last place; the king was of course its grand master; the membership was divided into five grades,—80 grand crosses, 160 grand officers, 400 commanders, 2000 officers, and an indeterminate number of chevaliers. These fixed numbers were to be exclusive of members of the royal family, princes of the blood, and foreigners. Admission (the reward of at least twenty-five years of distinguished service) in ordinary cases was to be made to the grade of chevalier only; and only chevaliers of more than four years' standing, officers of two years' standing, and commanders of three years were to be eligible for promotion. The admissions were in every case to be made on parade in the case of military persons, and at a public sitting of a court of first instance in the case of civilians. The terms of the oath required were, of course, somewhat modified, and the arrangements about yearly allowances could not be continued. After the revolution of July, the "Ordre royal de la légion d'honneur" again resumed the unique place and special character which had belonged to it under Bonaparte in 1802. But its constitution was again remodelled in 1852; the number of grand crosses, grand officers, commanders, and officers was fixed respectively at 80, 200, 1000, and 2000, the number of chevaliers being still left vague, while the system of annual allowances was restored. Since 1870 the maximum number of chevaliers has been fixed at 25,000, the remaining four classes having 70, 200, 1000, and 4000 assigned to them respectively. In each grade three-fifths must be military persons, the rest civilians. The yearly pension of a military chevalier is 250 francs, of an officer 500, of a commander 1000, of a grand officer 2000, and of a grand cross 3000. The order may be conferred upon foreigners, but these do not count. It has occasionally been conferred upon women (*e. g.*, Rosa Bonheur). In connection with the order there is an army medal, which may be distributed to the number of 40,000, and which entitles the bearer to a pension of 100 francs. On January 1, 1874, the military members of the legion, in point of fact, numbered 39,793, drawing 12,718,050 francs annually; and there were 51,460 holders of military medals, drawing 5,146,000 francs, besides not less than 15,000 civil members drawing no pension. By economy in making new appointments, these numbers have subsequently been reduced. Since 1805 there has existed an institution for the education of daughters, sisters, and nieces of members of the legion; in 1809 the numbers were fixed at 600, the place being the "Maison d'éducation de Saint Denis." The arrangements have subsequently been considerably extended. The decoration under the first empire consisted of a white enamelled five-rayed star, bearing the portrait of Napoleon, and a wreath of oak and laurel, with the words "Napoleon, empereur des Français;" on the reverse was the French eagle grasping a thunderbolt, and the legend "Honneur et patrie." The ribbon was of watered scarlet silk. At present the obverse of the star bears the effigy of the republic and the words "République Française," the reverse two tricolor flags with the original legend.

LEH, or Lé. See Ladák.

LEIAH, a town in Derá Ismáil Khan district, Punjab, India, is situated near the east bank of the Indus, in 30° 57′ 30″ N. lat., 70° 58′ 20″ E. long. The population in 1868 was 17,033 (13,151 Mohammedans, 3726 Hindus, 30 Síkhs, and 126 "others"). There is a considerable trade in local produce as well as through traffic between the districts of upper India and the countries to the west.

LEIBNITZ, or Leibniz, Gottfried Wilhelm (1646–1716), almost equally distinguished as philosopher, mathematician, and man of affairs, was born on the 21st of June (o. s.) 1646, at Leipsic, where his father was professor of moral philosophy. The name Leibniz, Leibnitz, or Lubeniecz was originally Slavonic, but his family was German, and for three generations his ancestors had been in the employment of the Saxon Government. Young Leibnitz was sent to the Nicolai school at Leipsic, but, from the time of his father's death, which took place when he was only six years old, seems to have been for the most part his own teacher. From his father he had acquired a love of historical study that bore remarkable fruit in after life. The German books at his command were soon all read through, and with the help of two Latin books which fell in his way—the *Thesaurus Chronologicus* of Calvisius and an illustrated edition of Livy—he learned Latin for himself at the age of eight. By the advice of a neighboring gentleman his father's library was now thrown open to him with the permission "Tolle, lege." At this his joy knew no bounds. "For," he says, "I burned to get sight of the ancients, most of them known to me only by name, Cicero and Seneca, Pliny, Herodotus, Xenophon, Plato, and the historical writers, and many church fathers, Latin and Greek." Thus before he was twelve he could read Latin easily and had begun Greek; and his facility in writing Latin verses made his instructors fear that he would be seduced by poetry from more serious pursuits. Next he took with avidity to the study of logic, attempting already to reform its doctrines, and reading the scholastics and some of the Protestant theologians with such zeal that his friends now began to fear that he would never leave scholastic subtleties, "not knowing," as he said, "that my mind could not be satisfied with one kind of things."

In the autumn of 1661, at the age of fifteen, he entered the university of Leipsic as a student of law. His first two years were devoted to philosophy under Scherzer, a follower of the scholastics, and Jacob Thomasius, a Neo-Aristotelian, who is looked upon as having founded the scientific study of the history of philosophy in Germany. It was at this time probably that he first made acquaintance with the modern thinkers who had already revolutionized science and philosophy, Francis Bacon, Cardan, and Campanella, Kepler, Galileo, and Descartes; and he began to discuss with himself the difference between the old and new ways of regarding nature. "I remember," he says, "walking alone, at the age of fifteen, in a wood near Leipsic called the Rosenthal, to deliberate whether I should retain the doctrine of substantial forms. At last mechanism triumphed and induced me to apply myself to mathematics." It was not, however, till the summer of 1663, which he spent at Jena under Weigel, that he obtained the instructions of a mathematician of repute; nor was the deeper study of mathematics entered upon till his visit to Paris and acquaintance with Huygens many years later.

The three years following his return from Jena were devoted to legal studies, and in 1666 Leibnitz became a candidate for the degree of doctor of law. The doctorate was a pathway to the post of assessor which he coveted, but through the opposition of older candidates for the same office his youth was made an excuse for refusing him the degree. Upon this he left his native town for ever. The doctor's degree refused him there was at once (November 5, 1666) conferred on him at Altdorf,—the university town of the free city of Nuremberg,—where his brilliant dissertation procured him the immediate offer of a professor's chair. This, however, he declined, having, as he said, "very different things in view."

Leibnitz, not yet twenty-one years of age, was already the author of several remarkable essays. In his bachelor's dissertation *De principio individui* (1663) he defended the nominalistic doctrine that individuality is constituted by the whole entity or essence of a thing; his arithmetical tract *De complexionibus*, published in an extended form under the title *De arte combinatoria* (1666), is an essay towards his life-long project of a reformed symbolism and method of thought; and besides these there are four juridical essays, including the *Nova methodus docendi discendique juris*, written in the intervals of his journeys from Leipsic to Altdorf. This last essay is remarkable, not only for the reconstruction it attempted of the *Corpus Juris*, but as containing the first clear recognition of the importance of the historical method in law.

Rejecting the professorial career, but without any definite plan for the future, Leibnitz turned his steps to Nuremberg. That city was a centre of the Rosicrucians, and Leibnitz, busying himself with writings of the alchemists, soon gained such a knowledge of their tenets that he was supposed to be one of the secret brotherhood, and was even elected their secretary. A more important result of his visit to Nuremberg was his acquaintance with Johann Christian von Boineburg, formerly first minister to the elector of Mainz, and one of the most distinguished statesmen of the day. By his advice Leibnitz printed his *Nova methodus* in 1667, dedicated it to the elector, and, going to Mainz, presented it to him in person. It was thus that Leibnitz entered the service of the elector of Mainz, at first as an assistant in the revision of the statute-book, afterwards on more important work.

The policy of the elector, which the pen of Leibnitz was now called upon to promote, was to maintain the security of the German empire, threatened on the west by the aggressive power of France, on the east by Turkey and Russia. Thus when in 1669 the crown of Poland became vacant, it fell to Leibnitz to support the claims of the German candidate, which he did in his first political writing, *Specimen demonstrationum politicarum*, attempting, under the guise of a Catholic Polish nobleman, to show by mathematical demonstration that it was necessary in the interest of Poland that it should have the count palatine of Neuburg as its king. But neither the diplomatic skill of Boineburg, who had been sent as plenipotentiary to the election at Warsaw, nor the arguments of Leibnitz were successful, and a Polish prince was elected to fill the vacant throne.

A greater danger threatened Germany in the aggressions of Louis XIV. and the wars of conquest on which he was entering. Though Holland was in most immediate danger from his arms, the seizure of Lorraine in 1670 showed that Germany too was threatened. It was in this year that Leibnitz wrote his *Thoughts on Public Safety*,[1] in which he urged the formation of a new

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[1] *Bedenken, welchergestalt securitas publica interna et externa und status præsens jetzigen Umständen nach auf festen Fuss zu stellen*

"Rheinbund" for the protection of Germany, and contended that the states of Europe should employ their power, not against one another, but in the conquest of the non-Christian world, in which Egypt, "one of the best situated lands in the world," would fall to the share of France. The plan thus proposed of averting the threatened attack on Germany by a French expedition to Egypt was discussed with Boineburg, and obtained the approval of the elector. French relations with Turkey were at the time so strained as to make a breach imminent, and at the close of 1671, about the time when the war with Holland broke out, Louis himself was approached by a letter from Boineburg and a short memorial from the pen of Leibnitz, who attempted to show that Holland itself, as a mercantile power trading with the East, might be best attacked through Egypt, while nothing would be easier for France or would more largely increase her power than the conquest of Egypt. On February 12, 1672, a request came from the French secretary of state, Pomponne, that the author of the memorial should further explain himself, and on the 18th of next month Leibnitz started for Paris. Louis seems still to have kept the matter in view, but never granted Leibnitz the personal interview he desired, while Pomponne wrote from the camp before Doesburg, "I have nothing against the plan of a holy war, but such plans, you know, since the days of St. Louis, have ceased to be the fashion." Not yet discouraged, Leibnitz wrote a full account of his project for the king,[1] and a summary of the same[2] evidently intended for Boineburg. But Boineburg died in December, 1672, before the latter could be sent to him. Nor did the former ever reach its destination. The French quarrel with the Porte was made up, and the plan of a French expedition to Egypt disappeared from practical politics till Napoleon menaced the power of England by the same means as those by which Louis had been invited to cripple Holland. The history of this scheme, and the reason of Leibnitz's journey to Paris, long remained hidden in the archives of the Hanoverian library. It was on his taking possession of Hanover in 1803 that Napoleon learned, through the *Consilium Ægyptiacum*, that the idea of a French conquest of Egypt had been first put forward by a German philosopher. In the same year there was published in London an account of the *Justa dissertatio*[3] of which the British Government had procured a copy in 1799. But it is only since the appearance of the edition of Leibnitz's works begun by Onno Klopp in 1864 that the full history of the scheme has been made known.

Leibnitz had other than political ends in view in his visit to France. It was as the centre of literature and science that Paris chiefly attracted him. Political duties never made him lose sight of his philosophical and scientific interests. At Mainz he was still busied with the question of the relation between the old and new methods in philosophy. In a letter to Jacob Thomasius (1669) he contends that the mechanical explanation of nature by magnitude, figure, and motion alone is not inconsistent with the doctrines of Aristotle's *Physics*, in which he finds more truth than in the *Meditations* of Descartes. Yet these qualities of bodies, he argues in 1668 (in an essay published without his knowledge under the title *Confessio naturæ contra atheistas*), require an incorporeal principle, or God, for their ultimate explanation. He also wrote at this time a defence of the doctrine of the Trinity against Wissowatius (1669), and an essay on philosophic style, introductory to an edition of the *Antibarbarus* of Nizolius (1670). Clearness and distinctness alone, he says, are what makes a philosophic style, and no language is better suited for this popular exposition than the German. In 1671 he issued a *Hypothesis physica nova*, in which, agreeing with Descartes that corporeal phenomena should be explained from motion, he carried out the mechanical explanation of nature by contending that the original of this motion is a fine æther, similar to light, or rather constituting it, which, penetrating all bodies in the direction of the earth's axis, produces the phenomena of gravity, elasticity, etc. The first part of the essay, on concrete motion, was dedicated to the Royal Society of London, the second, on abstract motion, to the French Academy.

Leibnitz thus came to Paris, not merely as a young diplomatist on an important if not very hopeful mission, but also as an author who had already made his début in the world of science and philosophy. At Paris he met with Arnauld, Malebranche, and, more important still, with Christian Huygens. This was pre-eminently the period of his mathematical and physical activity. Before leaving Mainz he was able to announce[4] an imposing list of discoveries, and plans for discoveries, arrived at by means of his new logical art, in natural philosophy, mathematics, mechanics, optics, hydrostatics, pneumatics, and nautical science, not to speak of new ideas in law, theology, and politics. Chief among these discoveries was that of a calculating machine for performing more complicated operations than that of Pascal—multiplying, dividing, and extracting roots, as well as adding and subtracting. This machine was exhibited to the Academy of Paris and to the Royal Society of London, and Leibnitz was elected a fellow of the latter society in April, 1673.[5] In January of this year he had gone to London as an attaché on a political mission from the elector of Mainz, returning in March to Paris, and while in London had become personally acquainted with Oldenburg, the secretary of the Royal Society, with whom he had already corresponded, with Boyle the chemist, and Pell the mathematician. It is from this period that we must date the impulse that directed him anew to mathematics. By Pell he had been referred to Mercator's *Logarithmotechnica* as already containing some numerical observations which Leibnitz had thought original on his own part; and, on his return to Paris, he devoted himself to the study of higher geometry under Huygens, entering almost at once upon the series of investigations which culminated in his discovery of the differential and integral calculus. For the history of this discovery and of the controversies to which it gave rise, see vol. xiii. p. 10 *sq.*

Shortly after his return to Paris in 1673, Leibnitz ceased to be in the Mainz service any more than in name, but in the same year entered the employment of Duke John Frederick of Brunswick-Lüneburg, with whom he had corresponded for some time. In 1676 he removed at the Duke's request to Hanover, travelling thither by way of London and Amsterdam. At the latter place he saw and conversed with Spinoza, now in the last year of his life.

For the next forty years, and under three successive princes, Leibnitz was in the service of the Brunswick family, and his headquarters were at Hanover, where he had charge of the ducal library. In leaving the electorate of Mainz for the dukedom of Brunswick, Leibnitz passed into a political atmosphere formed by the dynastic aims of the typical German state. The recognition of the rights of the dukedom amongst the states of Europe, the consolidation and permanence of the reigning house, the union of the two branches of the Brunswick family, and lastly,—the aim to which all the others led up—the attainment of the electoral hat, were the ends of its political action. Leibnitz had thus to support by his pen the claim of Hanover to appoint an ambassador at the congress of Nimeguen (1676)[6] to defend the establishment of primogeniture in the Lüneburg branch of the Brunswick family; and, when the proposal was made to raise the duke of Hanover to the electorate, with the charge of the imperial banner, he had to show that this did not interfere with the rights of the duke of Würtemberg, who was the hereditary custodian of the imperial colors. It was in 1692 that the duke of Hanover was made elector. Before, and with a view to this, Leibnitz had been employed by him to write the history of the Brunswick-Lüneburg family, and, to collect material for this history, had undertaken a journey through Germany and Italy in 1687–90, visiting and examining the records in Marburg, Frankfort-on-the-Main, Munich, Vienna (where he remained nine months), Venice, Modena, and Rome. At Rome he was offered the custodianship of the Vatican library on condition of his joining the Catholic Church.

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[1] *De expeditione Ægyptiaca regi Franciæ proponenda justa dissertatio.*

[2] *Consilium Ægyptiacum.*

[3] *A Summary Account of Leibnitz's Memoir addressed to Lewis the Fourteenth*, etc. [edited by Granville Penn], London, 1803.

[4] In a letter to the duke of Brunswick-Lüneburg (autumn, 1671), *Werke*, ed. Klopp, iii. 253 *sq.*

[5] He was made a foreign member of the French Academy in 1700.

[6] *Cæsarini Furstenerii tractatus de jure suprematus ac legationis principum Germaniæ*, Amsterdam, 1677; *Entretiens de Philarète et d'Eugène sur le droit d'ambassade*, Duisb., 1677.

About this time too his thoughts and energies were partly taken up with the scheme for the reunion of the Catholic and Protestant Churches. While at Mainz he had joined in an attempt made by the elector and Boineburg to bring about a reconciliation, and now, chiefly through the energy and skill of the Catholic Royas de Spinola, and from the spirit of moderation which prevailed among the theologians he met with at Hanover in 1683 it almost seemed as if some agreement might be arrived at. It was in these circumstances that, in 1686, Leibnitz wrote his *Systema theologicum*,[1] in which he strove to find common standing-ground for Protestants and Catholics in the details of their creeds. But the English Revolution of 1688, and the establishment of the Protestant succession, became a political obstacle to the prosecution of the scheme in Hanover, while it was soon found that the religious difficulties were greater than had at one time appeared. Spinola's practical and conciliatory tone did not make full allowance for the ecclesiastical and dogmatical claims of Rome, and the moderation of the Hanover theologians was not fairly representative of the spirit of the Protestant Churches. In the letters to Leibnitz from Bossuet, the landgrave of Hessen-Rheinfels, and Madame de Brinon, the aim is obviously to make converts to Catholicism, not to arrive at a compromise with Protestantism, and when it was found that Leibnitz refused to be converted the correspondence ceased. A further scheme of church union in which Leibnitz was engaged, that between the Reformed and Lutheran Churches, met with no better success.

Returning from Italy in 1690, Leibnitz was appointed librarian at Wolfenbüttel by Duke Anton of Brunswick-Wolfenbüttel. Some years afterwards began his connection with Berlin through his friendship with the electress Sophie Charlotte of Brandenburg and her mother the princess Sophie of Hanover. He was invited to Berlin in 1700, and on the 11th July of that year the academy he had planned was founded, with himself as its president for life. In the same year he was made a privy councillor of justice by the elector of Brandenburg. Four years before he had received a like honor from the elector of Hanover, and twelve years afterwards the same distinction was conferred upon him by Peter the Great, to whom he gave a plan for an academy at St. Petersburg, carried out after the czar's death. At Berlin, in the pleasant suburb of Charlottenburg, Leibnitz read and philosophized with his royal pupil, whose death in 1705 was the greatest loss he ever suffered. After this event his visits to Berlin became less frequent and less welcome, and in 1711 he was there for the last time. In the following year he undertook his fifth and last journey to Vienna, where he stayed till 1714. An attempt to found an academy of science there was defeated by the opposition of the Jesuits, but he now attained the honor he had coveted of an imperial privy councillorship (1712), and either at this time or on a previous occasion, was made a baron of the empire (*Reichsfreiherr*). Leibnitz returned to Hanover in September, 1714, but found the elector George Louis had already gone to assume the crown of England. Leibnitz would gladly have followed him to London, but was bidden remain at Hanover and finish his history of Brunswick.

During the last thirty years Leibnitz's pen had been busy with many matters. Mathematics, natural science,[2] philosophy, theology, history, jurisprudence, politics (particularly the French wars with Germany, and the question of the Spanish succession), economics, and philology, all gained a share of his attention; almost all of them he enriched with original observations.

His genealogical researches in Italy—through which he established the common origin of the families of Brunswick and Este—were not only preceded by an immense collection of historical sources, but enabled him to publish materials for a code of international law.[3] The history of Brunswick itself was the last work of his life, and had covered the period from 768 to 1005 when death ended his labors. But the Government, in whose service and at whose order the work had been carried out, left it to lie unheeded in the archives of the Hanover library, till it was published by Pertz in 1843.

It was in the years between 1690 and 1716 that Leibnitz's chief philosophical works were composed, and during the first ten of these years the accounts of his system were, for the most part, preliminary sketches. Indeed, he never gave a full and systematic account of his doctrines. His views have to be gathered from letters to friends, from occasional articles in the *Acta Eruditorum*, the *Journal des Savants*, and other journals, and from one or two more extensive works. It is evident, however, that philosophy had not been entirely neglected in the years in which his pen was almost solely occupied with other matters. A letter to the duke of Brunswick, and another to Arnauld, in 1671, show that he had already reached his new notion of substance; and it seems to have been the want of leisure and opportunity alone that prevented the systematic expression of his views. In a letter to Arnauld, of date March 23, 1690, the leading peculiarities of his system are clearly stated. The appearance of Locke's *Essay* in 1690 induced him (1696) to note down his objections to it, and his own ideas on the same subjects. In 1703–4 these were worked out in detail and ready for publication, when the death of the author whom they criticised prevented their appearance (first published by Raspe, 1765). In 1710 appeared the only complete and systematic philosophical work of his lifetime, *Essaies de Théodicée sur la bonté de Dieu, la liberté de l'homme, et l'origine du mal*, originally undertaken at the request of the late queen of Prussia, who had wished a reply to Bayle's opposition of faith and reason. In 1714 he wrote, for Prince Eugene of Savoy, a sketch of his system under the title of *La Monadologie*, and in the same year appeared his *Principes de la nature et de la grace*. The last few years of his life were perhaps more occupied with correspondence than any others, and, in a philosophical regard, were chiefly notable for the letters which, through the desire of the new queen of England, he interchanged with Clarke, *sur Dieu, l'âme, l'espace, la durée*.

Leibnitz died on the 14th November, 1716, his closing years enfeebled by disease, harassed by controversy, embittered by neglect, darkened by the loss of his dearest friend; but to the last he preserved the indomitable energy and power of work to which is largely due the position he holds as, more perhaps than any one in modern times, a man of almost universal attainments and almost universal genius. Neither at Berlin, in the academy which he had founded, nor in London, whither his sovereign had gone to rule, was any notice taken of his death. At Hanover, Eckhart, his secretary, was his only mourner; no courtiers, no clergyman followed him to the grave; not till 1787 was the simple monument that marks the place erected; "he was buried," says an eye-witness, "more like a robber than what he really was, the ornament of his country."[1] Only in the French Academy was the loss that had been sustained recognized, and a worthy eulogium devoted to his memory (November 13, 1717).

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[1] Not published till 1819. It is on this work that the assertion has been founded that Leibnitz was at heart a Catholic—a supposition clearly disproved by his correspondence.

[2] In his *Protogæa* (1691) he developed the notion of the historical genesis of the present condition of the earth's surface. Cf. O. Peschel, *Gesch. d. Erdkunde*, Munich, 1865, pp. 615 *sq.*

[3] *Codex juris gentium diplomaticus*, 1693; *Mantissa codicis juris gentium diplomatici*, 1700.

Accustomed from his boyhood to a studious life, Leibnitz possessed a wonderful power of rapid and continuous work, and for days together would hardly leave his chair. Even in travelling his time was employed in solving mathematical problems. He is further described as moderate in his desires and habits, quick of temper but easily appeased, charitable in his judgments of others, and tolerant of differences of opinion, though impatient of contradiction on small matters. He is also said to have been fond of money to the point of covetousness; he was certainly desirous of honor, and felt keenly the neglect in which his last years were passed.

Leibnitz's Philosophy.—The central point in the philosophy of Leibnitz was only arrived at after many advances and corrections in his opinions. This point is his new doctrine of substance (p. 702[2]), and it is through it that unity is given to the succession of occasional writings, scattered over fifty years, in which he explained his views. More inclined to agree than to differ with what he read (p. 425), and borrowing from almost every philosophical system, his own standpoint is yet most closely related to that of Descartes, partly as consequence, partly by way of opposition. Cartesianism, Leibnitz often asserted, is the ante-room of truth, but the ante-room only. Descartes's separation of things into two heterogeneous substances only connected by the omnipotence of God, and the more logical absorption of both by Spinoza into the one divine substance, followed from an erroneous conception of what the true nature of substance is. Substance, the ultimate reality, can only be conceived as force. Hence Leibnitz's metaphysical view of the monads as simple, percipient, self-active beings, the constituent elements of all things, his physical doctrines of the reality and constancy of force at the same time that space, matter, and motion are merely phenomenal, and his psychological conception of the continuity and development of consciousness. In the closest connection with the same stand his logical principles of consistency and sufficient reason, and the method he developed from them, his ethical end of perfection, and his crowning theological conception of the universe as the best possible world, and of God both as its efficient cause and its final harmony.

The ultimate elements of the universe are, according to Leibnitz, individual centres of force or monads. Why they should be individual, and not manifestations of one world-force, he never clearly proves.[3] His doctrine of individuality seems to have been arrived at, not by strict deduction from the nature of force, but rather from the empirical observation that it is by the manifestation of its activity that the separate existence of the individual becomes evident; for his system individuality is as fundamental as activity. "The monads," he says, "are the very atoms of nature—in a word, the elements of things," but, as centres of force, they have neither parts, extension, nor figure (p. 705). Hence their distinction from the atoms of Democritus and the materialists. They are metaphysicial points or rather spiritual beings whose very nature it is to act. As the bent bow springs back of itself, so the monads naturally pass and are always passing into action without any aid but the absence of opposition (p. 122). Nor do they, like the atoms, act upon one another (p. 680); the action of each excludes that of every other. The activity of each is the result of its own past state, the determinator of its own future (pp. 706, 722). "The monads have no windows by which anything may go in or out" (p. 705).

Further, since all substances are of the nature of force, it follows that—"in imitation of the notion which we have of souls"—they must contain something analogous to feeling and appetite. It is the nature of the monad to represent the many in one, and this is perception, by which external events are mirrored internally (p. 438). Through their own activity the monads mirror the universe (p. 725), but each in its own way and from its own point of view that is, with a more or less perfect perception (p. 127); for the Cartesians were wrong in ignoring the infinite grades of perception, and identifying it with the reflex cognizance of it which may be called apperception. Every monad is thus a microcosm, the universe in little,[4] and according to the degree of its activity is the distinctness of its representation of the universe (p. 709). Thus Leibnitz, borrowing the Aristotelian term, calls the monads *entelechies*, because they have a certain perfection (τὸ ἐντελές) and sufficiency (αὐτάρκεια) which make them sources of their internal actions and, so to speak, incorporeal automata (p. 706). That the monads are not pure entelechies is shown by the differences amongst them. Excluding all external limitations, they are yet limited by their own nature. All created monads contain a passive element or *materia prima* (pp. 440, 687, 725), in virtue of which their perceptions are more or less confused. As the activity of the monad consists in perception, this is inhibited by the passive principle, so that there arises in the monad an appetite or tendency to overcome the inhibition and become more perceptive, whence follows the change from one perception to another (pp. 706, 714). By the proportion of activity to passivity in it one monad is differentiated from another. The greater the amount of activity or of distinct perceptions the more perfect is the monad; the stronger the element of passivity, the more confused its perceptions, the less perfect is it (p. 709). The soul would be a divinity had it nothing but distinct perceptions (p. 520).

The monad is never without a perception; but, when it has a number of little perceptions with no means of distinction, a state similar to that of being stunned ensues, the *monade nue* being perpetually in this state (p. 707). Between this and the most distinct perception there is room for an infinite diversity of nature among the monads themselves. Thus no one monad is exactly the same as another; for, were it possible that there should be two identical, there would be no sufficient reason why God, who brings them into actual existence, should put one of them at one definite time and place, the other at a different time and place. This is Leibnitz's principle of the *identity of indiscernibles* (pp. 277, 755); by it his early problem as to the principle of individuation is solved by the distinction between genus and individual being abolished, and every individual made *sui generis*. The principle thus established is formulated in Leibnitz's law of continuity, founded, he says, on the doctrine of the mathematical infinite, essential to geometry, and of importance in physics (pp. 104, 105), in accordance with which there is neither vacuum nor break in nature, but "everything takes place by degrees" (p. 392), the different species of creatures rising by insensible steps from the lowest to the most perfect form (p. 312).

As in every monad each succeeding state is the consequence of the preceding, and as it is of the nature of every monad to mirror or represent the universe, it follows (p. 774) that the perceptive content of each monad is in "accord" or correspondence with that of every other (*cf.* p. 127), though this content is represented with infinitely varying degrees of perfection. This is Leibnitz's famous doctrine of pre-established harmony, in virtue of which the infinitely numerous independent substances of which the world is composed are related to each other and form one universe. It is essential to notice that it proceeds from the very nature of the monads as percipient, self-acting beings, and not from an *arbitrary* determination of the Deity.

From this harmony of self-determining percipient units Leibnitz has to explain the world of nature and mind. As everything that really exists is of the nature of spiritual or metaphysical points (p. 126), it follows that space and matter in the ordinary sense can only have a phenomenal existence (p. 745), being dependent not on the nature of the monads themselves but on the way in which they are perceived. Considering that several things exist at the same time and in a certain order of coexistence, and mistaking this constant relation for something that exists outside of them, the mind forms the confused perception of space (p. 768). But space and time are merely relative, the former an order of coexistences, the latter of successions (pp. 682, 752). Hence not only the secondary qualities of Descartes and Locke, but their so-called primary qualities as well, are merely phenomenal (p. 445). The monads are really without position or distance from each other; but, as we perceive several simple substances, there is for us an aggregate or extended mass. Body is thus active extension (pp. 110, 111). The unity of the aggregate depends entirely on our perceiving the monads composing it together. There is no such thing as an absolute vacuum or empty space, any more than there are indivisible material units or atoms from which all things are built up (pp. 126, 186, 277). Body, corporeal mass, or, as Leibnitz calls it, to distinguish it from the *materia prima* of which every monad partakes (p. 440), *materia secunda*, is thus only a "phenomenon bene fundatum" (p. 436). It is not a *substantia* but *substantiæ* or *substantiatum* (p. 745). While this, however, is the only view consistent with Leibnitz's fundamental principles, and is often clearly stated by himself, he also speaks at other times of the *materia secunda* as itself a composite substance, and of a real metaphysical bond between soul and body. But these expressions occur chiefly in the letters to Des Bosses, in which Leibnitz is trying to reconcile his views with the doctrines of the Roman Catholic Church, especially with that of the real presence in the Eucharist, and are usually referred to by him as doctrines of faith or as hypothetical (see especially p. 680). The true *vinculum substantiale* is not the *materia secunda*, which a consistent development of Leibnitz's principles can only regard as phenomenal, but the *materia prima*, through which the monads are individualized and distinguished and their connection rendered possible. And Leibnitz seems to recognize that the opposite assumption is inconsistent with his cardinal metaphysical view of the monads as the only realities.

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[1] *Memoirs of John Ker of Kersland*, by himself, 1726, i. 118.

[2] When not otherwise stated, the references are to Erdmann's edition of the *Opera philosophica*.

[3] See *Considérations sur la doctrine d'un esprit universel*, 1702.

[4] *Cf. Opera*, ed. Dutens, II. ii. 20.

From Leibnitz's doctrine of force as the ultimate reality it follows that his view of nature must be throughout dynamical. And though his project of a *dynamic* or theory of natural philosophy was never carried out, the outlines of his own theory and his criticism of the mechanical physics of Descartes are known to us. The whole distinction between the two lies in the difference between the mechanical and the dynamical views of nature. Descartes started from the reality of extension as constituting the nature of material substance, and found in magnitude, figure, and motion the explanation of the material universe. Leibnitz too admitted the mechanical view of nature as giving the laws of corporeal phenomena (p. 438), applying also to everything that takes place in animal organisms,[1] even the human body (p. 777). But, as phenomenal, these laws must find their explanation in metaphysics, and thus in final causes (p. 155). All things, he says (in his *Specimen Dynamicum*), can be explained either by efficient or by final causes. But the latter method is not appropriate to individual occurrences,[2] though it must be applied when the laws of mechanism themselves need explanation (p. 678). For Descartes's doctrine of the constancy of the quantity of motion (*i. e.*, momentum) in the world Leibnitz substitutes the principle of the conservation of *vis viva*, and contends that the Cartesian position that motion is measured by velocity should be superseded by the law that moving force (*vis motrix*) is measured by the square of the velocity (pp. 192, 193). The long controversy raised by this criticism was really caused by the ambiguity of the terms employed. The principles held by Descartes and Leibnitz were both correct, though different, and their conflict only apparent. Descartes's principle is now enunciated as the conservation of momentum, that of Leibnitz as the conservation of energy. Leibnitz further criticises the Cartesian view that the mind can alter the direction of motion though it cannot imitate it, and contends that the quantity of "*vis directiva*," estimated between the same parts, is constant (p. 108)—a position developed in his statical theorem for determining geometrically the resultant of any number of forces acting at a point.

Like the monad, body, which is its analogue, has a passive and an active element. The former is the capacity of resistance, and includes impenetrability and inertia; the latter is active force (pp. 250, 687). Bodies, too, like the monads, are self-contained activities, receiving no impulse from without—it is only by an accommodation to ordinary language that we speak of them as doing so—but moving themselves in harmony with each other (p. 250).

The psychology of Leibnitz is chiefly developed in the *Nouveaux Essais sur la l'entendement humain*, written in answer to Locke's famous *Essay*, and criticising it chapter by chapter. In these essays he worked out a theory of the origin and development of knowledge in harmony with his metaphysical views, and thus without Locke's implied assumption of the mutual influence of soul and body. When one monad in an aggregate perceives the others so clearly that they are in comparison with it bare monads (*monades nues*), it is said to be the ruling monad of the aggregate, not because it actually does exert an influence over the rest, but because, being in close correspondence with them, and yet having so much clearer perception, it seems to do so (p. 683). This monad is called the entelechy or soul of the aggregate or body, and as such mirrors the aggregate in the first place and the universe through it (p. 710). Each soul or entelechy is surrounded by an infinite number of monads forming its body (p. 714); soul and body together make a living being, and, as their laws are in perfect harmony—a harmony established between the whole realm of final causes and that of efficient causes (p. 714)—we have the same result as if one influenced the other. This is further explained by Leibnitz in his well-known illustration of the different ways in which two clocks may keep exactly the same time. The machinery of the one may actually move that of the other, or whenever one moves the mechanician may make a similar alteration in the other, or they may have been so perfectly constructed at first as to continue to correspond at every instant without any further influence (pp. 133, 134). The first way represents the common (Locke's) theory of mutual influence, the second the method of the occasionalists, the third that of pre-established harmony. Thus the body does not act on the soul in the production of cognition, nor the soul on the body in the production of motion. The body acts just as if it had no soul, the soul as if it had no body (p. 711). Instead, therefore, of all knowledge coming to us directly or indirectly through the bodily senses, it is all developed by the soul's own activity, and sensuous perception is itself but a confused kind of cognition. Not a certain select class of our ideas only (as Descartes held), but all our ideas, are innate, though only worked up into actual cognition in the development of knowledge (p. 212). To the aphorism made use of by Locke, "Nihil est in intellectu quod non prius fuerit in sensu," must be added the clause, "nisi intellectus ipse" (p. 223). The soul at birth is not comparable to a *tabula rasa*, but rather to an unworked block of marble, the hidden veins of which already determine the form it is to assume in the hands of the sculptor (p. 196). Nor, again, can the soul ever be without perception; for it has no other nature than that of a percipient active being (p. 246). Apparently dreamless sleep is to be accounted for by unconscious perception (p. 223); and it is by such insensible perceptions that Leibnitz explains his doctrine of pre-established harmony (p. 197).

In the human soul perception is developed into thought, and thus an infinite though gradual difference between it and the mere monad (p. 464). As all knowledge is implicit in the soul, it follows that its perfection depends on the efficiency of the instrument by which it is developed. Hence the importance, in Leibnitz's system, of the logical principles and method the consideration of which occupied him at intervals throughout his whole career.

There are two kinds of truths—(1) truths of reasoning and (2) truths of fact (pp. 83, 99, 707). The former rest on the principle of identity (or contradiction) or of possibility, in virtue of which that is false which contains a contradiction, and that true which is contradictory to the false. The latter rests on the principle of sufficient reason or of reality (*compossibilité*), according to which no fact is true unless there be a sufficient reason why it should be so and not otherwise (agreeing thus with the *principium melioris* or final cause). God alone, the purely active monad, has an *a priori* knowledge of the latter class of truths; they have their source in the human mind only in so far as it mirrors the outer world, *i. e.*, in its passivity, whereas the truths of reason have their source in our mind in itself or in its activity.

Both kinds of truths fall into two classes, primitive and derivative. The primitive truths of fact are, as Descartes held, those of internal experience, and the derivative truths are inferred from them in accordance with the principle of sufficient reason, by their agreement with our perception of the world as a whole. They are thus reached by probable arguments—a department of logic which Leibnitz was the first to bring into prominence (pp. 84, 164, 168, 169. 343). The primitive truths of reasoning are identical (in later terminology analytical) propositions, the derivative truths being deduced from them by the principle of contradiction. The part of his logic on which Leibnitz laid the greatest stress was the separation of these rational cognitions into their simplest elements—for he held that the root-notions (*cogitationes primæ*) would be found to be few in number (pp. 92, 93)—and the designation of them by universal characters or symbols,[3] composite notions being denoted by the formulæ formed by the union of several definite characters, and judgments by the relation of æquipollence among these formulæ, so as to reduce the syllogism to a calculus. This is the main idea of Leibnitz's "universal characteristic," never fully worked out by him, which he regarded as one of the greatest discoveries of the age. An incidental result of its adoption would be the introduction of a universal symbolism of thought comparable to the symbolism of mathematics and intelligible in all languages (*cf.* p. 356). But the great revolution it would effect would chiefly consist in this, that truth and falsehood would be no longer matters of opinion but of correctness or error in calculation[1] (pp. 83, 84, 89, 93). The old Aristotelian analytic is not to be superseded; but it is to be supplemented by this new method, for of itself it is but the A B C of logic.

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[1] The difference between an organic and an inorganic body consists, he says, in this, that the former is a machine even in its smallest parts.

[2] *Opera*, ed Dutens, iii. 371.

[3] Different symbolic systems were proposed by Leibnitz at different periods; *cf.* Květ, *Leibnitzen's Logik*, 1857, p. 37.

But the logic of Leibnitz is an art of discovery (p. 85) as well as of proof, and, as such, applies both to the sphere of reasoning and to that of fact. In the former it has by attention to render explicit what is otherwise only implicit, and by the intellect to introduce order into the *a priori* truths of reason, so that one may follow from another and they may constitute together a *monde intellectuel.* To this art of orderly combination Leibnitz attached the greatest importance, and to it one of his earliest writings was devoted. Similarly, in the sphere of experience, it is the business of the art of discovery to find out and classify the primitive facts or data, referring every other fact to them as its sufficient reason, so that new truths of experience may be brought to light.

As the perception of the monad when clarified becomes thought, so the appetite of which all monads partake is raised to will, their spontaneity to freedom, in man (p. 669). The will is an effort or tendency to that which one finds good (p. 251), and is free only in the sense of being exempt from external control[2] (pp. 262, 513, 521), for it must always have a sufficient reason for its action determined by what seems good to it. The end determining the will is pleasure (p. 269), and pleasure is the sense of an increase of perfection (p. 670). A will guided by reason will sacrifice transitory and pursue constant pleasures or happiness, and in this weighing of pleasures consists true wisdom. Leibnitz, like Spinoza, says that freedom consists in following reason, servitude in following the passions (p. 669), and that the passions proceed from confused perceptions (pp. 188, 269). In love one finds joy in the happiness of another; and from love follow justice and law. "Our reason," says Leibnitz,[3] "illumined by the spirit of God, reveals the law of nature," and with it positive law must not conflict. Natural law rises from the strict command to avoid offence, through the maxim of equity which gives to each his due, to that of probity or piety (*honeste vivere*)—the highest ethical perfection,—which presupposes a belief in God, providence and a future life.[4] Moral immortality—not merely the simple continuity which belongs to every monad—comes from God having provided that the changes of matter will not make man lose his individuality (pp. 126, 466).

Leibnitz thus makes the existence of God a postulate of morality as well as necessary for the realization of the monads. It is in the *Théodicée* that his theology is worked out and his view of the universe as the best possible world defended. In it he contends that faith and reason are essentially harmonious (pp. 402, 479), and that nothing can be received as an article of faith which contradicts an eternal truth, though the ordinary physical order may be superseded by a higher.[5]

The ordinary arguments for the being of God are retained by Leibnitz in a modified form (p. 375). Descartes's ontological proof is supplemented by the clause that God as the *ens a se* must either exist or be impossible (pp. 80, 177, 708); in the cosmological proof he passes from the infinite series of finite causes to their sufficient reason which contains all changes in the series necessarily in itself (pp. 147, 708); and he argues teleologically from the existence of harmony among the monads without any mutual influence to God as the author of this harmony (p. 430).

In these proofs Leibnitz seems to have in view an extramundane power to whom the monads owe their reality, though such a conception evidently breaks the continuity and harmony of his system, and can only be externally connected with it. But he also speaks in one place at any rate[6] of God as the "universal harmony;" and the historians Erdmann and Zeller are of opinion that this is the only sense in which his system can be consistently theistic. Yet it would seem that to assume a purely active and therefore perfect monad as the source of all things is in accordance with the principle of continuity and with Leibnitz's conception of the gradation of existences. In this sense he sometimes speaks of God as the first or highest of the monad (p. 678), and of created substances proceeding from Him continually by "fulgurations" (p. 708) or by "a sort of emanation as we produce our thoughts."[7]

The positive properties or perfections of the monads, Leibnitz holds, exist *eminenter*, *i. e.*, without the limitation that attaches to created monads (p. 716), in God—their perception as His wisdom or intellect, and their appetite as His absolute will or goodness (p. 654); while the absence of all limitation is the divine independence or power, which again consists in this, that the possibility of things depends on His intellect, their reality on His will (p. 506). The universe in its harmonious order is thus the realization of the divine end, and as such must be the best possible (p. 506). The teleology of Leibnitz becomes necessarily a *Théodicée.* God created a world to manifest and communicate His perfection (p. 524), and, in choosing this world out of the infinite number that exist in the region of ideas (p. 515), was guided by the *principium melioris* (p. 506). With this thoroughgoing optimism Leibnitz has to reconcile the existence of evil in the best of all possible worlds.[8] With this end in view he distinguishes (p. 655) between (1) metaphysical evil or imperfection, which is unconditionally willed by God as essential to created beings; (2) physical evil, such as pain, which is conditionally willed by God as punishment or as a means to greater good (*cf.* p. 510); and (3) moral evil, in which the great difficulty lies, and which Leibnitz makes various attempts to explain. He says that it was merely permitted, not willed by God (p. 655), and, that being obviously no explanation, adds that it was permitted because it was foreseen that the world with evil would nevertheless be better than any other possible world (p. 350). He also speaks of the evil as a mere set-off to the good in the world, which it increases by contrast (p. 149), and at other times reduces moral to metaphysical evil by giving it a merely negative existence, or says that their evil actions are to be referred to men alone, while it is only the power of action that comes from God, and the power of action is good (p. 658).

The great problem of Leibnitz's *Théodicée* thus remains unsolved. The suggestion that evil consists in a mere imperfection, like his idea of the monads proceeding from God by a continual emanation, was too bold and too inconsistent with his immediate apologetic aim to be carried out by him. Had he done so his theory would have transcended the independence of the monads with which it started, and found a deeper unity in the world than that resulting from the somewhat arbitrary assertion that the monads reflect the universe.

The philosophy of Leibnitz, in the more systematic and abstract form it received at the hands of Wolf, ruled the schools of Germany for nearly a century, and largely determined the character of the critical philosophy by which it was superseded. On it Baumgarten laid the foundations of a science of æsthetic. Its treatment of theological questions heralded the German *Aufklärung.* And on many special points—in its physical doctrine of the conservation of force, its psychological hypothesis of unconscious perception, its attempt at a logical symbolism—it has suggested ideas fruitful for the progress of science.

Literature.—No complete edition of the works of Leibnitz has been yet published. We have (1) the *Opera Omnia*, by Dutens, Geneva, 1768, which does not contain all the works known at the time; (2) *Leibnizens gesammelte Werke*, by G. H. Pertz, Berlin, 1843–63 (first series, History, 4 vols.; second series, Philosophy, vol. i., correspondence with Arnauld, etc., edited by G. L. Grotefend; third series, Mathematics, 7 vols., edited by C. J. Gerhardt); (3) that of M. Foucher de Careil, 7 vols., Paris, 1859–75, the same editor having previously issued *Lettres et Opuscules inédits de Leibniz*, Paris, 1854–57; (4) the magnificent edition of Ouno Klopp, *Die Werke von Leibniz gemäss seinem handschriftlichen Nachlasse in der Königlichen Bibliothek zu Hannover*, first series, Historico-Political and Political Writings, 10 vols., 1864–77. The *Œuvres de Leibniz*, by A. Jacques, 2 vols., Paris, 1842, may also be mentioned. The philosophical writings have been published by Raspe (Amsterdam and Leipsic, 1765), by J. E. Erdman (*Leibnitii Opera philosophica quæ extant Latina Gallica, Germanica omnia*, Berlin, 1840), and by P. Janet, 2 vols., Paris, 1866. The edition begun in 1875 by C. J. Gerhardt (*Die philosophische Schriften von G. W. Leibniz*), of which 4 vols. have been published, will, when finished, be the most complete. Leibnitz's *Deutsche Schriften* have been edited by G. E. Guhrauer (Berlin, 1838–40) and the (chiefly mathematical) *Briefwechsel zwischen Leibniz und Wolf*, by C. J. Gerhardt (Halle, 1860). The *Systema theologicum*, first published by Émery, Paris, 1819, was translated into English by C. W. Russell, D. D., Maynooth, in 1850; an English edition of the correspondence with Clarke was published by the latter, London, 1717.

The materials for the life of Leibnitz, in addition to his own works, are the biographical notes of Eckhart (not published till 1779), the *Éloge*, by Fontenelle (read to the French Academy in 1717), the "Eulogium," by Wolf, in the *Acta Eruditorum* for July, 1717, and the "Supplementum" to the same by Feller, published in his *Otium Hannoveranum*, Leipsic, 1718. The best biography is that of G. E. Guhrauer, *G. W. Freiherr von Leibnitz*, 2 vols., Breslau, 1842 (*Nachträge*, Breslau, 1846). A shorter *Life of G. W. von Leibnitz, on the basis of the German work of Guhrauer*, has been published by J. M. Mackie, Boston, 1845. More recent works are those of L. Grote, *Leibniz und sein Zeit*, Hanover, 1869; E. Pfleiderer, *Leibniz als Patriot, Staatsmann, und Bildungsträger*, Leipsic, 1870; and the slighter volume of F. Kirchner, *G. W. Leibniz: sein Leben und Denken*, Köthen, 1876.

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[1] The places at which Leibnitz anticipated the modern theory of logic mainly due to Boole are pointed out in Mr. Venn's *Symbolic Logic*, 1881.

[2] Hence the difference of his determinism from that of Spinoza, though Leibnitz too says in one place that "it is difficult enough to distinguish the actions of God from those of the creatures" (*Werke*, ed. Pertz, 2d ser., i. 160).

[3] *Opera omnia*, ed. Dutens, IV. iii. 282.

[4] *Ibid.*, IV. iii. 295. *Cf.* Bluntschli, *Gesch. d. allg. Staatsrechts u. Politik*. 1864, pp. 143 *sq.*

[5] P. 480; *cf.* *Werke*, ed. Pertz, 2d ser., i. 158, 159.

[6] *Werke*, ed. Klopp, iii. 259; *cf.* *Op. phil.*, p. 716.

[7] *Werke*, ed. Pertz, 2d ser., i. 167.

[8] "Si c'est ici le meilleur des mondes possibles, que sont donc les autres?" —Voltaire, *Candide*, ch. vi.

The monographs and essays on Leibnitz are too numerous to mention, but reference may be made to Feuerbach, *Darstellung, Entwicklung, und Kritik der Leibnitz'schen Phil.*, 2d ed., Leipsic, 1844; Nourrisson, *La Philosophie de Leibniz*, Paris, 1860; R. Zimmermann, *Leibnitz und Herbart: eine Vergleichung ihrer Monadologieen*, Vienna, 1849; O. Caspari, *Leibniz' Philosophie beleuchtet vom Gesichtspunkt der physikalischen Grundbegriffe von Kraft und Stoff*, Leipsic, 1870; G. Hartenstein, "Locke's Lehre von der menschl. Erk. in Vergl. mit Leibniz's Kritik derselben," in the *Abhandl. d. philol.-hist. Cl. d. K. Sächs. Gesells. d. Wiss.*, vol. iv., Leipsic, 1861; G. Class, *Die metaph. Voraussetzungen des Leibnitzischen Determinismus*, Tübingen, 1874; F. B. Květ, *Leibnitzens Logik*, Prague, 1857; the essays on Leibnitz in Trendelenburg's *Beiträge*, vols. ii. and iii., Berlin, 1855, 1867; L. Neff, *Leibniz als Sprachforscher*, Heidelberg, 1870–71; J. Schmit, *Leibniz und Baumgarten*, Halle, 1875; D. Nolen, *La Critique de Kant et la Métaphysique de Leibniz*, Paris, 1875; and the exhaustive work of A. Pichler, *Die Theologie des Leibniz*, Munich, 1869–70.

The best complete accounts of the philosophy of Leibnitz are those of Erdmann, *Gesch. d. neuern Phil.* ii. 2 (abridged in his *Grundriss d. Gesch. d. Phil.*, 3d ed., 1878, pp. 144–170); of Kuno Fischer, *Gesch. d. neuern Phil.*, vol. ii., 2d ed., 1867; and of E. Zeller, *Deutsche Philosophie seit Leibniz*, 1873, pp. 84–195. Fischer's volume contains an excellent biography. (W. R. SO.)

Plate VI.

LEICESTER, an inland county of England, is bounded N. by Nottinghamshire, E. by Lincolnshire and Rutland, S. E. by Northamptonshire, S. W. by Warwickshire, and N. W. by Derbyshire. It lies between 52° 24′ and 52° 59′ N. lat., and between 0° 39′ and 1° 37′ W. long. It has the form of an irregular hexagon, its greatest length being about 44 miles, and its greatest breadth about 40 miles. The area comprehends 511,719 acres, or nearly 800 square miles.

The surface of the county is an undulating table-land, the highest eminences being the rugged Charnwood hills in the north-west, one of which, Bardon Hill, has an elevation of 902 feet. The county belongs chiefly to the basin of the Trent, which forms for a short distance its boundary with Derbyshire. The principal tributary of the Trent in Leicestershire is the Soar, from whose old designation the *Leire* the county is said to derive its name, and which rises near Hinckley and flows beyond Kegworth. The Wreak, which under the name of the Eye rises on the borders of Rutland, flows south-westward to the Soar, and is connected with the canal navigation. Besides the Soar the other tributaries of the Trent are the Anker, the Devon, and the Mease. The Avon after receiving the Swift passes into Warwickshire to join the Severn, and the Welland forms for some distance the boundary between Leicester and Northampton. The principal canals are the Union and Grand Union, which with their various branches are connected with the Grand Junction canal in Northamptonshire, and the Ashby-de-la-Zouch canal, which crosses the western corner of the county to Nuneaton, where it joins the Coventry canal.

Geology.—An irregularly shaped district of country south of the valley of the Trent and adjoining Derbyshire is occupied by Carboniferous rocks, forming the Leicestershire coal-field. In the north-west Charnwood forest is formed of crystalline and slaty rocks, of special interest to geologists, since, as they contain no fossils and occupy an isolated position, it is impossible to determine their age, although they have been variously classed as Cambrian, Silurian, and Laurentian. Further south, the remainder of the county to the west of the river Soar is occupied chiefly by red sandstone rocks of Triassic age, while to the east a blue clay of the same age, mixed with marl, predominates. In several districts, especially in the north-east, there are beds of limestone of Oolite age, and drift deposits overlie all the other formations. At Whitwick there is a remarkable vein of dolerite lying between the Coal-measures and the New Red Sandstone. The Coal-measures, which underlie the New Red Sandstone, are workable in the western and eastern districts of Moira and Coleorton, the total area of productive coal extending to 15 square miles. The available coal in the Moira district is estimated at over 450,000,000 tons, and in the Coleorton district at over 380,000,000 tons. In 1870 the amount of coal produced was 599,450 tons, but for some years it has exceeded 1,000,000 tons, the number of collieries being about thirty. At a depth of 593 feet in the Moira coal-field there is a spring of salt-water, the brine of which is brought to Ashby-de-la-Zouch for use in scorbutic and rheumatic affections. Limestone is worked in various portions of the county, freestone is plentiful, gypsum is found, and a kind of granite, which is extensively used for paving purposes, is obtained at Charnwood forest, Mount-Sorrel, Sapcote, and Stoney-Stanton.

Agriculture.—The climate is mild, and, on account of the inland position of the county, and the absence of any very high elevations, the rainfall is very moderate. The soil is of a loamy character, the richest district being that to the east of the Soar, which is occupied by pasture, while the corn crops are grown chiefly on a lighter soil resting above the Red Sandstone formation. The following table gives a classification of holdings according to size, with the area under each class of holding:—

	50 Acres and under.		From 50 to 100 Acres.		From 100 to 300 Acres.		From 300 to 500 Acres.		From 500 to 1000 Acres.		Above 1000 Acres.		Total.	
	No.	Acres.	No.	Acres.	No.	Acres.	No.	Acres.	No.	Acres.	No.	Acres.	No.	Acres.
1875	5,974	77,391	966	69,044	1,406	243,605	165	60,990	25	15,615	3	3,360	8,539	470,005
1880	5,833	74,464	896	63,409	1,407	244,189	189	66,482	36	21,776	2	2,506	8,363	472,826

A large number of the holdings between 100 and 300 acres are possessed by owners who farm their own land. In 1881 the total area of arable land was 473,998 acres, of which 91,952 were under corn crop, 22,033 under green crop, 25,302 rotation grasses, 317,869 permanent pasture, and 16,842 fallow; 740 acres were under orchards, 345 market gardens, 125 nursery grounds, and 11,252 woods. It will be observed that the proportion of pasture is very great. The pasture land is especially rich along the banks of the rivers. Of corn crops 33,675 acres were under wheat, 27,724 barley, and 23,330 oats. The number of cows in 1881 was 33,863, the total number of cattle being 123,681, an average of 26 to every 100 acres under cultivation, the average for England being 16·9. There are many dairy farms for the manufacture of cheese, the famous Stilton cheese being made near Melton Mowbray. Horses numbered 18,085, the number used for agricultural purposes being 12,243. The breed was much improved by the importation by the well-known agriculturist Bakewell of mares from Flanders. As the county is famed for fox-hunting, there are many excellent riding horses. The number of sheep in 1881 was 263,383, an average of 51 to every 100 acres under cultivation, the average for England being 62·4. The famous New Leicesters, introduced by Bakewell, are the most common, but the Old Leicesters are still bred, and there is also a race of sheep peculiar to Charnwood forest. Pigs in 1881 numbered 21,765. According to the return of 1874, the land in 1872–73 was divided among 13,848 proprietors, possessing 519,524 acres, with an annual rental of £1,493,378, 10s. Of the owners only 35 per cent. possessed more than 1 acre, and the average value per acre all over was £2, 16s. Among the principal proprietors

are the duke of Rutland, possessing 30,109 acres; Lord Donington, 10,174; Earl Howe, 9755; the earl of Stamford and Warrington, 9012; and the earl of Dysart, 8420.

Manufactures.—The staple manufacture of the county is hosiery, for which the wool is obtained chiefly from home-bred sheep. Its principal seats are Leicester, Hinckley, and Loughborough. Cotton hose are likewise made, and the other industries include the manufacture of boots and shoes, elastic webbing, silk plush for hats and lace, agricultural implements, bricks and pottery, and artificial manures.

Administration and Population.—Leicestershire comprises six "hundreds," the municipal and parliamentary borough Leicester (122,351), and five other towns with a population of over 5000, viz., Loughborough (14,733), Hinckley, partly in Warwickshire (7673), Ashby-de-la-Zouch (7465), Melton Mowbray (5766), and Market Harborough (5350). The population of the county, which in 1801 was only 130,030, was 215,867 in 1841, 269,311 in 1871, and 321,018 (155,429 males and 165,589 females) in 1881, the increase within the last ten years being 19·2 per cent.

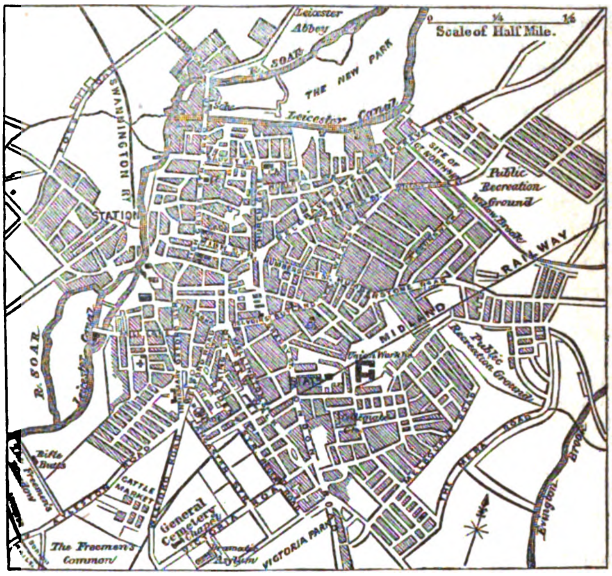
The county returns six members to Parliament,—two for North and two for South Leicestershire, and two for the borough of Leicester. It has one court of quarter sessions, and is separated into nine petty sessional divisions, with which the police divisions are nearly identical. The borough of Leicester has a commission of the peace, a separate court of quarter sessions, and also its own police. The county is almost wholly in the diocese of Peterborough, and contains 331 civil parishes, townships, or places, as well as parts of other parishes. It is included in the Midland circuit, and assizes and quarter sessions are held at Leicester.

History and Antiquities.—Before the Roman invasion Leicestershire was inhabited by the Coritani, and under the Romans it formed part of the province of *Flavia Cæsariensis*. The principal Roman roads are the Watling Street, which forms for 20 miles the south-west boundary of the county from Dovebridge near the Avon to near Atherstone, where it enters Warwickshire; the Fosse road from Lincolnshire, which enters the county at Six Hills, and passes by Leicester to Watling Street; the *Via Devana* from Colchester, which enters the county near Medbourne, and joins the Fosse at Leicester on its way to Chester. The principal Roman stations were *Ratæ* (Leicester), *Verometum* (supposed to have been Borough Hill), *Manduessedum* (Mancetter), and *Benones* (Highcross). Roman coins, urns, tesselated pavements, military weapons, and domestic utensils and other remains have been found in several places, especially at Leicester, Rothley, Wanlip, Harby, Bottesford, Hinckley, Sapcote, and Melton Mowbray. Two miles from Leicester a Roman milestone of the time of the emperor Hadrian was discovered in 1771. Under the Heptarchy Leicester was included in the kingdom of Mercia. Afterwards it was overrun by the Danes, from whom it was recovered by Ethelfleda. The most noteworthy event connected with the county was the battle of Bosworth Field, where Richard III. was slain 22d August, 1485; but it was frequently the scene of contests in the reigns of John and of Henry III. and during the Revolution period.

The principal monastic foundations in Leicester were priories of Black Canons at St. Mary Pre near Leicester founded in 1143, and at Breedon founded in 1144, priories of Benedictines at Hinckley in 1173 and of Benedictine nuns at Langley near Breedon in the time of Henry I., a collegiate church at Leicester founded in the reign of William I., a priory of canons of St. Augustine at Launde in the reign of Henry I. (now changed into a museum), houses of the Knights Hospitallers at Dalby and Heather, a priory of St. Austin at Bradley, a preceptory of Knights Templars at Rothley in 1230, a house of Franciscans at Leicester founded by Simon de Montfort, a friary of St. Augustine called St. Catherine's, also at Leicester, and a convent of canons regular of St. Augustine at Kirkby, founded in 1359. The principal old castles are those of Ashby-de-la-Zouch and Kirkby-Muxloe.

The principal histories of Leicestershire are those of Nichols, 1790, 4th edition 1795-1820, Throsby, 1790, and Curtis, 1831. See also *Domesday Book of Leicester*, 1862; Walcott, *Chantries of Leicester*, 1874; Hull, *Geology of the Leicester Coalfield*, 1860; Aveline, *Geology of part of Leicester*, 1860; Judd, *Geology of part of Leicester*, 1875; Harrison, *Geology of Leicester and Rutland*, 1876. For a fuller list see Anderson, *Topography of the United Kingdom*, 1881.

Leicester, a municipal and parliamentary borough and market-town of England, and the chief town of the county of Leicester, is situated at the intersection of several railway lines, in a gentle hollow on the river Soar, 97 miles north-north-west of London, and 27 south of Nottingham. The town is well built, the streets are spacious and regular, and the sanitary and water arrangements are very satisfactory. The most important of the churches are St. Martin's, near the site of an old Franciscan convent, restored in 1881 at a cost of £20,000; St. Mary's, Early English and Norman, originally built in the 12th century, and restored in 1861 at a cost of £10,000; All Saints, an ancient structure in the Early English style, restored in 1875; St. Margaret's, a beautiful and spacious building erected in 1444, Early English and Decorated, recently restored at a cost of £6000; and St. Nicholas's, in the Early Norman style. Of the old castle two gateways are still standing, and also a portion of the Norman Hall. The other principal buildings are the old town-hall, formerly the guild-hall of Corpus Christi, the new town-hall erected in 1875, the town museum, the school of art, and the public baths, erected in 1879 at a cost of £11,000. One of the ornaments of the town is the memorial clock-tower erected in 1868 in honor of Simon de Montfort and three other less known persons connected with the district. In the neighborhood of the town are the remains of the abbey of Black Canons, founded in 1143. On the site of St. Margaret's church was the old Saxon cathedral, and in the adjoining abbey Cardinal Wolsey was buried. Besides Trinity Hospital, founded in 1331 by Henry Plantagenet, earl of Leicester, and Wyggeston's Hospital, founded in 1513, there are a large number of minor charities. There is a fine promenade from the town to the Victoria park and racecourse, in addition to which the Abbey park of 40 acres has lately been opened. The staple trade of Leicester is hosiery, including stockings and all kinds of fancy goods. There are also iron-foundries, and manufactures of boots and shoes, elastic webs, and sewing cotton. The population of the municipal and parliamentary borough, 17,005 in 1801, had increased in 1871 to 95,220, and in 1881 to 122,351.



Plan of Leicester.

Leicester was an ancient British town, and under the name of *Ratæ* or *Ratiscorion* an important Roman station. It was also one of the five old Danish burghs, and until 874 it was an ecclesiastical see. Its charter of incorporation was obtained from King John, and from the 23d of Edward I. it returned two members to parliament. Parliaments were held in the town by Henry V. in 1414 and by Henry VI. in 1426. Richard III., who passed a night in it on his way to the fatal battle of Bosworth, was buried in the Franciscan convent. The town was stormed by Charles I., May 31, 1645, and recovered by Fairfax in the June following. See the *Histories* of Throsby (1777), Robinson (1791), and Thompson (1871).

LEICESTER, Simon de Montfort, Earl of. See Montfort.

LEICESTER, Robert Dudley, Earl of (c. 1531–1588). This favorite of Queen Elizabeth came of an ambitious family. They were not, indeed, such mere upstarts as their enemies loved to represent them; for Leicester's grandfather—the notorious Edmund Dudley who was one of the chief instruments of Henry VII.'s extortions—was descended from a younger branch of the barons of Dudley. But the love of power was a passion which seems to have increased in them with each succeeding generation, and though the grandfather was beheaded by Henry VIII. for his too devoted services in the preceding reign, the father grew powerful enough in the days of Edward VI. to trouble the succession to the crown. This was that John Dudley, duke of Northumberland, who contrived the marriage of Lady Jane Grey with his own son Guildford Dudley, and involved both her and her husband in a common ruin with himself. Robert Dudley, the subject of this article, was an elder brother of Guildford, and shared at that time in the misfortunes of the whole family. Having taken up arms with them against Queen Mary, he was sent to the Tower, and was actually sentenced to death; but the queen afterwards not only pardoned and restored him to liberty, but appointed him master of the ordnance. On the accession of Elizabeth he was also made master of the horse. He was then, perhaps, about seven and twenty, and was evidently rising rapidly in the queen's favor. At an early age he had been married to Amy, daughter of Sir John Robsart. The match had been arranged by his father, who was very studious to provide in this way for the future fortunes of his children, and the wedding was graced by the presence of King Edward. But it was not a happy marriage. The lady lived alone at Cumnor Hall in Berkshire, the house of one Anthony Forster, and there in the year 1560 she died under circumstances which certainly aroused some suspicions of foul play. The scandal was the more serious as it was insinuated that Dudley stood so high in the queen's favor that he might reasonably hope to marry her, and that a murder had been deliberately planned to remove an obstacle to his advancement. The point, it must be owned, is not free from obscurity, and recent revelations from the archives of Simancas prove that even before the unhappy lady's death it was said there was a design to poison her. After the event, however, the story was that she had broken her neck by a fall down stairs, and suspicious as the case may appear, there is much to be said in favor of Dudley's innocence, which cannot be discussed within our limits. Certain it is that he continued to rise in the queen's favor. She made him a Knight of the Garter, and bestowed on him the castle of Kenilworth, the lordship of Denbigh, and other lands of very great value in Warwickshire and in Wales. In September, 1564, she created him baron of Denbigh, and immediately afterwards earl of Leicester. In the preceding month, when she visited Cambridge, she at his request addressed the university in Latin. The honors shown him naturally excited jealousy, especially as it was well known that he entertained still more ambitious hopes, which the queen apparently did not altogether discourage. The earl of Sussex, in opposition to him, strongly favored a match with the archduke Charles of Austria. The court was divided, and, while arguments were set forth on the one side against the queen's marrying a subject, the other party insisted strongly on the disadvantages of a foreign alliance. The queen, however, was so far from being foolishly in love with him that in 1564 she recommended him as a husband for Mary Queen of Scots. But even this, it was believed, was only a blind, and indeed it may be doubted how far the proposal was serious. After his creation as earl of Leicester great attention was paid to him both at home and abroad. The university of Oxford made him their chancellor, and Charles IX. of France sent him the order of St. Michael. A few years later he formed an ambiguous connection with the baroness dowager of Sheffield, which was maintained by the lady, with great appearance of truth, to have been a valid marriage, though it was concealed from the queen. Long afterwards, in the days of James I., their son, Sir Robert Dudley, a man of extraordinary talents, sought to establish his legitimacy; but his suit was suddenly brought to a stop, and the documents connected with it sealed up by an order of the Star Chamber, without any reasons being assigned.

In 1575 Queen Elizabeth visited the earl at Kenilworth, where she was entertained for some days with great magnificence. The picturesque account of the event given by Sir Walter Scott has made every one familiar with the general character of the scene. Next year Walter, earl of Essex, with whom Leicester had had some differences, died in Ireland, not without suspicion of poison, and Leicester's subsequent marriage with his widow again gave rise to very serious imputations against him. This marriage, like the former, was kept secret at first; but it was revealed to the queen in 1579 by Simier, an emissary of the duke of Alençon, to whose projected match with Elizabeth the earl seemed to be the principal obstacle. The queen showed great displeasure at the news, and had some thought, it is said, of committing Leicester to the Tower, but was dissuaded from doing so by his rival the earl of Sussex. In February, 1582, Leicester, along with a number of other noblemen and gentlemen, escorted the duke of Alençon on his return to Antwerp to be invested with the government of the Low Countries. In 1584 he inaugurated an association for the protection of Queen Elizabeth against conspirators. About this time there issued from the press the famous pamphlet, believed to have been the work of Parsons the Jesuit, entitled *Leicester's Commonwealth*, which was intended to suggest to the people that the English constitution was subverted and the government handed over to one who was at heart an atheist and a traitor, besides being a man of infamous life and morals. The book was ordered to be suppressed by letters from the privy council, in which it was declared that the charges against the earl were to the queen's certain knowledge untrue; nevertheless they produced a very strong impression, and were believed in by some who had no sympathy with Jesuits long after Leicester's death. In 1585 he was appointed commander of an expedition to the Low Countries in aid of the revolted provinces, and sailed with a fleet of fifty ships to Flushing, where he was received with great enthusiasm. In January following he was invested with the government of the provinces, but immediately received a strong reprimand from the queen for taking upon himself a function which she had not authorized. Both he and the States General were obliged to apologize; but the latter protested that they had no intention of giving him absolute control of their affairs, and that it would be extremely dangerous to them to revoke the appointment. Leicester accordingly was allowed to retain his dignity; but the incident was inauspicious, nor did affairs prosper greatly under his management. His nephew Sir Philip Sidney was slain at the unsuccessful siege of Zutphen, and complaints were made by the States General of the conduct of the whole campaign. He returned to England for a time, and went back in 1587, when he made an abortive effort to raise the siege of Sluys. Disagreements increasing between him and the States, he was recalled by the queen, from whom, contrary to the expectation of his enemies, he met with a very good reception; and he continued in such favor that in the following summer (the year being that of the Armada, 1588) he was appointed lieutenant-general of the army mustered at Tilbury to resist Spanish invasion. After the crisis was past he was returning homewards from the court to Kenilworth, when he was attacked by a sudden illness and died at his house at Cornbury in Oxfordshire, on the 4th September.

Such are the bare facts of Leicester's life. Of his character it is more difficult to speak with confidence, but some features of it are indisputable. Being in person tall and remarkably handsome, he improved these advantages by a very ingratiating manner. A man of no small ability and still more ambition, he was nevertheless vain, and presumed at times upon his influence with the queen to a degree that brought upon him a sharp rebuff. On the other hand, Elizabeth stood by him, as we have seen, against efforts to supplant him. That she was ever really in love with him, as modern writers have supposed, is extremely questionable; but she saw in him some valuable qualities which marked him as the fitting recipient of high favors. He was a man of princely tastes, especially in architecture. At court he became latterly the leader of the Puritan party, and his letters were pervaded by expressions of religious feeling which it is hard to believe were insincere. Of the darker suspicions against him it is enough to say that much was certainly reported beyond the truth; but there remain some facts sufficiently mysterious to make a just estimate of the man a rather perplexing problem. (J. GA.)

LEIGH, a market and manufacturing town of Lancashire, England, is situated on several branch railway lines, 7½ miles south-west of Bolton. The ancient parish church was, with the exception of the old tower, rebuilt in 1873 in the Perpendicular style, at a cost of over £10,000. The grammar school, the date of whose foundation is unknown, received its principal endowments in 1655, 1662, and 1681. A union workhouse was erected in 1851 at a cost of £10,000. The staple manufactures of the town are silk and cotton, but there are also glass-works, foundries, breweries, and flour-mills, with extensive collieries. The local government board was formed in 1875 by the amalgamation of those previously existing for the townships of West Leigh, Bedford, and Pennington. The population of the district was 17,623 in 1871, and 21,733 in 1881. The town includes also a portion of the township of Atherton.

LEIGH, EDWARD (1602–1671), Puritan linguist and theologian, was born in 1602 at Shawell, Leicestershire, was educated at Magdalen Hall, Oxford, from 1616, and subsequently became a member of the Middle Temple. In 1636 he entered parliament as member for Stafford, and during the civil war he held a colonelcy in the parliamentary army. He has sometimes been confounded with John Ley, and so represented as having sat in the Westminster Assembly. The public career of Leigh terminated with his expulsion from parliament along with the rest of the Presbyterian party in 1648. From an early period in his life he devoted much of his time to the study of theology and to the preparation for the press of numerous compilations, the most important of these being the *Critica Sacra, containing observations on all the Radices of the Hebrew Words of the Old and the Greek of the New Testament* (1639–44; new ed., with supplement, 1662), for which the author received the thanks of the Westminster Assembly, to whom it was dedicated. It has frequently been reprinted abroad, and, in the opinion of Leigh's contemporary Fuller, it, "with many other worthy works, will make his judicious industry known to posterity." It is now, however, but little used. Leigh died in Staffordshire in June, 1671.

His remaining works include *A Treatise of Divinity* (1646–51), *A Body of Divinity* (1654), *Annotations upon the New Testament* (1650), of which a Latin translation by Arnold was published at Leipsic in 1732, *Annotations on the Five Poetical Books of the Old Testament* (1657), *A Treatise of Religion and Learning* (1656), *Select and Choice Observations concerning the First Twelve Cæsars* (1635).

LEIGHTON, ROBERT (1611–1684), bishop of Dunblane, and afterwards archbishop of Glasgow, was the eldest son of Dr. Alexander Leighton, the author of *Zion's Plea against the Prelacie*, whose terrible sufferings for having dared to question the divine right of Episcopacy, under the persecution of Laud, form one of the most disgraceful incidents of the reign of Charles I. Dr. Leighton is said to have been of the old family of Ulishaven in Forfarshire, and his illustrious son was born in the year 1611. From his earliest childhood, according to Burnet, he was distinguished for his saintly temper and disposition, and in his sixteenth year (1627) he was sent to complete his education at the university of Edinburgh, where, after studying with distinguished success for four years, he took his degree of M. A. in 1631.[1]

After leaving college his father sent him to travel abroad, and he is understood to have spent several years in France, where he acquired a complete mastery of the French language. While there he passed a good deal of time with some relations at Douay who had become Roman Catholics, and with whom he would seem to have formed a strict friendship, as he kept up a correspondence with them for many years afterwards. Either at this time or on some subsequent visit to the Continent he had also a good deal of intercourse with some members of the Jansenist party. And no doubt what he then saw among these excellent persons of the piety which was possible even in a communion which he believed to be corrupt contributed not a little to the charity towards those who differed from him in religious opinions, which ever afterwards formed so remarkable a feature in his character. The exact period of his return to Scotland has not been ascertained; but in 1641 he was ordained Presbyterian minister of Newbattle in Midlothian, where he continued for about ten years. At the end of that period he resigned his charge, and went to reside in Edinburgh (1652). What the precise circumstances were which led him to take this step does not distinctly appear. But the account given is that the fiery zeal of his brother clergymen on certain political questions found little sympathy with him, and that this led to severe censures on their part, which were too much for his gentle nature to bear.

Early in the following year (1653) he was appointed principal of the university of Edinburgh, and primarius professor of divinity. In this post he continued for seven or eight years, and, according to Burnet, "he was a great blessing in it; for he talked so to all the youth of any capacity or distinction that it had a great effect on many of them." A considerable number of his Latin prelections and other addresses to the students were published after his death, and are singularly remarkable for the purity and elegance of their Latinity, and their subdued and meditative eloquence. The reader will be disappointed if he expects to find in them any subtle exposition of a metaphysical system of theology. In this respect they present a curious contrast to any thing that is known of the theology taught at that time in the Presbyterian Church of Scotland. They are rather to be regarded as valuable instructions in the art of living a holy life than as a body of scientific divinity. Throughout, however, they bear the marks of a deeply learned and accomplished mind, fully saturated with both classical and patristic reading, and like all his works they breathe the spirit of one who lived very much above the world. It would be interesting to ascertain how far he succeeded in instilling something of his own spirit into the minds of those who listened to his teaching. We certainly meet with very little indication of its having taken any deep root in the hearts of either the Presbyterian or the Episcopalian clergy of the twenty or thirty years which succeeded the period of his principalship. The only writer of the time who has spoken with true appreciation of his character is Bishop Burnet; both in his *History of his Own Times* and in his *Pastoral Care* he has referred to Leighton in language of unbounded affection and admiration. This, however, was founded upon knowledge of him obtained in the course of a friendship formed after he had demitted his office of principal, and not upon his university teaching.

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[1] One has difficulty in thinking of even the youthful Leighton as capable of humor or sarcasm. But it so happens that the only anecdote of his college career which has been preserved to us indicates the presence of some trace of these in his character. The provost of Edinburgh at the time was a certain David Aikenhead, who had probably made himself offensive in some way to the young collegians, and Leighton, it appears, was tempted to perpetrate the following little epigram upon him:—

> "That quhilk his name pretends is falsely said,
> To wit that of ane aike his head is made,
> For if that it had been composed soe,
> His fyrie nose had flaimed it long agoe."

To "blaspheme the bailies" (much more the provost) was at that time a somewhat serious offence, and we are told that he was "extruded" from the college for his attack upon the provost's nose. It would seem, however, that the offence was speedily condoned, as he is found soon afterwards to have been restored to his position.

In 1661, when Charles II. had resolved to force Episcopacy once more upon Scotland, he fixed upon Leighton for one of his bishops. Looking at the matter, as we are apt to do, in the light of what followed in the history of Scotland during the next twenty-seven years, it seems almost unaccountable how such a man as Leighton could have submitted as he did to the degradation of being associated with coadjutors like Sharp and some of his companion bishops. The only explanations which can be given perhaps are that Leighton, living very much out of the world, and being somewhat deficient in what may be called the political sense, had no idea of the deadly hatred entertained toward Episcopacy by the great mass of the religious people of Scotland, and so of its utter unfitness to become the established church polity of the country, and that his soft and gentle nature rendered him too open to the persuasions which were used to induce him to enter a sphere for which he instinctively felt he was ill qualified. Every one will give him credit too for having no conception that the only object of the Government in establishing Episcopacy in Scotland was to make it subservient to despotism and persecution. The Episcopacy which he contemplated was that modified form which had been suggested by Archbishop Ussher, and to which Baxter and many of the best of the English Nonconformists would have readily given their adherence. It is significant on this head that he always refused to be addressed as "my lord," and it is stated that when dining with his clergymen on one occasion he was so far from arrogating any right of superiority or precedence that he wished to seat himself at the foot of the table.[1]

If Leighton did not know before, he soon began to discover the sort of men with whom he was to be associated in the episcopate. He travelled with them in the same coach from London towards Scotland, but having become, as he told Burnet, very weary of their company (as he doubted not they were of his), and having found that they intended to make a kind of triumphal entrance into Edinburgh, he left them at Morpeth and retired to the earl of Lothian's at Newbattle. He very soon, we are told, lost all hope of being able to build up the church by the means which the Government had set on foot, and his work, as he confessed to Burnet, "seemed to him a fighting against God." He did, however, what he could, governing his diocese (that of Dunblane) with the utmost mildness, as far as he could preventing the persecuting measures which were in active operation elsewhere, and endeavoring to persuade the Presbyterian clergy to sink their differences and come to an accommodation with their Episcopal brethren. In this last matter he seems to have succeeded no better with the Presbyterians than Baxter in England did in a similar attempt with the Episcopalian party; and, after a hopeless struggle of three or four years to induce the Government to put a stop to their fierce persecution of the Covenanters, he at length determined to resign his bishopric, and went up to London in 1665 for this purpose. He told the king that "he could not concur in the planting the Christian religion itself in such a manner, much less a form of government," and so far worked upon the mind of Charles that he promised to enforce the adoption of milder measures. In the hope that this would be carried into effect, he returned to his diocese, but it does not appear that any material improvement took place. In 1669 Leighton again went to London and made fresh representations on the subject, which were so far attended to, but, partly perhaps from faults on the Presbyterian as well as the Episcopalian side, little result followed. The slight disposition, however, shown by the Government to accommodate matters appears to have inspired so much hope into Leighton's mind that in the following year he agreed, though with a good deal of hesitation, to accept the archbishopric of Glasgow. In this new and higher sphere he redoubled his efforts with the Presbyterians to bring about some degree of conciliation with Episcopacy, but all was of no avail, and the only result of his attempts was to embroil himself with the hot-headed Episcopal party as well as with the Presbyterians. In utter despair, therefore, of being able to be of any further service to the cause of religion, he at length in 1674 threw up the archbishopric and retired, after a short stay, probably with his successor in the divinity chair, William Colville, within the precincts of Edinburgh university, to the house of his widowed sister, Mrs. Lightmaker, at Broadhurst in Sussex. Here he spent the remaining ten years, in all likelihood the happiest, of his life, and died somewhat suddenly on a visit to London in 1684, in the seventy-fourth year of his age.

It is difficult to form a just or at least a full estimate of Leighton's character. He stands almost alone in his age. In some respects he was immeasurably superior both in intellect and in piety to most of the Scottish ecclesiastics of his time; and yet he seems to have had almost no influence in moulding the characters or conduct of his contemporaries. One is half inclined to think that he would have shown himself a greater or at least a more complete man if a few natural weaknesses and imperfections had intermingled with his nobler qualities. So intense was his absorption in the love of God that little room seems to have been left in his heart for human sympathy or affection. Can it be that there was after all something to repel in his outward manner? Burnet tells us that he had never seen him to laugh, and very seldom even to smile. One can hardly forgive him for regarding Episcopacy so purely under the dry light of human reason after the horrible treatment which his excellent father had suffered from it. In other respects, too, he gives the impression of standing aloof from human interests and ties. It may go for little that he never married, but it was surely a curious idiosyncrasy in the man that he habitually cherished the wish (which was granted him) that he might die in an inn, where there could be no loving hand to support, no loving heart to cheer him. In fact, holy meditation seems to have been the one absorbing interest of his life. At Dunblane tradition still preserves the memory of "the good bishop," silent and companionless, pacing up and down the sloping walk by the river's bank under the beautiful west window of his cathedral. And from a letter of the earl of Lothian to his countess it appears that, whatever other reasons Leighton might have had for resigning his charge at Newbattle, the main object which he had in view was to be left to his own thoughts. It is therefore on the whole not very wonderful that he was completely misjudged and even disliked both by the Presbyterian and the Episcopal party. Some of the bitter expressions of hatred towards him, however, on the part of the former, sound very strange to us who now know how holy, humble, and blameless the man really was. Thus in *Naphtali* it is said, "Mr. Leighton, prelate of Dumblain, under a Jesuitical-like vizard of pretended holiness, humility, and crucifixion to the world, hath studied to seem to creep upon the ground, but always up the hill, toward promotion and places of more ease and honor, and as there is none of them all hath with a kiss so betrayed the cause and smitten religion under the fifth rib, and hath been such an offence to the godly, so there is none who by his way, practice, and expressions giveth greater suspicion of a popish affection, inclination, and design." So also in the continuation of Robert Blair's life by his son-in-law, William Ross, the most innocent of Leighton's acts have a malicious interpretation put upon them. When he resigned Newbattle, he "pretended insufficiency for the ministry;" when he returned to Edinburgh as bishop and expressed an opinion in favor of the English liturgy and ceremonies, "it was suspected that he was popish and Jesuited;" when he refused the title of lord, and in other respects carried himself modestly and humbly, he was simply "a pawky prelate." When he spoke in parliament in favor of the outed ministers, and thought that they ought to be "cherished and embraced" instead of persecuted, offending all the other prelates by the course he took, "it was difficult what to judge of his actings or sayings, he carried so smoothly among the ministers of his diocese." Some, indeed, we are told, thought well of him, but others thought "that he spoke from a popish principle." When he behaved sweetly and gently to the clergy of his diocese, telling them to hold their presbyteries and sessions as before, and suggesting without commanding any thing, it was "thought that he was but straking cream in their mouths at first." When disgusted with the proceedings of the other bishops in "outing so many honest ministers and filling their places with insufficient and for the most part scandalous men," and intimating his wish to demit his office in consequence, he was only "*pretending* to be displeased." When the king wrote to the council that some of the most peaceable and moderate outed ministers might have liberty to preach, and Leighton pleaded that *all* might have the like liberty, it was "thought that he did this of purpose to oppose and crush it." Nothing that the good man could say or do brought upon him anything but suspicion and calumny. Even Wodrow, who generally gets credit for fairness and candor, tells us that "he was judged void of any doctrinal principles," and that he was regarded "as very much indifferent to all professions which bore the name of Christian."

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[1] For an interesting and characteristic indication of the purity of his motives in accepting a bishopric, reference may be made to his letter to the earl of Lothian, dated December 23, 1661, which is still preserved among the Lothian papers.

It is worth while to set over against these uncharitable and malignant insinuations the estimate which his intimate friend Bishop Burnet formed of him. At the conclusion of his *Pastoral Care*, he says, "I have now laid together with great simplicity what has been the chief subject of my thoughts for above thirty years. I was formed to them by a bishop that had the greatest elevation of soul, the largest compass of knowledge, the most mortified and heavenly disposition that I ever yet saw in mortal; that had the greatest parts as well as virtue, with the perfectest humility that I ever saw in man, and had a sublime strain in preaching, with so grave a gesture, and such a majesty of thought, of language, and of pronunciation, that I never once saw a wandering eye where he preached, and have seen whole assemblies often melt in tears before him; and of whom I can say with great truth that, in a free and frequent conversation with him for above two and twenty years, I never knew him say an idle word, or one that had not a direct tendency to edification; and I never once saw him in any other temper but that which I wished to be in, in the last minutes of my life."

No one can study Leighton's works without feeling that Burnet's judgment of the man must have been the true one. We know not if anywhere, except in Holy Scripture, there is to be found so much of what seems to breathe the very breath of heaven, or to be the expression of a life quite apart from the life of this world. It was characteristic of him that he could never be made to understand that anything which he wrote possessed the smallest value. None of his works were published by himself, and it is stated that he actually left orders that all his MSS. should be destroyed after his death. But fortunately for the world this charge was disregarded. Like all the best writing, it seems to flow from his pen without effort. It is simply the easy unaffected outcome of his saintly nature, and hence it always carries the reader along with it without arresting the current of his thoughts or diverting his attention by brilliant flashes of imagination or curious turns of expression like what we find in Jeremy Taylor, Dr. Donne, and others of that time. Throughout, however, it is the language of a scholar and a man of perfect literary taste; and with all its spirituality of thought there are no mystical raptures, and none of that luscious sensuousness which sometimes intermingles itself in the Scottish practical theology of the 17th century. No writer conveys a clearer or more elevated idea both of what Christian religion is and what it is capable of in the heart of man. It was a common reproach against Leighton, as we have seen, that he had leanings towards Roman Catholicism, and perhaps this is so far true that he had formed himself in some degree upon the model of some of those saintly persons of that faith, such as Pascal and Thomas a Kempis, who had carried the spiritual life to more ethereal heights than appear to be as yet attained within the lines of Protestantism.

Editions.—It is matter of regret that no perfectly satisfactory edition of Leighton's works has as yet appeared. After his death his *Commentary on Peter* and several of his other works were published under the editorship of his friend Dr. Fall, and on the whole those early editions may be said to be, with some drawbacks, by far the best. All his later editors have unfortunately been possessed by the tasteless mania of reducing his good archaic and nervous language to the bald feebleness of modern phraseology, dealing with him like literary martinets correcting a schoolboy's themes. It is unfortunately impossible to exempt from this criticism even the edition, in other respects very valuable and meritorious, lately published under the superintendence of the Rev. W. West (London, 1875).

(J. T. BR.)

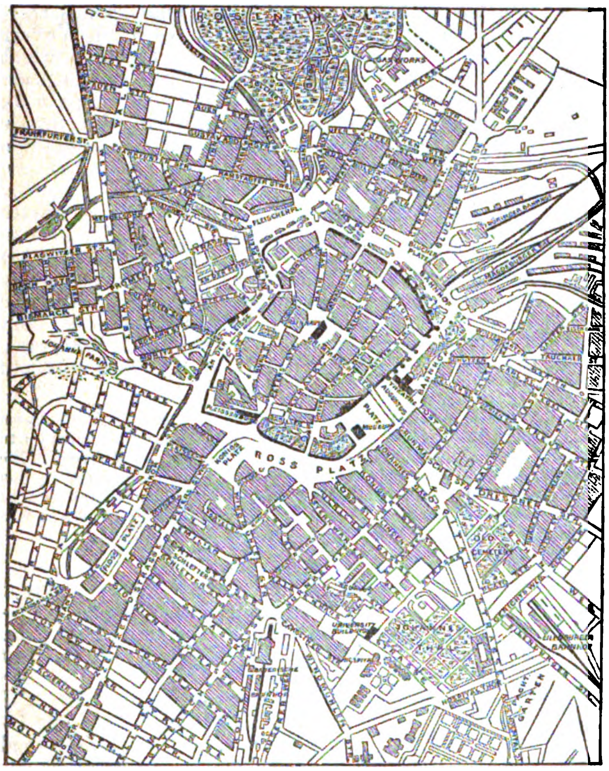
LEIGHTON-BUZZARD, a market-town of Bedfordshire, is situated on the river Ouse, which there divides Bedford from Bucks, and on the North-Western Railway, 40 miles north of London. The town, which is generally well built, contains a spacious market-place, and of late great improvement has taken place in the appearance of the shops. The church of All Saints, in the Early English style of architecture, possesses a tower and spire 193 feet in height. In the market-place are the town-hall, rebuilt in 1852, and containing portions of a very ancient structure, the corn exchange erected in 1862, and the fine old market-cross, in the Perpendicular style, erected in 1330. National school premises were built in 1872. There are also several charities. The manufacture of straw plait gives employment to a considerable number of females, but the town is chiefly dependent on agriculture. The population of the registration sub-district in 1871 was 9942, and in 1881 it was 10,384.

Some identify Leighton-Buzzard with the *Lygeanburgh* mentioned in the Saxon Chronicle as having been taken in 571 by Cuthwulf, brother of Ceawlin, king of Wessex. The addition Buzzard has been conjectured to be a corruption of *Beau-desert*, but others also derive it from Bozzard or Bosart, the name of an ancient family, one of whom was knight of the shire in the time of Edward III.

LEINSTER. See IRELAND.

LEIPSIC (in German, *Leipzig*), the second town of the kingdom of Saxony in size, and the first in commercial importance, is situated in a large and fertile plain, in 51° 20′ 6″ N. lat. and 12° 23′ 37″ E. long., about 65 miles north-west of Dresden and 6 miles from the Prussian frontier. It stands just above the junction of three small rivers, the Pleisse, the Parthe, and the Elster, which flow in various branches through or round the town, and afterwards, under the name of Elster, discharge themselves into the Saale. Though of unimposing exterior, Leipsic is one of the most prosperous and enterprising of German towns. Besides being the most important commercial city in Germany next to Hamburg, it possesses the second largest German university, is the headquarters of the supreme courts of the empire, and forms one of the most prominent literary and musical centres in Europe. It consists of the old or inner city, surrounded by a wide and pleasant promenade laid out on the site of the old fortifications, and of the very much more extensive inner and outer suburbs. Beyond the last is a fringe of thriving suburban villages, such as Reudnitz, Volkmarsdorf, Gohlis, Eutritzsch, Plagwitz, and Lindenau, which are gradually becoming absorbed by the growth of the town. On the north-west the town is bordered by the fine public park and woods of the Rosenthal.

The old town, with its narrow streets and numerous houses of the 16th and 17th centuries, still preserves much of its quaint mediæval aspect. The most interesting of its buildings are the Rathhaus, a Gothic edifice built by Hieronymus Lotter in 1556 (now doomed to demolition), and the Fürstenhaus, with its curious projecting balconies. The Pleissenburg, or citadel, now used for barracks and public offices, also dates from the middle of the 16th century. Auerbach's Keller, a curious old wine-vault, is interesting for the use made of it by Goethe in his *Faust;* it contains a series of mural paintings of the 16th century, representing the legend on which the play is based. The business of Leipsic is chiefly concentrated in the inner city; but the headquarters of the book trade lie in the east suburb. The streets of the suburbs are mostly broad and well built. The most notable modern buildings are the new theatre, an imposing Renaissance structure designed by Langhans, and the museum, which stand facing each other at opposite ends of the spacious Augustus-Platz. Most of the west side of the same square is occupied by the Augusteum, or main building of the university, which, however, also possesses several special institutes in another part of the town. The new district law courts are contained in a large and substantial though not specially imposing building, and the municipal hospital and the hospital of St. John are also handsome edifices. The so-called Roman House, with loggie and frescoes in the Italian style, is the only private dwelling demanding remark. The churches of Leipsic are comparatively uninteresting. The oldest, in its present form, is the Paulinerkirche or university church, built in 1229–40, and the largest is the Thomaskirche, dating from 1496. The university of Leipsic, founded in 1409 by a secession of two thousand German students from Prague, has long ranked among the most important in Germany. A few years ago it was also the most numerously attended, but it is now outstripped by Berlin, which has about four thousand students as compared with thirty-five hundred at Leipsic (1882). The professors and "Privatdocenten," or lecturers, number about one hundred and seventy. The university library contains 350,000 volumes and 4000 manuscripts; it occupies the Paulinum, a characteristic specimen of old monastic architecture, dating in part from 1229–1240. The other educational institutions of Leipsic include three gymnasia, two "Realschulen," a commercial academy (*Handelsschule*), a high school for girls, another for boys, and a large number of admirable public and private schools of a lower grade.



Plan of Leipsic.

The number of literary, scientific, and artistic institutions in Leipsic is unusually large for the size of the town. One of the most important is the museum, which contains about four hundred modern paintings, a large number of casts, a few pieces of original sculpture, and a well-arranged collection of drawings and engravings. The art-industrial museum, the collection of the historical society, and the ethnographical museum are also of considerable interest, and will be still more useful when they are united in the large building to be erected for them with part of the munificent bequest made to the town by Herr Grassi in 1881. As a musical centre Leipsic is known all over the world for its excellent conservatorium, founded in 1843 by Mendelssohn-Bartholdy. The series of concerts given annually in the old Gewandhaus, or Drapers' Hall, is also of world-wide reputation, and the operatic stage of Leipsic is deservedly ranked among the finest in Germany. A further stimulus to the musical taste of the inhabitants is afforded by the numerous vocal and orchestral societies, some of which have brought their art to a very high pitch of perfection. The prominence of the publishing interest (more fully noticed below), has attracted to Leipsic a large number of gifted authors, and made it a literary centre of considerable importance. About two hundred and seventy newspapers and periodicals are published here, including several of the most widely circulated in Germany.

The outstanding importance of Leipsic as a commercial town is mainly derived from its three great fairs, which annually attract a concourse of about forty thousand merchants from all parts of Europe, and from Persia, Armenia, and other Asiatic countries. The most important fairs are held at Easter and Michaelmas, and are said to have been founded as markets about 1170. The smaller New Year's fair was established in 1458. In 1268 Margrave Dietrich granted a safe-conduct to all frequenters of the fairs, and in 1497 and 1507 the emperor Maximilian greatly increased their importance by prohibiting the holding of annual markets at any town within a wide radius of Leipsic. During the Thirty Years' War, the Seven Years' War, and the troubles consequent upon the French Revolution, the trade of the Leipsic fairs considerably decreased, but it recovered itself after the accession of Saxony to the German Customs Union (*Zollverein*) in 1833, and for the next twenty years rapidly and steadily increased. Since then, owing to the greater facilities of communication and consequent alterations in the mode of conducting business, the transactions at the fairs may be said to have diminished in relative though they have increased in actual value. Wares that can be safely purchased by sample appear at the fairs in steadily diminishing quantities, while others, such as hides, furs, and leather, which require to be actually examined, show as marked an increase. It is impossible to give accurate statistics of the business done at the fair, but the value of the sales considerably exceeds £10,000,000 sterling per annum. The principal commodity is furs (chiefly American and Russian), of which about one and a quarter million pounds worth are annually disposed of; next in order come leather, hides, wool, cloth, linen, and glass. The Leipsic wool-market, held for two days in June, is also important.

In the trades of bookselling and publishing Leipsic occupies a unique position, not only taking the first place in Germany, but even surpassing London and Paris in the number and total value of its sales (Hasse, *Leipzig und ihre Umgebung*, p. 236). There are upwards of three hundred publishers and booksellers in the town, and about five thousand firms in other parts of Europe are represented here by commissioners. About 2500 books, or one-sixth of the total production of Germany, are published in Leipsic annually. Several hundred booksellers assemble in Leipsic every year at Jubilate, and settle their accounts at their own exchange (*Buchhändler-Börse*). Leipsic also contains seventy printing-works, some of great extent, and a corresponding number of type-foundries, binding-shops, and other kindred industries. The so-called "polygraphic" industries give employment to nearly ten thousand hands.

As a manufacturing town Leipsic is important rather for the variety than for the magnitude of its industries. The great manufacturing staples, such as iron and the textile fabrics, are scarcely represented at all, but in certain specialties, such as etheric oils, artificial flowers, and perfumes, it ranks before any other town in Germany. In absolute value the most important articles of manufacture are pianos and other musical instruments, tobacco and cigars, spirits, chemicals, scientific instruments, and waxcloth. Wool-combing has also of late years been extensively carried on. Upwards of fifty thousand workpeople are employed in the factories in and around Leipsic.

The population of Leipsic has been quintupled within the present century, rising from 31,887 in 1801 to 153,988 in 1881, and has of late increased at the rate of between 3 and 4 per cent. per annum. With the suburban villages the population amounts to 220,000. While the dwelling-houses in the suburbs have been multiplied sixfold in the last two hundred years, the number in the inner town has remained almost stationary for the same period, the business part of Leipsic thus exhibiting the same phenomenon as in other large cities. The vast majority of the population (upwards of 90 per cent.) belongs to the Lutheran Church, while the religious bodies next in numerical order are the Roman Catholics (4288), the Reformed (3368), and the Jews (3179). The annual death-rate is 23 to 24 per 1000, in which Leipsic, thanks in part to its excellent system of drainage, compares favorably with other large German towns. It is remarkable that the proportion of suicides to population is larger in Leipsic than in any other European town. In the five years 1876–80 no fewer than 332 persons voluntarily put an end to their lives, being at the rate of 62 per annum, or 1 suicide to every 30 deaths of adults.

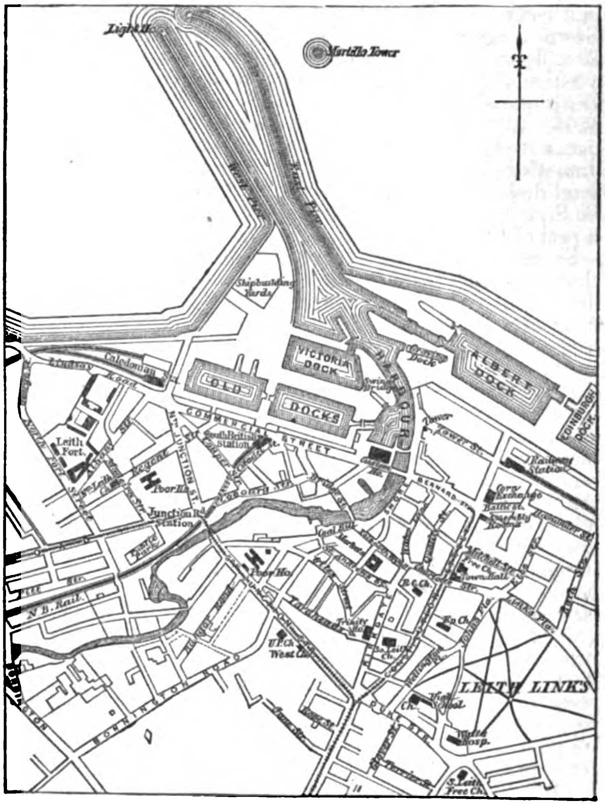
History.—Though recent discoveries point to the conclusion that the site of Leipsic was inhabited even during the Stone Age, the history of the present town begins with the foundation of a Sorbian fishing village at the junction of the Pleisse and the Parthe, which derived its name of Lipzk from the Slavonic *lip* or *lipa*, a lime-tree. This settlement was probably already in existence when the emperor Henry I. built a castle here about 920. The Slavonic language long continued to be spoken in Leipsic, and was legal in the courts of law down to 1327. The first historical mention of Leipsic occurs in a writing of the beginning of the 11th century, when it is spoken of as an "urbs," or fortified place. In 1134 it came into the possession of Conrad of Wettin, margrave of Meissen, and under Margrave Otho the Rich (1156–89) it received many important privileges, and became a flourishing town of 5000 to 6000 inhabitants. Its favorable situation, almost equidistant from the Baltic Sea and the Alps, the Rhine and the Oder, in the midst of a fertile plain intersected by the principal highways of central Europe from north to south and east to west, co-operated with the fostering care of the margrave in raising it in the 15th century to the position of one of the most important commercial towns in Germany. The growth of its fairs, which of course were mainly instrumental in producing this result, has been above described. The famous conference between Luther and Dr. Eck, held in the Leipsic Pleissenburg in 1519, did much for the spread of the Reformation, but it was not till twenty years later that Leipsic formally espoused the Protestant cause. In 1547, in the war of the Smalkaldic league, the town was besieged and the suburbs reduced to ashes, and during the Thirty Years' War it suffered six sieges and was four times occupied by hostile troops. Its commerce was also greatly interrupted by the Seven Years' War. The publishing trade of Leipsic began to grow important towards the end of the 17th century, when the severity of the censorship at Frankfort-on-the-Main caused many of its booksellers to emigrate to Leipsic. The preliminary years of the French Revolutionary wars were not unfavorable to the commerce of Leipsic, but in 1813 and 1814 the town suffered greatly. Its accession to the Zollverein in 1833 and the establishment of the German system of railways (of which Leipsic is an important centre) inaugurated a period of great prosperity, which has continued to the present day. The revolutionary riots of 1848–49 and the Prussian occupation in 1866–67 were merely passing shadows. In 1879 Leipsic acquired a new importance by becoming the seat of the supreme courts of the German empire.

The immediate neighborhood of Leipsic has been the scene of numerous battles, two of which are of more than ordinary importance, viz., the battle of Breitenfeld in 1631 (vol. xi. p. 299), and the great battle of Leipsic, known in Germany as the *Völkerschlacht*, fought in 1813 between Napoleon and the allied forces of Russia, Germany, and Austria.

Towards the middle of the last century Leipsic was the seat of the most influential body of literary men in Germany, over whom GOTTSCHED (*q.v.*) like his contemporary Samuel Johnson in England, exercised a kind of literary dictatorship. Then, if ever, Leipsic deserved the epithet of a "Paris in miniature" (*Klein-Paris*), assigned to it by Goethe in his *Faust*. The young Lessing produced his first play in the Leipsic theatre, and the university counts Goethe, Klopstock, Jean Paul Richter, the Schlegels, Fichte, Schelling, and numerous other eminent writers and thinkers among its quondam alumni. Schiller also resided for a time in Leipsic, and Sebastian Bach, Hiller, and Mendelssohn all filled musical posts there. Among the famous natives of the town are the philosopher Leibnitz and the composer Wagner.

See the *Urkundenbuch der Stadt Leipzig*, 1870 *sq.*; Grosse, *Geschichte der Stadt Leipzig*, 1837–42; Sparfeld, *Chronik der Stadt Leipzig*, 2d ed., 1851; Gretschel, *Die Universität Leipzig*, 1830; Moser, *Leipzig's Handel und Messen*, 1869; Hasse, *Die Stadt Leipzig und ihre Umgebung geographisch und statistisch beschrieben*, 1878; the *Mittheilungen* of the Statistical Bureau of Leipsic; and the *Schriften* of the Leipsic Historical Society. (J. F. M.)

LEITH, a municipal and parlimentary burgh of Midlothian, the chief seaport of the east coast of Scotland, 1¾ miles north by east of Edinburgh, with which it is connected by Leith Walk and other lines of street. It is built on the southern shore of the Firth of Forth, at the mouth of the Water of Leith, which, crossed by



Plan of Leith.

seven bridges, divides it into North and South Leith. Stretching along the coast for about 3¼ miles from Seafield on the east to Granton on the west, the burgh includes the fishing village of Newhaven, the suburb of Trinity, and part of Wardie, and extends to an area of 1978 acres. It figures as Inverleith ("mouth of the Leith") in the foundation charter of Holyrood Abbey (1128): and many of its houses, in narrow wynds and along the eastern waterside, have an antique and decayed appearance. The earliest date on any is 1573; but one at the Coalhill, is thought to be the "handsome and spacious edifice" built for her privy council by the queen regent, Mary of Guise. Nothing remains of D'Essé's fortifications (1549) or of Cromwell's "fair citadel" (1650); but it was Cromwell's troops that raised the battery mounds upon the Links, a grassy expanse of 1140 by 400 yards, bought for a public park in 1857. Leith Fort, the headquarters of the royal artillery in Scotland, dates from 1779; the quaint old Tolbooth, where Maitland of Lethington poisoned himself (1573) was demolished in 1819; and the public buildings one and all are modern, most of them classical structures. They comprise the town-hall (1828), the custom-house (1812), Trinity-house (1817), with David Scott's Vasco de Gama and other paintings, the exchange buildings, the corn exchange (1862), the markets (1818), the slaughter-house (1862), the post-office (1876), the public institute (1867), the poor-house (1862), the hospital (1872–76), John Watt's hospital (1862), the high school (1806), and Dr. Bell's school (1839). In December, 1881, eight board schools had 4839 children on the roll, and an average attendance of 3932.

Of twenty-seven churches, belonging to nine different denominations, the only ancient one is that of South Leith parish, which, founded in 1483, and dedicated to St. Mary, was originally cruciform, but now, as "restored" in 1852, consists of merely an aisled nave and square north-western tower; David Lindsay preached in it before James VI. a thanksgiving sermon on the Gowrie conspiracy (1600), and in its graveyard lies the Rev. John Home (1722–1808), author of *Douglas*, and a native of Leith. Other places of worship are North Leith parish church (1814–16), with Grecian spire of 158 feet; North Leith Free church (1859), in Germanized Gothic, with spire of 160 feet; and St. James's Episcopal church (1862–69), a cruciform structure, designed in Early English style by the late Sir G. G. Scott, with apsidal chancel, a spire of 160 feet, and a peal of bells.

So early as 1313 Leith possessed its ships, they in that year being burnt by the English. But in a wide flat foreshore and drifting sands the port has had great difficulties to contend with; and Tucker in 1656 describes it merely as "a convenient dry harbor into which the firth ebbs and flows every tide, with a convenient quay on the one side thereof, of a good length for lading of goods." The earliest dock was commenced in 1720, and the custom-house quay constructed in 1777; but little of the existing works is older than the present century. These, with date, cost, and area, comprise the Old docks (1801–17; £285,108; 10½ acres), the Victoria dock (1852; £135,000; 5 acres), the Albert dock (1863–69; £224,500; 10¾ acres), and the Edinburgh dock (1874–81; £400,000; 16¾ acres); in connection with the last two 62 and 108 acres were reclaimed from the east sands. The largest of seven graving docks, the Prince of Wales dock (1858), measures 370 by 60 feet, and cost £100,000; the east and west piers, extended or formed during 1826–52, and respectively 3530 and 3123 feet long, leave an entrance to the harbor 250 feet broad, with a depth at high water of 20 to 25 feet. The aggregate tonnage registered as belonging to the port was 1702 in 1692, 6935 in 1752, 25,427 in 1844, 28,303 (3946 steam) in 1854, 33,303 in 1860, 44,892 in 1867, 65,692 in 1873, 74,713 in 1878, and 86,509 on 31st December, 1881, viz., 64 sailing vessels of 16,371 tons, and 125 steam-vessels of 70,138 tons, the largest of the latter being one of 2144 tons. This shows marked progress, as likewise does the following table, giving the aggregate tonnage of British and foreign vessels that entered and cleared from and to foreign ports and coast-wise, in cargoes and ballast, during the years ending 15th May:—

Year.	Entered.			Cleared.		
	Sailing.	Steam.	Total.	Sailing.	Steam.	Total.
1854	...	...	369,499	...	...	364,022
1867	235,065	321,035	556,100	97,669	304,806	402,475
1875	304,201	534,479	838,680	291,344	536,458	827,797
1878	309,751	652,624	962,375	312,621	654,427	967,048
1879	250,343	595,258	845,601	252,062	593,751	845,813
1880	261,407	678,793	940,200	263,927	681,308	945,235
1881	262,871	711,282	974,153	259,143	712,056	971,199

Of 3838 vessels of 952,580 tons that entered in the twelvemonth ending 31st December, 1880, 861 of 215,268 tons were foreign, 464 of 61,514 tons were in ballast, and 2241 of 343,005 tons were coasters; whilst of 3766 of 935,607 tons that cleared in the same year, 837 of 212,250 tons were foreign, 1093 of 225,655 tons were in ballast, and 2611 of 471,055 tons were coasters. The total value of foreign and colonial imports was £7,887,096 in 1876, £9,777,270 in 1877, £8,514,889 in 1878, £7,351,548 in 1879, and £9,475,030 in 1880. The total value of exports again was £3,145,829 in 1876, £2,861,992 in 1877, £2,804,912 in 1878, £3,036,780 in 1879, and £2,819,111 in 1880. Lastly, the customs revenue has fluctuated between £607,264 in 1867 and £290,570 in 1880,—the amount for the year ended March 31, 1882, being £466,018; and the port's revenue and expenditure amounted to £1,996,609 and £1,993,947 from July, 1838 to May, 1876, and to £655,682 and £606,306 from 15th May, 1876, to 15th May, 1881.

In 1511 James IV. here "buildit the 'Michael,' ane verrie monstruous great ship, whilk tuik sae meikle timber that schee waisted all the woodis in Fyfe, except Falkland wood, besides the timber that cam out of Norroway;" at present three shipbuilding yards employ together nearly two thousand men. During the six years, 1875–80, 10 sailing vessels of 932 tons and 34 steam-vessels of 11,217 tons were built at Leith, of which those built in 1880 were all steamships—11 of 3655 tons being of iron, and 5 of 191 tons of wood. Glass-making dates from 1682, sugar-refining from 1757, meat-preserving from 1837; and other industries are flour-grinding, canvas-weaving, soap-boiling, rope-making, engineering, tanning, and the manufacture of artificial manures. Leith is an important centre of trade in grain, timber, and wool, and in wine from Spain, Portugal, and France. It is also head of one of the twenty-five fishery districts of Scotland. Granted to the city of Edinburgh in 1329, it first became an independent parliamentary and municipal burgh in 1832–33, with Portobello and Musselburgh returning one member to parliament, and being governed by a provost, four bailies, a treasurer, and ten councillors. The annual value of real property amounted in 1882 to £366,295, against £150,642 in 1860, and £252,349 in 1873. Population (1811) 20,363, (1841) 26,808, (1851) 30,919, (1861) 30,628, (1871) 44,277, (1881) 58,193.

The history of Leith is closely connected with that of Edinburgh, episodes being the burning of its shipping by the English in 1313 and 1410, its sack by them in 1544 and 1547, its tenure by Mary of Guise as stronghold of the Catholic party from 1548 to 1560, an ineffectual siege in the latter year by the Scotch and English allies, the sailing from it of the first Darien expedition in 1698, and the seizure of its citadel by Brigadier Mackintosh of Borlum and 1600 Highland Jacobites in 1715, to which may be added the arrival, departure, or visit of James II. (1437), Mary Queen of Scots (1561), James VI. and his queen Anne of Denmark (1590), Charles I., who is said to have first got tidings of the Irish rebellion (1641) when playing golf upon the Links, Cromwell and Charles II. (1650), George IV. (1822), Queen Victoria (1842), the king of Denmark (1874), and the Duke of Edinburgh (1881).

See A. Campbell's *History of Leith* (Leith, 1827). (F. H. G.)

LEITMERITZ (Boh., *Litoměřice*), an episcopal see and chief town of Leitmeritz district, Bohemia, is situated on the right bank of the Elbe, crossed there by an iron bridge 1700 feet in length, and on the Austrian North-Western Railway, about 35 miles north-north-west of Prague, in 50° 33′ N. lat., 14° 10′ E. long. Leitmeritz is the seat of the judicial, fiscal, and military authorities for the district, and has a fine cathedral (founded 1057) and several other Roman

Catholic churches and ecclesiastical establishments, also a training institute for teachers, classical, mercantile, and industrial schools, two hospitals, and an old-fashioned town-hall dating from the 16th century. The town is noted for its breweries, producing, according to the latest returns, 1,056,420 gallons of beer annually; it also possesses glass-works, tile-kilns, potteries, and metallic ware factories. The principal agricultural products of the surrounding country, which on account of its fertility has been called the "Bohemian Paradise," are corn, fruit, hops, and wine. Population in 1880, 10,854.

At a very early date Leitmeritz enjoyed special privileges, which were extended and confirmed in 1325 by King John of Luxemburg. In 1421 the town was ineffectually besieged by Ziska. Royal diets were held there in 1494 and 1547, but subsequently the commune was deprived of several of its ancient rights, and its importance declined. In 1631, during the Thirty Years' War, Leitmeritz was captured and forcibly occupied by Saxon troops, who were, however, obliged to relinquish it in 1632 to the imperialists. In 1639 it was taken by the Swedes, who did irretrievable damage to the town. In 1742 the suburbs were burned by the French.

LEITRIM, a maritime county of Ireland in the province of Connaught, is bounded on the N. W. by Donegal Bay, N. E. by Fermanagh, E. by Cavan, S. E. by Longford, and S. W. by Roscommon and Sligo. Its shape resembles that of an hour-glass. From about 20 miles at the extremities it narrows in the centre to a breadth of only 7 miles, and its greatest length from south-east to north-west is 52 miles. The total area is 376,212 acres, or about 588 square miles.

The northern portion of the county consists of an elevated table-land, of which the highest summits are Lugnaquila, 1485 feet; Benbo, 1365; and Lacka, 1315. In the southern part the country is comparatively level, and is generally richly wooded. The extent of coast-line is only about 3 miles. The principal river is the Shannon, which, issuing from Lough Allen, forms the south-western boundary of the county with Roscommon. The Bonnet rises in the north-west and flows to Lough Gill, and the streams of Bundrows and Bunduff separate Leitrim from Donegal and Sligo. Besides Lough Allen, which has an area of 8900 acres, the other principal lakes in the county are Lough Macnean, Lough Scur, Lough Gill, and Lough Melvin. A canal from Carrick-on-Shannon passes through the county to Lough Erne.

Geology and Minerals.—The central part of the county round Lough Allen is included in the Connaught coal-field, which both north and south is bounded by carboniferous limestone interspersed with millstone grit and Yoredale beds. In the southern districts there is a considerable extent of bog resting on marl or blue clay. The coal-fields consist of a series of eminences ranging from 1000 to 1377 feet, the most important beds being those to the west of Lough Allen near the Arigna. Only the lower measures remain, and they contain marine fossils. The coal is bituminous, and is well suited for manufacturing purposes; but it is not extensively wrought. In the Yoredale shales of the Coal-measures clay ironstone of a very rich quality is found, and was formerly smelted at the Arigna ironworks on Lough Allen. Lead has been found near Lurganboy, and copper in Benbo mountain. Manganese is obtained in considerable quantities, and also yellow ochre and various kinds of clays and chalks. The most important sulphureous spring is that of Drumsna; and the chalybeate springs of Cavan on the borders of the county, and of Oakfield adjoining the sea-coast, are also much visited.

Climate and Agriculture.—The climate is very moist and unsuitable for grain crops. On the higher districts the soil is stiff and cold, and, though abounding in stones, very retentive of moisture, but in the valleys there are some very fertile districts resting upon limestone. In the higher regions the chief implement of culture is the spade. Lime, marl, and similar manures are abundant, and on the coast seaweed is plentiful. The total number of holdings in 1880 was 14,812, of which only 624 were less than one acre. More than two-thirds of the holdings are included in those between 5 and 15 acres and between 15 and 30 acres, which numbered respectively 5439 and 5250. The following table shows the number of acres under the various crops in 1855 and 1881:—

	Wheat.	Oats.	Other Corn Crops.	Potatoes.	Turnips.	Other Green Crops.	Flax.	Total under Tillage.	Meadow and Clover	Total.
1855	291	28,780	587	23,587	1,075	1,193	718	56,181	28,598	84,779
1881	806	13,749	193	19,319	942	1,529	177	36,215	46,338	82,553

The acreage under crops is thus less than one-fourth of the whole area. In 1880 there were 212,374 acres under pasture, and 78,330 waste. The number of horses in 1881 was 3983, of which 2627 were used for agricultural purposes. Between 1855 and 1881 cattle diminished from 91,061 to 84,914. The number of milch cows in the latter year was 35,732, the production of butter being one of the principal industries of the small farmer. Sheep diminished from 20,578 in 1855 to 11,347 in 1881, and pigs from 20,790 to 19,302. Poultry in 1881 numbered 311,920.

According to the corrected return of 1878 the land was divided among 451 owners possessing 371,371 acres, with a total annual valuation of £135,946. Of the owners about 70 per cent. possessed more than one acre, and the average value per acre was 7s. 3d. The average size of the estates is 823 acres; and the largest owners are Lord Massy, 24,751; Earl of Leitrim, 22,038; George Lane Fox, 18,850; Owen Wynne, 15,436; and Arthur L. Tottenham, 14,561.

Manufactures.—These are confined chiefly to coarse linens for domestic purposes, but coarse pottery is also made. In 1880 there were three scutching mills in the county, all driven by water.

Railways.—The Longford and Sligo branch of the Midland Great Western Railway passes through the southern part of the county, and in the northern part there is a branch between Sligo and Bundoran.

Administration and Population.—The county is divided into 5 baronies, and contains 17 parishes, with 1489 town-lands. It is within the Connaught circuit, and assizes are held at Carrick-on-Shannon, and quarter sessions at Ballinamore, Carrick-on-Shannon, and Manorhamilton. There are two poor-law unions in the county and portions of other three. The county is within the Dublin military district, and there are barracks at Carrick-on-Shannon. It is in the dioceses of Kilmore and Ardagh. In the Irish House of Commons two members were returned for the county and two for the boroughs of Carrick-on-Shannon and Jamestown, but at the union the boroughs were disfranchised. In 1760 the population was 26,142, which in 1821 had increased to 124,785 and in 1841 to 155,309, but in 1861 had diminished to 104,744, in 1871 to 95,562, and in 1881 to 89,795, of whom 44,777 were males and 45,018 were females. The total number of emigrants from the county between 1st May, 1851, and 31st December, 1880, was 43,186, a percentage of 41·2 to the population in 1861. In 1880 the rate of marriages per 1000 of estimated population was 2·6, of births 22·4, and of deaths 15·9. The population is almost entirely rural, the only town being Carrick-on-Shannon, with a population in 1871 of 1442.

History and Antiquities.—Anciently the entire country bordering on Lough Erne, including Fermanagh and Cavan, was, according to Ptolemy, occupied by the Erdini. Afterwards, along with Cavan, Leitrim formed part of the territory of Breffny or Brenny, which was divided into two principalities, of which Leitrim under the name of Hy Bruin-Breffny or Brenny formed the western. From the fact that for a long time it was possessed by the O'Rourkes, descendants of Roderick, king of Ireland, it was also called Breffny O'Rourk. In the 12th century Tiernan O'Rourk was expelled from the government by the princes of Leinster and Connaught, but he was afterwards reinstated by

Turlough, king of Ireland, and, although after the arrival of the English it was united to Roscommon, the O'Rourks remained practically independent till the reign of Elizabeth. Large confiscations took place in the reigns of Elizabeth and James I., in the Cromwellian period, and after the Revolution of 1688–89.

There are "druidical" remains near Fenagh and at Letterfyan, and important monastic ruins at Creevelea near the Bonnet, with several antique monuments, and at Finagh in the parish of Fenagh. There was an important Franciscan friary at Jamestown. The abbeys of Mohill, Annaduff, and Drumlease have been converted into parish churches. Among the more notable old castles are O'Rourk's Hall at Dromahaire, now in ruins, Manorhamilton Castle, originally very extensive, but now also in ruins, and Castle John on an island in Lough Scur.

LELAND, Leyland, or Laylonde, John (c. 1506–1552), a famous English antiquary, was born in London towards the close of the reign of Henry VII. From St. Paul's School, where he was brought up under Lily, the famous grammarian, he passed to Christ's College, Cambridge, and thence to All Soul's College, Oxford. After residing for some time in Paris, he returned to England, and became chaplain to Henry VIII. who appointed him, in 1530, to the rectory of Popeling, in the marches of Calais, made him his librarian, and in 1533 commissioned him as "king's antiquary," with power to search for records, manuscripts, and relics of antiquity, in all the cathedrals, colleges, abbeys, and priories of England. Accordingly he set out on a tour which lasted six years, and afforded him materials for study during the remainder of his life. On his return in 1542 he was rewarded by the king with the rectory of Haseley in Oxfordshire; in 1543 he became a canon of King's College (now Christ Church), Oxford, and about the same time a prebendary of Salisbury. Leland now withdrew to his house in the parish of St. Michael le Querne, London, and devoted himself exclusively to the digesting of his information. In 1547 he fell into a state of insanity, which continued until his death on the 18th April, 1552.

Some of Leland's papers, after passing through several hands, were deposited by Burton, the historian of Leicestershire, in the Bodleian Library at Oxford in 1632. Others came into the possession of Sir Robert Cotton, and are now, along with the rest of his books, in the British Museum. His principal works are *The laboryeuse Journey and Serche for Englandes Antiquitees*; *A New Yeares Gyfte to Kynge Henry the VIII. in the 37 yeare of his Regne*, London, 1549; *Commentarii de Scriptoribus Britannicis*, edited by Anthony Hall, Oxford, 1709, 2 vols. 8vo; *The Itinerary*, published by Thomas Hearne, Oxford, 1710–12, 9 vols. 8vo, and reprinted in 1770; and *De Rebus Britannicis Collectanea*, edited by Hearne, Oxf., 1715, 6 vols. 8vo, and reprinted at London in 1770. See *The Lives of those eminent antiquaries John Leland, Thomas Hearne, and Anthony à Wood*, vol. i., Oxford, 1772.

LELAND, John (1691–1766), a polemical theologian of the 18th century, was born at Wigan, Lancashire, in 1691, and was educated in Dublin, where he made such progress in theological and other studies that in 1716, without having attended any college or hall, he was appointed first assistant and afterwards sole pastor of a congregation of Presbyterians in New Row. This office he continued to fill until his death on January 16, 1766.

Leland's first publication was *A Defence of Christianity* (1733), in reply to Tindal's *Christianity as Old as the Creation*; it was succeeded by his *Divine Authority of the Old and New Testaments asserted* (1738), in answer to *The Moral Philosopher* of Morgan; in 1741 he published two volumes, in the form of two letters, being *Remarks on* [H. Dodwell's] *Christianity not Founded on Argument*; and in 1753 *Reflexions on the Late Lord Bolingbroke's Letters on the Study and Use of History*. *A View of the Principal Deistical Writers that have appeared in England* was published in 1754–56. This is the only work of the author—"most worthy, painstaking, and commonplace of divines," as he has recently been styled—which can now be said to have any present value. This value, however, is purely historical; his facts about the deists are interesting and useful, but it may be safely conjectured that no one now reads his (doubtless sincere) arguments, here and elsewhere, against the creed he opposed without some sense of their hollowness, contradictoriness, and obvious unfairness. His latest work was a treatise entitled *The Advantage and Necessity of the Christian Revelation shown from the State of Religion in the Ancient Heathen World*. *Discourses on various Subjects*, with a *Life* prefixed, was published posthumously, 4 vols. 8vo, 1768–69; also a *Life* by Huddesford, 1772.

LELEGES was the name applied to an early race or set of races around the Ægean Archipelago. The name occurs in Leucadia, Acarnania, Ætolia, Phocis, Locris, Bœotia, Megara, Laconia, Elis, the islands of the Ægean, the Troad, and Caria. It is hardly possible to suppose that a single race was to be found in so many widely separated localities. Herodotus identifies the Leleges with the Carians, saying that the ancient name of that race was Leleges, whereas Pausanias declares that the name Leleges was younger, and Athenæus makes the Leleges serfs of the Carians. Homer introduces both Leleges and Carians as distinct peoples in alliance with Troy. The former have a king Altes and a city Pedasus. Strabo counts the Leleges and the Carians different races, so intermingled that they were often identified. Both in Leucadia and in Laconia the story runs that the autochthonous inhabitants were the Leleges, whereas in Messenia the Leleges were an immigrant race who had founded Pylus. They were said to be the ancestors of the Taphians and Teleboans, two seafaring and piratic races. The only view as yet advanced which introduces any unity into these scattered notices is that of Curtius. According to him the name Leleges represents rather a stage in historical development than a single race. The name occurs always in the coast lands; and in the early stage of Greek history, when the simple barbarous tribes of older stock were stimulated to the first beginnings of progress and civilization by the appearance of foreign mariners on their shore, the mixed race of immigrants and natives was called Leleges. It is the almost universal opinion that the whole of the Ægean coast lands were occupied by homogeneous tribes of Aryan stock; on this view then the Leleges, *i. e.*, as Strabo already maintained, the *mixed people*, represent one of the first stages of these original tribes in the path of civilization. Accounts which connect the Leleges with Egypt may be definitely rejected as fabulous.

See Deimling, *Leleger*; Curtius, *Greek History*, i.; Thuc., i. 4; *Iliad*, x. 429; Strabo, pp. 321, 572, 680, etc.; Herod., i. 171; Pausan., i. 39, 6; Athen., vi. 271*b*.

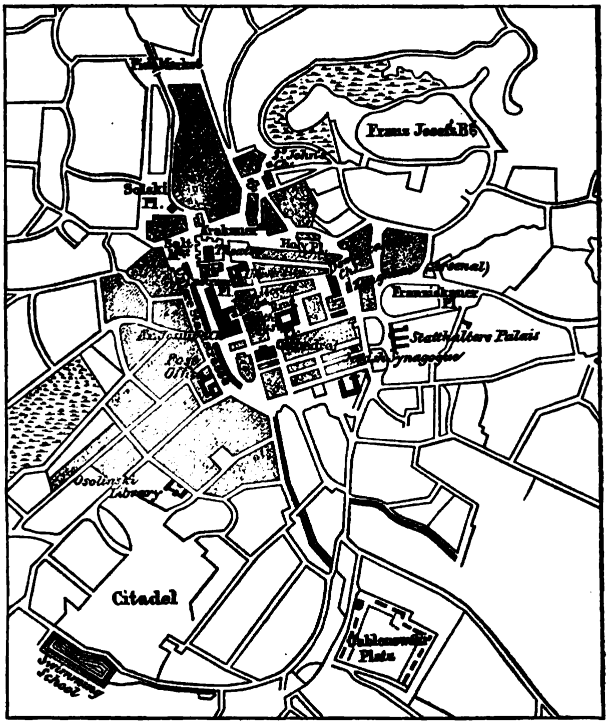
LELEWEL, Joachim (1786–1861), Polish historian, was born at Warsaw in 1786. His family came from Prussia in the early part of the 18th century; his grandfather was appointed physician to the Polish king then reigning, and his father caused himself to be naturalized as a Polish citizen. The original form of the name appears to have been Loelheffel. From his earliest childhood the future historian showed his fondness for books. In the year 1807 we find him teacher in a school at Krzemieniec in Volhynia, and in 1814 professor of history at Vilna, a post which he quitted in 1820 for a four years' discharge of the same office at the university of Warsaw, but returned to it in 1824. His lectures enjoyed great popularity, and the enthusiasm felt for him by the students is shown in the beautiful lines addressed to him by Mickiewicz. But this very circumstance made him obnoxious to the Russian Government, and at Vilna Novosiltzev was then all-powerful. Lelewel was removed from his professorship, and returned to Warsaw, where he was elected a deputy to the diet in 1829. He joined the revolutionary movement with great enthusiasm, but was throughout deficient in energy, and, in fact, although the emperor Nicholas distinguished him as one of the most dangerous rebels, he did not appear to advantage as a man of action. On the suppression of the rebellion he made his way in disguise to Germany, and subsequently reached Paris in 1831. There, however, he was not allowed to stay long, as the Government of Louis Philippe ordered him to quit French territory in 1833 at the request of the Russian ambasador. The cause of this expulsion is said to have been his activity in writing revolutionary proclamations. He now repaired to Brussels, where he for a time lectured on history at the university, but was from some cause or other compelled to abandon his occupation. Lelewel spent several years in Brussels in great poverty, barely earning a scanty livelihood by his writings. He died in 1861 at Paris, whither he had removed a short time previously.

Lelewel was an indefatigable man of letters. He was of a simple austere character, and of the strictest probity—in short, of an antique type, one of the few men who have loved learning for its own sake. His literary activity was enormous, extending over the period from the "Edda Skandinawska" of 1807 to the *Géographie des Arabes*, 2 vols., Paris, 1851. Many of his works are concerned with Polish history, yet he by no means confined himself to it. Thus he has written on the trade of Carthage, on Pytheas the early geographer, and on numismatics (*La Numismatique du Moyen Âge*, Paris, 1835, 2 vols.; *Études Numismatique*, Brussels, 1840). One of his most important publications was *La Géographie du Moyen Âge*, Brussels, 1850–52, with an atlas of fifty plates entirely engraved by himself, for he rightly attached such importance to the accuracy of his maps that he would not allow them to be executed by any one else. His works on Polish history are monumental; they have been collected into a series under the title *Polska, dzieje i rzeczy jej rozpatrzywane* (Poland, her History and Affairs Surveyed), published at Posen, 1854–1868, in 20 vols. He had intended to have written a complete history of the country on an extensive scale, but never accomplished the task. His method is shown in the little history of Poland, first published at Warsaw in Polish in 1823, under the title *Dzieje Polski*, and afterwards almost rewritten in the *Histoire de Pologne*, published at Paris in 2 vols. in 1844. Two other works on Polish history which may be especially mentioned are an edition of the "Chronicle of Matthew of Cholewa" and "Ancient Memorials of Polish Legislation" (*Księgi ustaw polskich i mazowieckich*). While employed in the university library of Warsaw he studied bibliography, and the fruits of his labors may be seen in his *Bibliograficznych Ksiąg dwoje* (A Couple of Books on Bibliography), 2 vols. 8vo, Vilna, 1823–26. The characteristics of Lelewel as an historian are great research and power to draw inferences from his facts; his style is too often careless, and his narrative is not picturesque, but his expressions are frequently terse and incisive. He has left valuable materials for a just comprehension of his career in his autobiography (*Adventures while Prosecuting Researches and Inquiries on Polish Matters*).

LELY Sir Peter (1617–1680), a celebrated painter, was born at Soest, Westphalia, in 1617. His father, a military captain and a native of Holland, was originally called Van der Vaes; the nickname of Le Lys or Lely, by which he was generally known, was adopted by his son as a proper surname. After studying for two years under Peter de Grebber, an artist of some note at Haarlem, Lely, induced by the patronage of Charles I. for the fine arts, removed to England in 1641. There he at first painted historical subjects and landscape; and he soon became so eminent in his profession as to be employed by Charles to paint his portrait shortly after the death of Vandyck. He afterwards portrayed Cromwell. At the Restoration his genius and gentlemanly manners won the favor of Charles II., who made him his state-painter, and afterwards knighted him. He formed a famous collection, the best of his time, containing drawings, prints, and paintings by the best masters; it sold by auction for no less than £26,000. His great example, however, was Vandyck, whom, in some of his most successful pieces, he almost rivals. Lely's paintings are carefully finished, warm and clear in coloring, and animated in design. The graceful posture of the heads, the delicate rounding of the hands, and the broad folds of the draperies are admired in many of his portraits. The eyes of the ladies are drowsy with languid sentiment, and allegory of a commonplace sort is too freely introduced. His most famous work is a collection of portraits of the ladies of the court of Charles II., preserved at Hampton Court, and known by the title of the Windsor Beauties. Of his few historical pictures, the best is Susannah and the Elders, at Burleigh House. His Jupiter and Europa, in the duke of Devonshire's collection, is also worthy of note. Lely was nearly as famous for crayon work as for oil-painting. Towards the close of his life he often retired to an estate which he had bought at Kew. He died of apoplexy in London (the Piazza, Covent Garden) in 1680, and was buried in Covent Garden Church, where a monument was afterwards erected to his memory. Pepys characterized Lely in a few graphic words —"a mighty proud man and full of state." The painter married an English lady of family, and left a son and daughter, who died young. His only disciples were Greenhill and Buckshorn; he did not, however, allow them to obtain an insight into his special modes of work.

LE MANS. See Mans, Le.

LEMBERG (*i. e.*, *Leonberg*; also *Lemburg* or *Löwenburg*; Polish, *Lwow*; Lat., *Leopolis*), the capital of the Austrian crown-land of Galicia, and according to its population the third city of Austria-Hungary, lies 180 miles east of Cracow and 60 miles from the Russian frontier. The hollow of the Sarmatian plateau, in which the town is situated, is about 1000 feet above the sea-level, and, as drained by the Peltew, a tributary of the Bug, belongs to the basin of the Vistula. The Löwenburg proper or Castle Hill rises to 1300 feet. In the early part of the present century Lemberg would have been described as a small fortified place, with a number of large villages in the immediate vicinity; but the fortifications were transformed into pleasure grounds about 1811, and the villages have gradually changed into suburb and town. The old city proper occupies only about 60 acres; the suburbs extend over 12 square miles. During the 16th and 17th centuries the most striking feature of Lemberg was the immense number of its ecclesiastical buildings, and it still possesses among the rest a Greek Catholic, a Roman Catholic, and an Armenian cathedral. The church of the Dominicans (an imitation of the Karlskirche at Vienna) contains a monument, by Thorwaldsen, to the countess Josepha Borkowska. Lemberg is the seat of a university, founded

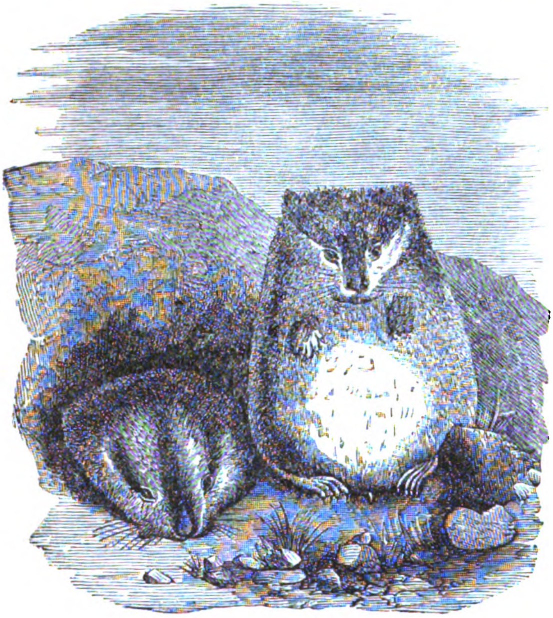


Plan of Lemberg.

in 1784 by Joseph II., and restored by Francis I. in 1817; and in the national institution founded by Ossolinski it has a noble library of books and manuscripts, and valuable antiquarian and scientific collections. The linguistic heterogeneousness of the population requires the maintenance of three separate gymnasiums,—for the Poles, the Germans, and the Ruthenians respectively; and there are besides two normal colleges, a deaf and dumb institution, and a blind asylum. Industrially and commercially Lemberg is a more important city than Cracow; it has a chamber of trade and commerce, and among the leading articles of manufacture are flour, beer, vinegar, oil of roses, and matches. The population has increased from 87,109 in 1869 to 110,250 in 1880. At the former date 46,252 were Roman Catholics, 26,694 Jews, and 12,406 Greek Catholics.

Leopolis was founded about 1259 by the Ruthenian prince Daniel for his son Leo. From Casimir the Great, who captured it in 1340, it received the Magdeburg rights, and for almost two hundred years the public records were kept in German. During the whole period of Polish supremacy it was a most important city, and after the fall of Constantinople it greatly developed its trade with the East. In 1648 and 1655 it was besieged by the Cossacks, and in 1672 by the Turks. Charles XII. of Sweden captured it in 1704. In 1848 it was bombarded.

LEMMING, a small animal belonging to the order *Rodentia*, family *Muridæ*, and subfamily *Arvicolinæ*, or voles, of which the common water-rat and short-tailed field-mouse of England are members. It is the *Myodes lemmus* (Linn.) of most modern zoological systems, the *Lemmus norvegicus* of Desmarest and some other authors. In both size and color different specimens vary considerably, but its usual length is about five inches, and its soft fur yellowish-brown, marked with spots of dark brown and black. It has a short, rounded head, obtuse muzzle, small bead-like eyes, and short rounded ears, nearly concealed by the fur. The tail is very short. The feet are small, each with five claws, those of the fore feet strongest, and fitted for scratching and digging. The usual dwelling place of the lemmings is in the high lands or fells of the great central mountain chain of Norway and Sweden, from the southern branches of the Langfjeldene in Christiansand stift to the North Cape and the Varangerfjord. South of the Arctic circle they are, under ordinary circumstances, exclusively confined to the plateaus covered with dwarf birch and juniper above the conifera region, though in Tromsö and in Finmarken they occur in all suitable localities down to the level of the sea. The nest is formed under a tussock of grass or a stone, and constructed of short dry straws, and usually lined with hair. The number of young in each nest is generally five, sometimes only three, occasionally seven or eight, and at least two broods are produced annually. Their food is entirely vegetable, especially grass roots and stalks, shoots of the dwarf birch, reindeer lichens, and mosses, in search of which they form, in winter, long galleries through the turf or under the snow. They are restless, courageous, and pugnacious little animals. When suddenly disturbed, instead of trying to escape they will sit upright, with their back against a stone or other coign of vantage, hissing and showing fight in a very determined manner.



Lemming.

The circumstance which has given more popular interest to the lemming than to a host of other species of the same order of animals, and has justified its treatment in a separate article in this work, is that certain districts of the cultivated lands of Norway and Sweden, where in ordinary circumstances they are quite unknown, are occasionally and at very uncertain intervals, varying from five to twenty or more years, literally overrun by an army of these little creatures, which steadily and slowly advance, always in the same direction, and regardless of all obstacles, swimming across streams and even lakes of several miles in breadth, and committing considerable devastation on their line of march by the quantity of food they consume. In their turn they are pursued and harassed by crowds of beasts and birds of prey, as bears, wolves, foxes, dogs, wild cats, stoats, weasels, eagles, hawks, and owls, and never spared by man; even the domestic animals not usually predaceous, as cattle, goats, and reindeer, are said to join in the destruction, stamping them to the ground with their feet, and even eating their bodies. Numbers also die from diseases produced apparently from overcrowding. None ever return by the course by which they came, and the onward march of the survivors never ceases until they reach the sea, into which they plunge, and swimming onwards in the same direction as before perish in the waves. These extraordinary and sudden appearances of vast bodies of lemmings, and their singular habit of persistently pursuing the same onward course of migration, have given rise to various speculations, from the ancient belief of the Norwegian peasants, shared in by Olaus Magnus, that they fall down from the clouds, to the almost equally untenable hypothesis, ingeniously maintained by the late Mr. W. D. Crotch, that they are acting in these migrations in obedience to an instinct inherited from vastly ancient times, and are still seeking the congenial home in the submerged Atlantis, to which their ancestors of the Miocene period were wont to resort when driven from their ordinary dwelling places by crowding or scarcity of food. The principal really ascertained facts regarding these migrations, as stated by Mr. R. Collett (*Proceedings of the Linnean Society*, vol. xiii. p. 327, 1878), seem to be as follows. When any combination of circumstances has occasioned an increase of the numbers of the lemmings in their ordinary dwelling places, impelled by the restless or migratory instinct possessed in a less developed degree by so many of their congeners, a movement takes place at the edge of the elevated plateau, and a migration towards the lower-lying land begins. The whole body move forward slowly, always advancing in the same general direction in which they originally started, but following more or less the course of the great valleys. They only travel by night; and, staying in congenial places for considerable periods, with unaccustomed abundance of provender, notwithstanding all the destructive influences to which they are exposed, they multiply excessively during their journey, having still more numerous families and more frequently than in their usual homes. The progress may last from one to three years, according to the route taken, and the distance to be traversed until the sea-coast is reached.

which in a country so surrounded by water as the Scandinavian peninsula must be the ultimate goal of such a journey. This may be either the Atlantic or the Gulf of Bothnia, according as the migration has commenced from the west or the east side of the central elevated plateau. Those that finally perish in the sea, committing what appears to be a voluntary suicide, are only acting under the same blind impulse which has led them previously to cross smaller pieces of water with safety. Further information about the migrations of the lemming will be found in Mr. Collett's paper referred to above, and also in those of Mr. Crotch in the same volume. (W. H. F.)

LEMNOS was an island in the northern part of the Ægean Sea, now called by the inhabitants Limnos. The Italian form of the name, Stalimene, *i. e.*, ἐς τὴν Λῆμνον, is not used in the island itself, but is commonly employed in geographical works. The island, which belongs to Turkey, is of considerable size: Pliny says that the coast-line measured 112½ Roman miles, and the area has been estimated at 150 square miles. Great part of it is mountainous, but some very fertile valleys exist, to cultivate which two thousand yoke of oxen are employed. The hill-sides afford pasture for 20,000 sheep. No forests exist on the island; all the wood which is used is brought from the coast of Roumelia or from Thasos. A few mulberry and fruit trees grow, but no olives. The inhabitants number about 22,000, of whom 2000 are Turks and the rest Greeks. The chief towns are Kastro on the western coast, with a population of 4000 Greeks and 800 Turks, and Mudros on the southern coast. Kastro possesses an excellent harbor, and is the seat of all the trade carried on with the island. Greek, English, and Dutch consuls or consular agents were formerly stationed here; but the whole trade is now in Greek hands. The archbishop of Lemnos and Ai Strati, a small neighboring island with 2000 inhabitants, resides in Kastro. In ancient times the island was sacred to Hephæstus, who as the legend tells fell on Lemnos when his father Zeus hurled him headlong out of Olympus. This tale, as well as the name Æthaleia, sometimes applied to it, points to its volcanic character. It is said that fire occasionally blazed forth from Mosychlos, one of its mountains; and Pausanias (viii. 33) relates that a small island called Chryse off the Lemnian coast was swallowed up by the sea. All volcanic action is now extinct.

The most famous product of Lemnos is the medicinal earth, which is still used by the natives. At one time it was popular over western Europe under the name *terra sigillata*. This name, like the Greek Λημνία σφραγίς, is derived from the stamp impressed on each piece of the earth; in ancient times the stamp was the head of Artemis. The Turks now believe that a vase of this earth destroys the effect of any poison drunk from it,—a belief which the ancients attached rather to the earth from Cape Kolias in Attica. Galen went to see the digging up of this earth (see Kuhn, *Medic. Gr. Opera*, xii. 172 *sq.*); on one day in each year a priestess performed the due ceremonies, and a wagon-load of earth was dug out. At the present time the day selected is the 6th of August, the feast of Christ the Saviour. Both the Turkish hodja and the Greek priest are present to perform the necessary ceremonies; the whole process takes place before daybreak. The earth is sold by apothecaries in stamped cubical blocks. The hill from which the earth is dug is a dry mound, void of vegetation, beside the village of Kotschinos, and about two hours from the site of Hephæstia. The earth was considered in ancient times a cure for old festering wounds, and for the bite of poisonous snakes.

The name Lemnos is said by Hecatæus (*ap.* Steph. Byz.) to have been a title of Cybele among the Thracians, and the earliest inhabitants are said to have been a Thracian tribe, called by the Greeks Sinties, *i. e.*, "the robbers." According to a famous legend the women were all deserted by their husbands, and in revenge murdered every man on the island. From this barbarous act, the expression Lemnian deeds, Λήμνια ἔργα, became proverbial. The Argonauts landing soon after found only women in the island, ruled over by Hypsipyle, daughter of the old king Thoas. From the Argonauts and the Lemnian women were descended the race called Minyæ, whose king Euneus, son of Jason and Hypsipyle, sent wine and provisions to the Greeks at Troy. The Minyæ were expelled by a Pelasgian tribe who came from Attica. The historical element underlying these traditions is probably that the original Thracian people were gradually brought into communication with the Greeks as navigation began to unite the scattered islands of the Ægean (see JASON); the Thracian inhabitants were barbarians in comparison with the Greek mariners. The worship of Cybele was characteristic of Thrace, whither it spread from Asia Minor at a very early period, and it deserves notice that Hypsipyle and Myrina (the name of one of the chief towns) are Amazon names, which are always connected with Asiatic Cybele-worship. Coming down to a better authenticated period, we find that Lemnos was conquered by Otanes, one of the generals of Darius Hystaspes; but was soon reconquered by Miltiades, the tyrant of the Thracian Chersonese. Miltiades afterwards returned to Athens, and Lemnos continued an Athenian possession till the Macedonian empire absorbed it. On the vicissitudes of its history in the 3d century B. C. see Köhler in *Mittheil. Inst. Athen.*, i. p. 261. The Romans declared it free in 197 B. C. but gave it over in 166 B. C. to Athens, which retained nominal possession of it till the whole of Greece was made a Roman province. A colony of Attic κληροῦχοι was established by Pericles, and many inscriptions on the island relate to Athenians. After the division of the empire, Lemnos of course passed under the Byzantine emperors; it shared in the vicissitudes of the eastern provinces, being alternately in the power of Greeks, Italians, and Turks, till finally the Turkish sultans became supreme in the Ægean. In 1476 the Venetians successfully defended Kokkinos or Kotchinos against a Turkish siege; but in 1657 Kastro was captured by the Turks from the Venetians after a siege of sixty-three days. Kastro was again besieged by the Russians in 1770.

Homer speaks as if there were one town in the island called Lemnos, but in historical times there was no such place. There were two towns, Myrina, now Kastro, and Hephæstia. The latter was the chief town; its coins are found in considerable number, the types being sometimes the Athenian goddess and her owl, sometimes native religious symbols, the caps of the Dioscuri, Apollo, etc. Few coins of Myrina are known. They belong to the period of Attic occupation, and bear Athenian types. A few coins are also known which bear the name, not of either city, but of the whole island. Conze was the first to discover the site of Hephæstia, at a deserted place named Palæokastro on the east coast. It had once a splendid harbor, which is now filled up. Its situation on the east explains why Miltiades attacked it first when he came from the Chersonese. It surrendered at once, whereas Myrina, with its very strong citadel built on a perpendicular rock, sustained a siege. It is said that the shadow of Mount Athos fell at sunset on a bronze cow in the agora of Myrina. Pliny says that Athos was 87 miles to the north-west; but the real distance is about 40 English miles. One legend localized in Lemnos still requires notice. Philoctetes was left there by the Greeks on their way to Troy; and there he suffered ten years' agony from his wounded foot, until Ulysses and Neoptolemus induced him to accompany them to Troy. He is said by Sophocles to have lived beside Mount Hermæus, which Æschylus (*Agam.*, 262) makes one of the beacon points to flash the news of Troy's downfall home to Argos.

See Rhode, *Res Lemnicæ;* Conze, *Reis auf den Aeg. Inseln* (where the latest account by a skilled eye-witness is to be found; the above-mentioned facts about the present state of the island are taken from him): also Hunt in Walpole's *Travels;* Belon du Mans, *Observations de plusieurs singularites*, etc.; Finlay, *Greece under the Romans;* Von Hammer, *Gesch. des Osman. Reiches; Gött. Gel. Anz.*, 1837. The chief references in ancient writers are *Iliad*, i. 593; v. 138; xiv. 229, etc.; Herod., iv. 145; Str., pp. 124, 330; Plin., iv. 23; xxxvi. 13.

LEMON, the fruit of *Citrus Limonum*, Risso, which is regarded by some botanists as a variety of *Citrus medica*, L. The wild stock of the lemon tree is a native of the valleys of Kumaon and Sikkim in the North-West Provinces of India, ascending the mountains to a height of 4000 feet, and occurring under several forms.

The lemon seems to have been unknown to the ancient Greeks and Romans, and to have been introduced by the Arabs into Spain between the 12th and 13th centuries. In 1494 the fruit was cultivated in the Azores, and largely shipped to England, but since 1838 the exportation has ceased. As a cultivated plant the lemon is now met with throughout the Mediterranean region, in Spain and Portugal, in California and Florida, and in almost all tropical and subtropical countries. Like the apple and pear, it varies exceedingly under cultivation. Risso and Poiteau enumerate forty-seven varieties of this fruit, although they maintain as distinct the sweet lime, *Citrus Limetta*, Risso, with eight varieties, and the sweet lemon, *Citrus Lumia*, Risso, which differ only in the fruit possessing an insipid instead of an acid juice, with twelve varieties.

The lemon is more delicate than the orange, although, according to Humboldt, both require an annual mean temperature of 62° Fahr. Unlike the orange, which presents a fine close head of deep green foliage, it forms a straggling bush, or small tree, 10 to 12 feet high, with paler, more scattered leaves, and short angular branches with sharp spines in the axils. The flowers, which possess a sweet odor quite distinct from that of the orange, are in part hermaphrodite and in part unisexual, the outside of the corolla having a purplish hue. The fruit, which is usually crowned with a nipple, consists of an outer rind or peel, the surface of which is more or less rough from the convex oil receptacles imbedded in it, and of a white inner rind, which is spongy and nearly tasteless, the whole of the interior of the fruit being filled with soft parenchymatous tissue, divided into about ten to twelve compartments, each generally containing two or three seeds. The white inner rind varies much in thickness in different kinds, but is never so thick as in the citron. As lemons are much more profitable to grow than oranges, on account of their keeping properties, and from their being less liable to injury during voyages, the cultivation of the lemon is preferred in Italy wherever it will succeed. In damp valleys it is liable to be attacked by a fungus called "charbon" (*Dematium monophyllum*), the stem, leaves, and fruit becoming covered with a blackish dust. This is said to be coincident with or subsequent to the attacks of a small oval brown insect, *Chermes hesperidum*, L. Trees grown in the shade, and not properly exposed to sunlight and air, suffer most severely from these pests. Syringing with milk of lime when the young insects are hatched, and before they have fixed themselves to the plant, seems to be the most effectual remedy known. Since the year 1875 this fungoid disease has made great ravages in Sicily among the lemon and citron trees, especially around Catania and Messina. M. Heritte attributes the prevalence of the disease to the fact that the growers have induced an unnatural degree of fertility in the trees, permitting them to bear enormous crops year after year. This loss of vitality is in some measure met by grafting healthy scions of the lemon on the bitter orange, but trees so grafted do not bear fruit until they are eight or ten years old.

The lemon tree is said to be exceedingly fruitful, a large one in Spain or Sicily ripening as many as three thousand fruits in favorable seasons. In the south of Europe lemons are collected more or less during every month of the year, but in Sicily the chief harvest takes place from the end of October to the end of December, those gathered during the last two months of the year being considered the best for keeping purposes. The fruit is gathered while still green. After collection the finest specimens are picked out and packed in cases, each containing about four hundred and twenty fruits, and also in boxes, three of which are equal to two cases, each lemon being separately packed in paper. The remainder, consisting of ill-shaped or unsound fruits, are reserved for the manufacture of the essential oil and juice. The whole of the sound lemons collected are usually packed in boxes, but those which are not exported immediately are carefully picked over and the unsound ones removed before shipment. The exportation is continued as required until April and May. The large lemons with a rougher rind, which appear in the London market in July and August, are grown at Sorrento near Naples, and in this case are allowed to remain on the trees until ripe.

Candied lemon peel is usually made in England from a larger variety of the lemon cultivated in Sicily on higher ground than the common kind, from which it is distinguished by its thicker rind and larger size. This kind, known as the Spadaforese lemon, is also allowed to remain on the trees until ripe, and when gathered the fruit is cut in half longitudinally and pickled in brine, before being exported in casks. Before candying the lemons are soaked in fresh water to remove the salt. Citrons are also exported from Sicily in the same way, but these are about six times as expensive as lemons, and a comparatively small quantity is shipped. Besides those exported from Messina and Palermo, lemons are also imported into England to a less extent from the Riviera of Genoa, and from Malaga in Spain, the latter being the most esteemed. Of the numerous varieties the wax lemon, the imperial lemon, and the Gaeta lemon are considered to be the best.

The Greek island of Andros is said to produce ten millions of lemons annually; these are exported chiefly to Constantinople, the Black Sea, and the Danube, realizing an average price of £1 to £1 3s. per thousand.

Until recently the United States have been large importers of lemons, at good prices, from the Mediterranean. In 1878 Palermo exported 463,977 boxes of this fruit, at 6s. 6d. per box. Owing to increased facilities for transit, and the hazardous character of the trade, the lemons are now chiefly exported by the proprietors of small plantations, who, in their eagerness to dispose of their stock, glut the market at New York and Philadelphia, and sometimes find the speculation a ruinous one.

For some years past lemons have been extensively cultivated in the south of California, and the new industry will probably affect the Mediterranean trade to a serious extent. In 1874 half a million California lemons were received in San Francisco. Since it was found that, with a little care in the selection of the soil, these trees could be grown throughout the State, they have been planted in immense numbers, and the produce of each tree has been found to bring from 30s. to 60s. It has been estimated that in a few years the produce will be equal to the requirements of the Pacific States and Territories, and that ultimately the whole of the United States may be supplied with lemons from California. In east Florida also, where suitable land is obtainable at 15 to 20 dollars an acre, lemons, limes, citrons, and more especially oranges, are being raised in abundance. In New South Wales lemons are also grown, having been introduced into Sydney about the year 1790.

Lemons of ordinary size contain about 2 ounces of juice, of specific gravity 1·039–1·046, yielding on an average 32·5 to 42·53 grains of citric acid per ounce. The amount of this acid, according to Stoddart, varies in different seasons, decreasing in lemons kept from February to July, at first slowly and afterwards rapidly, until at the end of that period it is all split up into glucose and carbonic acid,—the specific gravity of the juice being in February 1·046, in May 1·041, and in July 1·027, while the fruit is hardly altered in appearance. Mr. George Mee, however, states that lemons may be kept for some months with scarcely perceptible deterioration by varnishing them with an alcoholic solution of shellac—the coating thus formed being easily removed when the fruit is required for household use by gently kneading it in the hands. Besides citric acid, lemon juice contains 3 to 4 per cent. of gum and sugar, albuminoid matters, and 2·28 per cent. of inorganic salts. Cossa has determined that the ash of dried lemon juice contains 54 per cent. of potash, besides 15 per cent. of phosphoric acid. In the white portion of the peel (in common with other fruits of the genus) a bitter principle called *hesperidine* has been found. It is very slightly soluble in boiling water, but is soluble in dilute alcohol and in alkaline solutions, which it soon turns of a yellow or reddish color. It is also darkened by tincture of perchloride of iron. Another substance named *lemonine*, crystallizing in lustrous plates, was discovered in 1879 by Palerno and Aglialoro in the seeds, in which it is present in very small quantity, 15,000 grains of the seed yielding only 80 grains of it. From hesperidine it differs in dissolving in potash without alteration. It melts at 275°.

Various modes of preserving lemon juice in small quantities for medicinal or domestic use have been suggested. Mr. Judicis states that if allowed to deposit and then filtered through paper it keeps well. Dr. Symes recommends heating the juice to 150° Fahr., filling bottles with it at that temperature, and immediately closing them when perfectly full so as to keep out access of air. Another writer advises the addition of 10 per cent. of alcohol. Perhaps the most simple method is to keep it covered with a layer of olive or almond oil in a closed vessel furnished with a glass tap, by which the clear liquid may be drawn off as required.

As a commercial article for use on shipboard as a preventive of scurvy, lemon juice is largely consumed. By the provisions of the Act of Parliament 30 & 31 Vict. c. 124, § 4, every ship going to other countries where lemon or lime juice cannot be obtained is required to take sufficient to give one ounce to every member of the crew daily. Of this juice it requires about 13,000 lemons to yield one pipe (108 gallons). Sicilian juice in November yields about 9 ounces of crude citric acid per gallon, but only 6 ounces if the fruit is collected in April. The crude juice was formerly exported to England, and was often adulterated with sea water, but is now almost entirely replaced by lime juice. It is said, however, to be still an article of considerable export from Turkey, where lemons are abundantly grown, to Odessa. But a concentrated lemon juice for the manufacture of citric acid is prepared in considerable quantities, chiefly at Messina and Palermo, by boiling down the crude juice in copper vessels over an open fire until its specific gravity is about 1·239, seven to ten pipes of raw making only one of concentrated lemon juice. Of this concentrated juice Messina exported in 1877 1,631,332 kilogrammes, valued at 2,446,996 lire, and in 1878 Naples exported it to the value of £767.

Lemon juice for this purpose is prepared also from the fruits of limes and Bergamot oranges. It is said to be sometimes adulterated with sulphuric acid on arrival in England.

Essence or Essential Oil of Lemon.—The essential oil contained in the rind of the lemon also occurs in commerce as a distinct article. It is manufactured chiefly in Sicily, at Reggio in Calabria, and at Mentone and Nice in France. The small and irregularly shaped fruits are employed while still green, in which state the yield of oil is greater than when they are quite ripe. In Sicily and Calabria the oil is extracted in November and December, as follows. A workman cuts three longitudinal slices off each lemon, leaving a three cornered central core having a small portion of rind at the apex and base. These pieces are then divided transversely and cast on one side, and the strips of peel are thrown in another place. Next day the pieces of peel are deprived of their oil by pressing four or five times successively the outer surface of the peel (zest or flavedo) bent into a convex shape, against a flat sponge held in the palm of the left hand and wrapped round the forefinger. The oil vesicles in the rind, which are ruptured more easily in the fresh fruit than in the state in which lemons are imported, yield up their oil to the sponge, which when saturated is squeezed into an earthen vessel furnished with a spout and capable of holding about three pints. After a time the oil separates from the watery liquid which accompanies it, and is then decanted. By this process four hundred fruits yield 9 to 14 ounces of essence. The prisms of pulp are afterwards expressed to obtain lemon juice, and then distilled to obtain the small quantity of volatile oil they contain. At Mentone and Nice a different process is adopted. The lemons are placed in an *écuelle à piquer*, a shallow basin of pewter, about 8½ inches in diameter, having a lip for pouring on one side and a closed tube at the bottom about 5 inches long and 1 inch in diameter. A number of stout brass pins stand up about half an inch from the bottom of the vessel. The workman rubs a lemon over these pins, which rupture the oil vesicles, and the oil collects in the tube, which when it becomes full is emptied into another vessel that it may separate from the aqueous liquid mixed with it. When filtered it is known as *Essence de Citron au Zeste*, or, in the English market, as perfumers' essence of lemon, inferior qualities being distinguished as druggists' essence of lemon. An additional product is obtained by immersing the scarified lemons in warm water and separating the oil which floats off. *Essence de Citron distillée* is obtained by rubbing the surface of fresh lemons (or of those which have been submitted to the action of the *écuelle à piquer*) on a coarse grater of tinned iron, and distilling the grated peel. The oil so obtained is colorless and of inferior fragrance, and is sold at a lower price, while that obtained by the cold processes has a yellow color and powerful odor.

Essence of lemon is chiefly brought from Messina and Palermo packed in copper bottles holding 25 to 50 kilogrammes or more, and sometimes in tinned bottles of smaller size. It is said to be rarely found in a state of purity in commerce, almost all that comes into the market being diluted with the cheaper distilled oil. This fact may be considered as proved by the price at which the essence of lemon is sold in England, this being less than it costs the manufacturer to make it. When long kept, the essence deposits a white greasy stearoptene, apparently identical with the *bergaptene* obtained from the essential oil of the Bergamot orange. The chief constituent of oil of lemon is the terpene, $C_{10}H_{16}$, boiling at 348°·8 Fahr., which, like oil of turpentine, readily yields crystals of terpin, $C_{10}H_{16}3OH_2$, but differs in yielding the crystalline compound, $C_{10}H_{16}+2Cl$, oil of turpentine forming one having the formulæ $C_{10}H_{16}+HCl$. Oil of lemons also contains, according to Tilden, another hydrocarbon $C_{10}H_{16}$, boiling at 320° Fahr., a small amount of *cymene*, and a compound acetic ether, $C_2H_3O.C_{10}H_{17}O$. The natural essence of lemon not being wholly soluble in rectified spirit of wine, an essence for culinary purposes is sometimes prepared by digesting 6 ounces of lemon peel in one pint of pure alcohol of 95 per cent., and, when the rind has become brittle, which takes place in about two and a half hours, powdering it and percolating the alcohol through it. This article is known as lemon flavor.

The name lemon is also applied to some other fruits. The Java lemon is the fruit of *Citrus javanica*, Bl., the pear lemon of a variety of *Citrus Limetta*, and the pearl lemon of *Citrus margarita*. The fruit of a passion-flower, *Passiflora laurifolia*, is sometimes known as the water-lemon, and that of a Berberidaceous plant, *Podophyllum peltatum*, as the wild lemon. In France and Germany the lemon is known as the citron, and hence much confusion arises concerning the fruits referred to in different works. The essential oil known as oil of cedrat is usually a factitious article instead of being prepared, as its name implies, from the citron (Fr. *cédratier*). An essential oil is also prepared from *Citrus Lumia*, Risso, at Squillace in Calabria, and has an odor like that of bergamot but less powerful.

The juice of the sweet lime (*Citrus Limetta*, Risso), which is now largely substituted in the British navy for lemon juice for the prevention of scurvy, is imported principally from Montserrat. This island, although it only contains an area of 47 square miles, possesses the most extensive and best cultivated plantations of limes, *Citrus Limetta*, in the world. About thirty years ago a small plantation was commenced in the island by Mr. Burke, at considerable outlay and with no prospect of an immediate return, and hence was not at first attended with success. But the Montserrat Lime Juice Co. now owns 600 acres, bearing 120,000 trees. Although the fruit is collected all the year round, it is never gathered from the trees, but gangs of women laborers are sent out about 5 o'clock in the morning to collect all the fallen fruit. These when brought home are immediately sorted into sound and unsound fruits. The sound fruits are then bruised by hand in an *écuelle*, a saucer-like vessel with a number of projections arising from its bottom; by this means the oil cells in the rind are ruptured and the oil collects at the bottom of the vessel. More oil may be obtained from green fruits, but these yield less juice and less citric acid, and are therefore not gathered. The limes are then placed in a hopper with a sliding bottom through which they are supplied to two revolving rollers of gun-metal furnished with projecting spikes of different lengths. By these the fruit is torn to small pieces, which fall on a coarse copper sieve placed below. After passing through this strainer the juice is run directly into oaken puncheons or casks containing 100 gallons. These casks are filled quite full so as to exclude air, and bunged down immediately,—the small proportion of essential oil contained in the vegetable matter which passes through the sieve helping to preserve the juice from decomposition. The slightly musty flavor of lime juice is produced by keeping, even after a few days, although the fresh juice is quite free from it. The whole of the limes collected in the morning must be pressed for lime juice the same day, as the juice rapidly loses citric acid when exposed to the air, even as much as 3 ounces in one day, or the whole of the acid in three weeks. Even when run at once into the casks, although it may contain 13 or 14 ounces or rarely 15 ounces of citric acid per gallon, it seldom contains more than 9 or 10 ounces on arrival in England. The mass of fruit, pulp, etc., remaining on the sieves is put in bags of coir or cocoa-nut fibre, and a number of these placed one upon another, with strainers between, are then submitted to strong pressure in a screw press, to obtain more juice, the marc left after expression being returned to the plantation as manure. The unsound limes are treated in like manner and the juice boiled down in copper pans to a consistence of about 40° (Twaddle), a loss of citric acid taking place if the liquor be further concentrated. It then forms a black fluid of a consistence approaching that of treacle, and is exported in casks to England for the manufacture of citric acid. Turbines of sixteen horse-power are used as the motors for the machinery. Although the lime begins to bear in three or four years, until the trees are seven or eight years old the crops are very small. The trees require pruning and attention to keep them free from a species of mistletoe with red or yellow berries and a kind of dodder. They are usually manured with cotton seed cake. A fungus resembling black dust, and apparently the same as that which attacks the lemon trees in Europe, occasionally injures the plantations. For these reasons they are continually being extended. The young plants are grown from seeds picked out of the straining sieves, and are planted about 15 yards apart. In the plantations in the higher parts of the island the limes show a tendency to assume the form of a lemon and to become thicker skinned, while nearer the sea they are smaller, more globular, and thinner skinned. The young leaves of the lime are used for perfuming the water in finger-glasses, a few being placed in the water and bruised before use. In 1874 concentrated lime juice was exported from Montserrat to the value of £3390; and in 1878 Surinam exported 34,900 litres of lime juice. From Dominica 11,285 gallons, valued at £1825, were shipped in 1875.

Other trees belonging to the same natural order to which the name of limes has been given are *Citrus acida*, and *Atalantia monophylla*, the wild lime of the Hindus. *Nyssa candicans*, the ogeechee lime of North America, and *Tilia europæa*, the common lime or linden tree, belong to other natural orders.

See *Pharmacographia*, 2d ed., p. 114; Bentley and Trimen, *Medicinal Plants*, 64; Risso and Poiteau, *Histoire naturelle des Orangers*, 1873; Alfonso, *Coltivazione degli Agrumi*, 1875. (E. M. H.)

LEMONNIER, Pierre Charles (1715–1799), a distinguished astronomer, was born in Paris, November 23, 1715, where his father combined the practice of astronomy with the profession of philosophy. His first recorded observation was made before he was sixteen, and the presentation of an elaborate lunar map procured for him admission to the Academy, April 21, 1736, at the early age of twenty. He was chosen in the same year to accompany Maupertuis and Clairaut on their geodesical expedition to Lapland. In 1738, shortly after his return, he explained, in a memoir read before the Academy, the striking advantages of Flamsteed's mode of determining right ascensions. Indeed his persistent recommendation of English methods and instruments combined with the labors of Lacaille to effect a revolution in French practical astronomy, and constituted the most eminent of his services to science. He corresponded with Bradley, was the first to represent the effects of nutation in the solar tables, and introduced, in 1741, the use of the transit-instrument at the Paris observatory. He visited England in 1748, and in company with the earl of Morton and Short the optician continued his journey to Scotland, where he observed the annular eclipse of July 25. The liberality of Louis XV., in whose favor he stood high, furnished him with the means of procuring the best instruments, many of them by English makers, and gave him the command of the royal printing establishment for the publication of his works. Amongst the fruits of his industry may be mentioned a laborious investigation of the disturbances of Jupiter by Saturn, the results of which were employed and confirmed by Euler in his prize essay of 1748; a series of lunar observations extending over fifty years; some interesting researches in terrestrial magnetism and atmospheric electricity, in the latter of which he detected a regular diurnal period; and the determination of the places of a great number of stars, including twelve separate observations of Uranus between 1765 and its discovery as a planet. In his lectures at the Collége de France he first publicly expounded the analytical theory of gravitation, and his timely patronage secured the services of Lalande for astronomy. His temper was irritable, and his hasty utterances exposed him to retorts which he did not readily forgive. Against Lalande, his jealousy having been excited by his preference for Lacaille, he closed his doors "during an entire revolution of the moon's nodes." His career was arrested by paralysis late in 1791, and a repetition of the stroke terminated his life. He died at Héril near Bayeux, May 31, 1799. By his marriage with Mademoiselle de Cussy, he left three daughters, one of whom became the wife of Lagrange. He was admitted in 1739 to the Royal Society, and was one of the one hundred and forty-four original members of the Institute

He wrote *Histoire Céleste*, 1741; *Théorie des Comètes*, 1743, a translation, with additions, of Halley's *Synopsis*; *Institutions astronomiques*, 1746, an improved translation of Keill's text-book; *Nouveau Zodiaque*, 1755; *Observations de la Lune, du Soleil, et des Étoiles fixes*, 1751–75; *Lois du magnétisme*, 1776–78, etc.

LEMUR, a term applied by Linnæus to a group of mammals, and suggested by the nocturnal habits and strange ghost-like appearance of some of its members. As they had previously no vernacular appellation in English, it has been generally adopted, and is now completely anglicized, making "lemurs" in the plural. The French call them *Makis*, the Germans *Halbaffen*, in allusion to their forming, in appearance at least, a transition from monkeys to ordinary quadrupeds. For the same reason they are called *Prosimiæ* by some systematic writers. When the name was bestowed by Linnæus, only five species were known, of which one, *L. volans*, Linn., *Galeopithecus volans* of modern writers, is now removed by common consent from the group. Notwithstanding the discovery of many new and curious forms, the lemurs remain a very natural and circumscribed division of the animal kingdom, though no longer considered a single genus, but divided up into many genera and even families.

The Lemurs, or Lemuroid animals, as they ought more properly to be called, were formerly associated with the monkeys in the Linnæan order *Primates*, and afterwards in the *Quadrumana* of Cuvier, forming in that order the third main division, called by Geoffroy St. Hilaire *Strepsirhina*, on account of the twisted form of the external nostrils, a division equivalent in value to the *Catarhina* or Old World and the *Platyrhina* or New World monkeys. As more complete knowledge of their organization has been gradually attained, the interval which separates them structurally from the monkeys has become continually more evident, and they are now considered either as a distinct suborder of the *Primates*, or even as forming an order apart, without any very near affinities with the animals with which they have hitherto been so closely associated.[1]

The existing species are not numerous, and do not diverge widely in their organization or habits, being all of small or moderate size, all adapted to an arboreal life, climbing with ease, and, as they find their living, which consists of fruits, leaves, birds' eggs, small birds, reptiles, and insects, among the branches of the trees, they rarely have occasion to descend to the ground. None are aquatic, and none burrow in the earth. Many of the species, but by no means all, are nocturnal in their habits, spending the day in sleeping in holes, or rolled up in a ball, perched on a horizontal branch, or in the fork of a tree, and seeking their food by night. Their geographical distribution is very peculiar; by far the larger proportion of species, including all those to which the term "lemur" is now especially restricted, are exclusively inhabitants of Madagascar, where they are so abundant and widely distributed that it is said by M. Grandidier, who has contributed more than any other traveller to enrich our knowledge of the structure and manners of these animals, that there is not a little wood in the whole island in which some of them cannot be found. From Madagascar as a centre a few species less typical in character extend through the African continent westward as far as Senegambia, and others are found in the Oriental region as far east as the Philippine Islands and Celebes.

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[1] For the arguments in favor of the latter view see Alphonse Milne-Edwards, "Observations sur quelques points de l'embryologie des Lemuriens et sur les affinités zoologiques de ces animaux," in the *Ann. des Sciences Nat.*, October, 1871; and P. Gervais, "Encephale des Lemures," in *Journ. de Zoologie*, tom. i. p. 7. For those for retaining them among them the *Primates*, see Mivart, "On Lepilemur and Chirogaleus, and on the Zoological Rank of the Lemuroidea," in *Proc. Zool. Soc.*, 1873, p. 484.

The following are the essential anatomical characters common to the whole group:—

Teeth heterodont, or divided by their form into incisors, canines, and molars, and diphyodont, or consisting of a first and second set. Molars multicuspidate. Skull with complete bony margin to the orbits, which communicate freely (except in *Tarsius*) with the temporal fossæ. Lacrymal foramen outside the margin of the orbit. Clavicles well developed. Radius and ulna distinct. Scaphoid, lunar, and central bones of the carpus almost always separate. Five digits on the manus and pes, though the index of the manus may be rudimentary. Pollex (or thumb) and hallux (or great toe) always well developed—the latter especially large, opposable to the other digits, and with a flat nail. The index or second digit of the pes always terminating in a long pointed claw. The fingers and toes generally not tapering towards their extremities, but (except in *Chiromys*) dilated, flattened, and rounded at the tips. Cerebral hemispheres not completely overlapping the cerebellum, and but little convoluted. Stomach simple. Cæcum always present, generally large. The middle or transverse portion of the colon almost always folded or convoluted on itself. Uterus bicornuate. Placenta non-deciduate, diffused or bell-shaped—the whole of the chorion, except the cephalic pole, being covered with villosities. Allantois of great size.

In subdividing the group for the purpose of a more detailed description of the different animals of which it is composed, it must first be noted that there are two very aberrant forms, each represented by a single species—(1) the little *Tarsius* of the Indian archipelago, and (2) the singular *Chiromys* or aye-aye, which, though an inhabitant of the headquarters of the order, Madagascar, and living in the same forests and under the same external conditions as the most typical lemurs, exhibits a most remarkable specialization in the structure of its limbs and teeth, the latter being modified so as to resemble, at least superficially, those of the rodents, an order in which it was once placed. The differences between these two forms and the remaining lemurs is so great that the whole order naturally divides itself into three families, the first of which may be again divided into four subfamilies, which with the genera they contain may be thus arranged:—

	Genera.
Family 1. *Lemuridæ.*	
Subfamily 1. *Indrisinæ*	*Indris.* *Propithecus.* *Avahis.*
" 2. *Lemurinæ*	*Lemur.* *Hapalemur.* *Lepilemur.*
" 3. *Galaginæ*	*Chirogaleus.* *Galago..*
" 4. *Lorisinæ*	*Loris.* *Nycticebus.* *Perodicticus.*
Family 2. *Tarsiidæ*	*Tarsius.*
" 3. *Chiromyidæ*	*Chiromys.*

Family LEMURIDÆ.

Upper incisors two on each side, small and separated by an interval in the middle line. Upper canines large, conical, compressed, and pointed. Premolars two or three, molars three on each side above and below, with numerous, more or less pointed, cusps. In the front of the lower jaw are on each side two or three closely approximated, long, slender teeth lying almost horizontally and projecting forwards. These are generally considered to represent the incisors and canines, but there is some doubt about their homologies, and they may be all considered as incisors, the canine being absent. The first lower premolar larger than those behind it, and shaped like a canine. The orbit and temporal fossa widely continuous beneath the bar of bone (formed by the frontal and malar) constituting the posterior boundary of the former cavity. The fibula well developed and distinct from the tibia. All the digits of both feet (except the second of the hind foot) with flat nails, and corresponding form of ungual phalanges.

I. Subfamily **Indrisinæ.**—The dentition of the adult consists of thirty teeth, usually expressed by the formula $i\frac{2}{1}$, $c\frac{1}{1}$, $p\frac{2}{2}$, $m\frac{3}{3}$; but, as indicated above, they may be $i\frac{2}{2}$, $c\frac{1}{0}$, $p\frac{2}{2}$, $m\frac{3}{3}$. In the milk dentition there are twenty-two teeth, the true molars of course not being represented, but there are two additional teeth in the fore part of the lower jaw which have no successors in the permanent series. Hind limbs greatly developed, but the tarsus normal. Hallux of large size, and very opposable. The other toes united at their base by a fold of skin, which extends as far as the end of the first phalanx. Mammæ two, pectoral. Cæcum very large, and colon extremely long and spirally coiled.

The animals of this group are, as their organization indicates, essentially arboreal, and feed exclusively on fruit, leaves, buds, and flowers. When they descend to the ground, which is but seldom, they sit upright on their hind legs, and move from one clump of trees to another by a series of short jumps, holding their arms above them in the air. They are restricted geographically to the island of Madagascar. Among them are the largest members of the order. A very detailed and beautifully illustrated account of their characters, external and internal, and distribution and habits, is given in the *Histoire Naturelle de Madagascar*, by A. Grandidier and Alphonse Milne-Edwards (1875). The species are not numerous and are distributed into three genera.

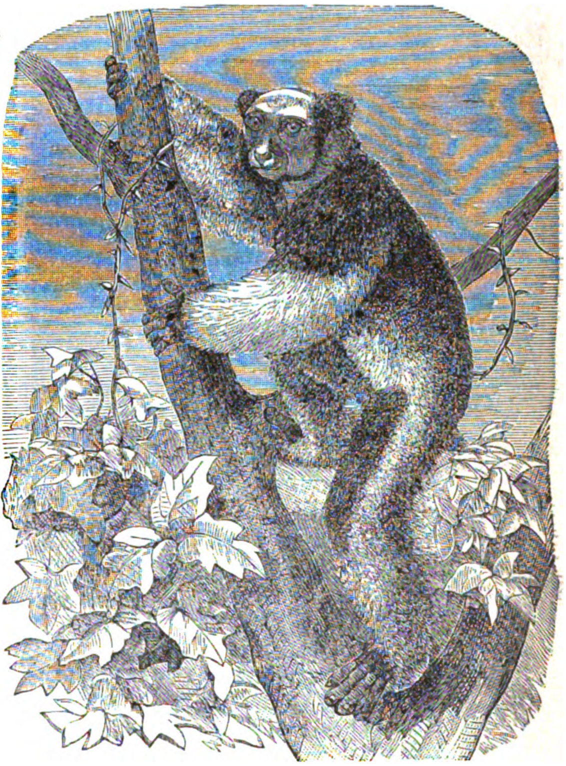

FIG. 1—Indris (*Indris brevicaudatus*). From Milne-Edwards and Grandidier, *Mammifères de Madagascar*, pl. 12.

1. *Indris*, Geoff.—Upper incisors subequal in size. Upper canine larger than the first premolar, muzzle moderately long, ears exserted. Carpus without an os centrale. Tail rudimentary. Vertebræ: C7, D12, L9, S4, C9.

The only well-established species is the indris (*I. brevicaudatus*, Geoff., fig. 1), discovered by Sonnerat in 1780. It is the largest of the lemurs, the length of the head and body being about two feet, and the tail 2 inches. It is very variable in color, for although usually nearly black, marked with whitish spots principally in the lumbar region and fore arm, individuals have been found quite white. It inhabits exclusively the forests of a part of the east coast of Madagascar, living in small troops of four or five in number, and resembling in most of its habits the animals of the next genus.

2. *Propithecus*, Bennett.—Second upper incisor much smaller than the first. Upper canine larger than the first premolar. Muzzle rather short. Ears short, concealed by the fur. An os centrale in the carpus. Tail long. Vertebræ: C7, D12, L8, S3, C28.

The species are all subject to great variations in color, which has led to much difficulty in discriminating them, and to much confusion of synonomy. Grandidier and Milne-Edwards recognize three as certainly distinct:—*P. diadema*, *P. verreauxii*, and *P. coronatus* (fig. 2). Some of these are to be found in almost every part of the island of Madagascar, living in the woods in small bands of six or eight together, and feeding exclusively on buds, flowers, and berries. Their powerful hind limbs enable them to leap from tree to tree, often to a distance of ten yards, without any apparent effort, seeming to fly through the air. When obliged to descend to the ground to pass from one clump of trees to another, they do not run on all fours, but stand erect, and throwing their arms above their heads, progress by a series of short jumps, producing an effect which is described by travellers who have seen them thus in their native haunts as exceedingly ludicrous. They are not nocturnal, but most active in the morning and evening, remaining seated or coiled up among the branches during the heat of the day. They are naturally of a quiet and gentle disposition, and do not show much intelligence. They are also less vociferous than the true lemurs, only when alarmed or angered making a noise which has been compared to the clucking of a fowl. Like the rest of the subfamily they never have more than one young one at a time.

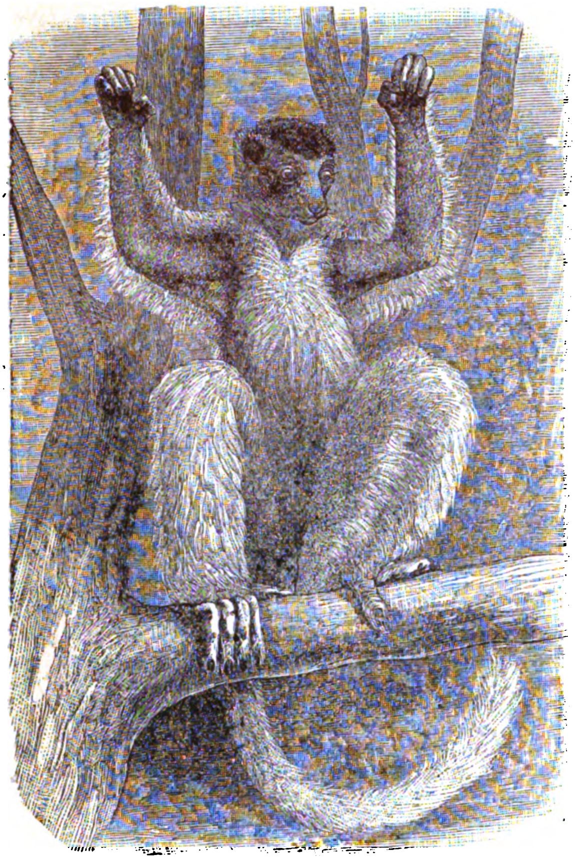
FIG. 2.—*Propithecus coronatus*. From Milne-Edwards and Grandidier, *Mammifères de Madagascar*, pl. 7.

3. *Avahis*, Jourdan.—Second upper incisor larger than the first. Upper canine scarcely larger than the first premolar. Muzzle very short. Ears very small and hidden in the fur, which is very soft and woolly. Carpus without os centrale. Tail long. Vertebræ: C7, D11, L9, S3, C23.

One species, *A. Laniger* (Gmelin), the woolly lemur, or avahis, considerably smaller than any of the last group. It differs from them in its habits, being quite nocturnal, and not associating in small troops, but being always met with either alone or in pairs. It is very slow in its movements, and rarely descends to the ground, but when it does it walks upright like the other *Indrisinæ*. It is found throughout the forests which clothe the mountains on the east coast of Madagascar, and also in a limited district on the north-west coast, the specimens from which locality are of smaller size and rather different in color.

II. Subfamily **Lemurinæ**.—The dentition in the adult consists of thirty-six teeth, which as usually enumerated are $i\frac{2}{2}$, $c\frac{1}{1}$, $p\frac{3}{3}$, $m\frac{3}{3}$. In the fore part of the lower jaw are on each side three elongated, compressed, procumbent teeth, of which the outer, usually considered the homologue of the canine, is larger than the others. All have long tails. Hind limbs not of the same disproportionate size as in the last group; and the cæcum much less developed. Tarsus but slightly elongated, the os calcis being always less than one-fourth the length of the tibia. Toes of the hind feet free to the base. Habitat, Madagascar and some of the adjacent Comoro islands.

This group contains the typical lemurs, or those to which the term is now chiefly restricted. Two rather aberrant members make it necessary to divide it into three genera.

1. *Lemur*, Linn.—Upper incisors separated by an interval in the middle, but not in contact with each other or the canine, in front of which they are both placed. Muzzle elongated. Ears conspicuous and tufted. Mammæ two, pectoral. Vertebræ: C7, D12, L7 (or D13, L6), S3, C27.

Animals much about the size of a common cat, with fox-like faces, soft thick fur, and long tails well clothed with hair. Not having the same disproportionate size of the limbs as the last group, they are much more quadrupedal in their actions, walking on the ground or running along the branches of trees on all four feet, but also jumping with marvellous agility. They are gregarious, living in small troops, are diurnal in their habits, but most active towards evening, when they make the woods resound with their loud cries, and feed, not only on fruits and buds, but also on eggs, young birds, and insects. When at rest or sleeping, they generally coil their long, bushy tails around their bodies, apparently for the sake of the warmth it affords. They have usually either one or two young ones at a birth, which are at first nearly naked, and are carried about, hanging close to and almost concealed by the hair of the mother's belly. After a while they change their position and mount upon the mother's back, where they are carried about until they are able to climb and leap by themselves. Though no member of the *Indrisinæ* has as yet lived long enough in captivity to be brought alive to Europe, the lemurs are commonly seen in menageries, and often breed in England. They present a great tendency to variation in their coloring, in consequence of which many nominal species have been made. The most distinct, and at the same time most beautiful, is the ring-tailed lemur (*L. cotta*, Linn., fig. 4), of a delicate gray color, and with a long tail marked with alternating rings of black and white. This is said by Mr. G. A. Shaw (*Proc. Zool. Soc.*, 1879, p. 132) to be an exception to all the other lemurs in not being arboreal, but living chiefly among rocks and bushes. Pollen, however, says that it inhabits the forests of the south-west parts of Madagascar, living, like its congeners, in considerable troups, and not differing from them in its habits. He adds that it is extremely gentle, and active and graceful in its movements, and utters at intervals a little plaintive cry like that of a domestic cat. All the others have the tail of uniform color. The largest species is *L. varius*, Geoff., the ruffed lemur, sometimes black and white, and sometimes reddish-brown, the variation apparently not depending on sex or age, but on the individual. In *L. macaco* the male is black and the female red. *L. mongoz*, *L. collaris*, and *L. albifrons* are other well-known species.

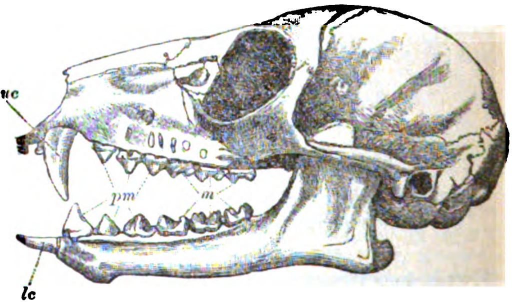

FIG. 3.—Skull of Ring-tailed Lemur (*Lemur cotta*). × ½. Mus. Roy. Coll. Surgeons. *uc*, upper canine; *lc*, lower canine; *pm*, premolars; *m*, true molars.

2. *Hapalemur*, Is. Geoff.—Upper incisors very small, subequal separated widely in the middle line. Those of each

side in contact with each other and with the canine, the posterior one being placed on the inside, and not in front of the latter. Muzzle very short and truncated. Mammæ four. There is apparently but one species, *H. griseus*, smaller than any of the true lemurs, of a dark gray color, with round face and short ears. It is quite nocturnal, and lives chiefly among bamboos, subsisting on the young shoots. A second species has been named *H. simus*, but it is doubtful if it is not only a variety.

3. *Lepilemur*, Is. Geoff.; *Lepidolemur* and *Myxocebus*, Peters.—Upper incisors absent or only two in number and very small. Muzzle more elongated than in the last. No distinct os centrale in the carpus. *L. mustelinus* is the best known species. It has, at all events when adult, no upper incisors. It is rare, and like *Hapalemur* nocturnal in its habits. A second closely allied species, but with better developed premaxillæ, containing a pair of small styliform incisors, has been described by Peters under the name of *Myxocebus caniceps* (*Monatsb. Berlin, Akad.*, 1874, p. 690).

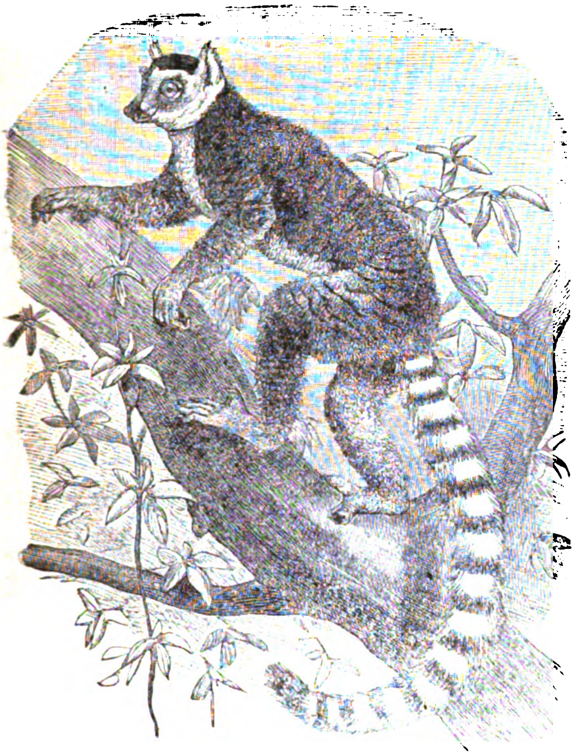

FIG. 4.—Ring-tailed Lemur (*Lemur catta*). From life.

III. Subfamily Galaginæ.—Dentition as in *Lemurinæ*, from which they are distinguished by the elongation of the tarsus, caused by a peculiar modification of the os calcis and the naviculare, the distal portion of the former and the whole of the latter having the form of nearly cylindrical rods placed side by side, while the other bones retain nearly their normal form and proportion.

1. *Chirogaleus*, Geoff.—Third upper premolar very much smaller than the first molar, and with only one external cusp. The animals included under this name appear to form a transition between the true lemurs and the galagos. The genus was originally established by Geoffroy St. Hilaire, in 1812, for the reception of three animals only known at that time by drawings made in Madagascar by the traveller Commerson. Subsequent discoveries have brought to light several species that may be referred to it, including one or two which are sometimes considered as forming a genus apart under the name of *Microcebus*. They are all small, some being less than a rat in size, long-tailed, and nocturnal in their habits. One of the largest, *C. furcifer*, is of a reddish-gray color, and is distinguished by a dark median stripe on its back which divides on the top of the head into two branches, one of which passes forwards above each eye. The most interesting peculiarity of these animals, a knowledge of which we owe to M. Grandidier, is that certain species (*C. samati*, *C. gliroides*, *C. milii*, etc.) during the dry season coil themselves up in holes of trees, and pass into a state of torpidity, like that of the hibernating animals in the winter of northern climates. Before this takes place, an immense deposit of fat accumulates upon certain parts of the body, especially upon the basal portion of the tail, which has then dimensions corresponding to that of the well known fat-tailed sheep of the Cape, but which by the time they emerge from their torpor has acquired its normal proportions. The smallest species, to which many names has been given (*C. pucillus*, *rufus*, *smithii*, etc.), lives among the small branches on the tops of the highest trees, feeding on fruit and insects, and making nests which resemble those of birds.

2. *Galago*, Geoff. = *Otolicnus*, Illiger.—Third upper premolar, with two large external cusps, and nearly equalling the first molar in size. Os calcis about one-third the length of the tibia, and the naviculare much longer than the cuboid. Vertebræ: C7, D13, L6, S3, C22–26. Tail long, and generally bushy. Ears large, rounded, naked, and capable of being folded at the will of the animal. Mammæ four, two pectoral and two inguinal.

The galagos differ from all the lemuroids previously mentioned, inasmuch as they are all inhabitants, not of Madagascar, but of the African continent, being widely distributed in the wooded districts from Senegambia in the west to Abyssinia in the east, and as far south as Natal. They pass the day in sleep, but are very active at night, feeding on fruit, insects, and small birds. When they descend to the ground they sit upright, and move about by jumping with their hind legs, like jerboas and kangaroos. They are pretty little animals, varying in size from that of a small cat to less than a rat, with large eyes and ears, soft woolly fur, and long tails. There are several species, of which *G. crassicaudatus*, from Mozambique, is the largest. A similar species, or perhaps variety, from Angola is *G. montieri*. *G. garnetti*, *alleni*, *maholi*, *demidoffi*, and *senegalensis* are other recognized species. The last-mentioned was the first known to science, having been brought from Senegal by Adanson, and described in 1796 by Geoffroy, who adopted the name *Galago*, by which it was said to be called by the natives.

IV. Subfamily Lorisinæ.—Dental formula as in *Lemurinæ*. Index finger very short, sometimes rudimentary and nailless. Fore and hind limbs nearly equal in length. Tarsus not specially elongated. Pollex and hallux diverging widely from the other digits, the hallux especially being habitually directed backwards. Tail short or quite rudimentary. Mammæ two, pectoral.

A small group of very peculiar animals, of essentially nocturnal habits, and remarkable for the slowness of their movements. They are completely arboreal, their limbs being formed only for climbing and clinging to branches, not for jumping or running. They have rounded heads, very large eyes, short ears, and thick, short, soft fur. They feed, not only on vegetable substances, but, like many of the *Lemuridæ*, also on insects, eggs, and birds, which they steal upon while roosting at night. None of the species are found in Madagascar. One of the greatest anatomical peculiarities of these animals is the breaking up of the large arterial trunks of the limbs into numerous small parallel branches, constituting a *rete mirabile*, which is found also in the true sloths, with which the loris are sometimes confounded on account of the slowness of their movements. The animals of this group are usually divided into four genera, though the characters by which they are separated are very trivial. There are more properly two natural divisions.

A. Characterized by the index finger being small, but having the complete number of phalanges, and by their Asiatic habitat.

These form the genus *Loris* of Geoffroy St. Hilaire (1796), *Stenops* of Illiger (1811), but they were in 1812 divided by Geoffroy into two genera, *Nycticebus* and *Loris*, a division which has been accepted by most modern zoologists.

Genus *Nycticebus*, Geoff.—First upper incisor larger than the second, which is often early deciduous. Inner margin of the orbits separated from each other by a narrow flat space. Nasal and premaxillary bones projecting but very slightly in front of the maxillæ. Body and limbs stout. No tail. Vertebræ: C7, D17, L6, S3, C12. The species are *N. tardigradus*, the common slow lemur or loris, of the Malay countries, Sumatra, and Borneo; *N. javanicus*, of Java; and *N. cinereus* (fig. 5), of Siam and Cochin China. The habits of all are much alike. They lead a solitary life in the recesses of large forests, chiefly in mountainous districts, where they sleep during the day in holes or fissures of large trees, rolled up into a ball, with the head between the hind legs. On the approach of evening they awake; and during the night they ramble among the branches of trees, slowly and quietly, in search of their food, which consists of tender leaves and fruit, small birds, insects, and mice. When in quest of living prey, they move noiselessly till quite close, and then suddenly seize it with one of their hands. The female produces but one young one at a time. *L. tardigradus* was placed by Linnæus at the head of the list of species of his genus *Lemur*, and its habits doubtless suggested the generic name which was transferred by Geoffroy to the less nocturnal and spectre-like Madagascar members of the group.[1]

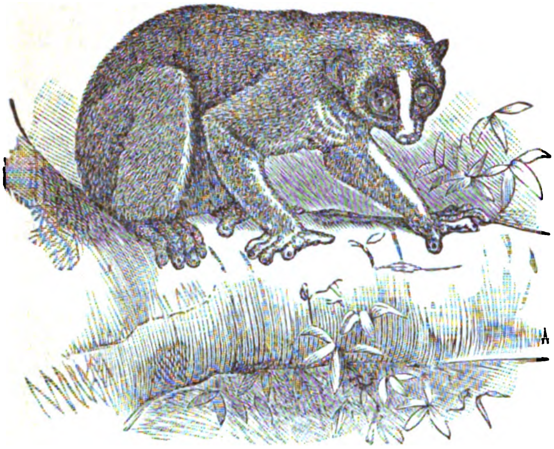

FIG. 5.—Gray Loris (*Nycticebus cinereus*). From A. Milne-Edwards, *N. Archives du Muséum*, tome iii. pl. 3.

Genus *Loris*, Geoff.—Upper incisors very small and equal. Orbits very large, and only separated in the middle line above by a thin vertical plate of bone. Nasals and premaxillæ produced forwards considerably beyond the anterior limits of the maxillæ, and supporting a pointed nose. Body and limbs slender. No external tail. Vertebræ: C7, D14, L9, S3, C6.

One species, *L. gracilis*, the slender loris of Ceylon, a very strange-looking creature, about the size of a squirrel, of a yellowish-brown color, with large prominent eyes, pointed nose, long thin body, long, angularly bent, slender limbs, and no tail. Its habits are like those of the rest of the group.

B. Index finger reduced to a mere tubercle without nail. Both the known species are from West Africa.

Genus *Perodicticus*, Bennett.—A short tail about the third of the length of the trunk. Two or three of the anterior dorsal vertebræ have very long slender spinous processes, which in the living animal project beyond the general level of the skin, forming distinct conical prominences, covered only by an exceedingly thin and naked integument. *P. potto* (*Lemur potto*, Gmelin), the potto, is one of the oldest known members of the lemuroid group, having been described in 1705 by Bosman, who met with it in his voyage to Guinea. It was, however, lost sight of until 1825, when it was rediscovered in Sierra Leone and fully described by Bennett in the *Proceedings of the Zoological Society*, part i., 1830–31. under the name of *Perodicticus Geoffroyi*. Bennett's generic name has been retained, but the specific name bestowed by Gmelin, adopted from Bosman, has been restored. It is also found in the Gaboon. It is strictly nocturnal, and slower in its movements even than *Nycticebus tardigradus*, which otherwise it much resembles in its habits.[2]

A second species, the awantibo (*P. calabarensis*, Smith), rather smaller and more delicately made, with smaller hands and feet, and rudimentary tail, constitutes the genus *Arctocebus*, Gray. It is found at Old Calabar, and is very rare, only a few individuals having as yet been met with. Its anatomy has been described by Professor Huxley in the *Proc. Zool. Soc.*, 1864, p. 314. Vertebræ: C7, D15, L7, S3, C9.

Family TARSIIDÆ.

Dentition, $i\frac{2}{1}$, $c\frac{1}{1}$, $p\frac{3}{3}$, $m\frac{3}{3}-\frac{3}{3}$, total 34. The first upper incisor large, and in contact with its fellow of the opposite side. Canine of moderate size. Molars, with numerous pointed cusps. Lower canine semi-erect, its apex diverging from that of the single incisor. First lower premolar smaller than those behind it. Orbit to a large extent separated from the temporal fossa by a bony partition. Fibula slender, with its lower half confluent with the tibia. Second and third digits of the hind foot with compressed claws; all the other digits of both feet with flat nails. Calcaneum and navicular bone of the foot elongated as in the chirogales and galagos, but to a still greater extent. Colon short and not folded. Vertebræ: C7, D13, L6, S3, C27.

This family contains the single genus *Tarsius*, Storr, of which but one species is known, *T. spectrum*, the tarsier, a very singular little animal, rather smaller than an English squirrel, with very large eyes and ears, a long thin tail, tufted at the end and immensely elongated tarsal portion of the foot, in allusion to which its generic name was given to it. It inhabits the forests of many of the islands of the Indo-Malayan archipelago, Sumatra, Borneo, Celebes, and some of the Philippines, feeds chiefly on insects and lizards, sleeps during the day, but is tolerably active at night, moving chiefly by jumping from place to place, an action for which the structure of its hind legs, which present a curious resemblance to those of a frog, seems particularly well adapted. It is rare, not more than two being generally found together, and only brings forth one young at a time.[3]

Family CHIROMYIDÆ.

Dentition of adult, $i\frac{1}{1}$, $c\frac{0}{0}$, $p\frac{1}{0}$, $m\frac{3}{3}-\frac{4}{4}$, total 18. Incisors very large, compressed, curved, with persistent pulps and enamel only in front as in rodents. Teeth of molar series with flat, very indistinctly tuberculated crowns. In the young the first set of teeth more resemble those of the normal lemurs, being $i\frac{2}{2}$, $c\frac{1}{0}$, $m\frac{2}{2}$, all very small. Orbit surrounded by a ring of bone posteriorly, beneath which it communicates freely with the temporal fossa. Fibula well developed and distinct from the tibia. All the digits of both feet with pointed rather compressed claws, except the hallux, which has a flattened nail. Middle digit of the hand excessively attenuated. Vertebræ: C7, D12, L6, S3, C27.

This family, like the last, is formed for the reception of a single genus, *Chiromys*, Cuvier,[4] containing one species, *C. madagascariensis* (Gmelin), the aye-aye, an animal about the size of a cat, with a broad rounded head, short face, and large and naked ears. It has very large hands and long thin fingers with pointed claws, one of which (the middle or third) is remarkable for its extreme slenderness. The foot resembles that of the other lemurs in its large opposable hallux, with a flat nail, but all the other toes have pointed compressed claws, like that of the second toe in the *Lemurinæ* and the second and third in the *Tarsiidæ*. Tail long and bushy. General color dark brown, the outer fur being long and rather loose, with a woolly undercoat. Mammæ two, inguinal in position. It is a native of Madagascar, where it was discovered by Sonnerat in 1780. The specimen brought to Paris by that traveller was the only one known until 1860. Since then many others have been obtained, and one has lived for several years in the gardens of the Zoological Society of London. Like so many of the lemurs, it is completely nocturnal in its habits, living either alone or in pairs, chiefly in the bamboo forests. Observations upon captive specimens have led to the conclusion that it feeds principally on succulent juices, especially of the sugar cane, which it obtains by tearing open the hard woody circumference of the stalk with its strong incisor

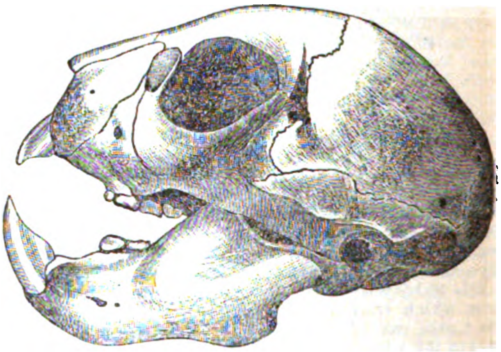

FIG. 6.—Skull of Aye-aye (*Chiromys madagascariensis*). × [illegible] Mus. Roy. Coll. Surgeons.

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[1] For the anatomy of this genus, see J. L. C. Shroeder van der Kolk and W. Vrolik, "Recherches d'Anatomie comparée sur le genre *Stenops* d'Illiger," in *Bijdragen tot de Dierkunde*, part i., Amsterdam, 1848–54.

[2] Van der Hoeven and Van Campan, "Ontleebkundig ondersoek van der Potto van Bosman," in *Verh. Kong. Akad. van Wetenschappen*, Amsterdam, 1859.

[3] H. Burmeister, *Beiträge zur näheren Kenntniss der Gattung Tarsius*, Berlin. 1846.

[4] It was first named *Daubentonia* by Geoffroy; but this name was withdrawn by its author in favor of *Chiromys*, as it had been previously given to a genus in the vegetable kingdom. It ought not, therefore, to be revived, as has been done by some modern authors

teeth. It is said also to devour certain species of wood-boring caterpillars, which it obtains by first cutting down with its teeth upon their burrows, and then picking them out of their retreat with the claw of its attenuated middle finger. It constructs large ball-like nests of dry leaves, lodged in a fork of the branches of a large tree, and with the opening on one side. The resemblance of its teeth to those so characteristic of the *Rodentia* caused it to be placed formerly in that order, and it was only when its anatomical characters were fully known that its true affinities with the lemurs became apparent.[1]

Extinct Lemuroidea.—The disputed zoological position of the lemurs, and the great importance which has been attached to them by those naturalists who regard them as the direct transition between the lower and higher mammals, and survivors of a large group, now almost extinct, through which the higher *Primates*, including man, must have passed in the progress of their development, make the consideration of their ancient history one of great interest. Until very recently fossil lemurs were quite unknown; at all events the affinities of certain remains provisionally assigned to the group were much questioned; but within the last few years the existence of lemuroid animals in Europe during the later Eocene and early Miocene periods has been perfectly established, and remains of a large number of animals attributed, though with less certainty, to the group have been found in beds of corresponding age in North America. In 1862 Rütimeyer described the fragment of a right maxilla and three molars from a siderolitic deposit (Bohnerz) at Egerkingen, near Soleure, under the name of *Cœnopithecus lemuroides*, supposing them to belong to an animal partaking of the characters of the American monkeys and the lemurs. The remains were, however, by most other palæontologists referred to the *Ungulata*. More recently M. Bétille discovered in deposits which were being worked for phosphate of lime at Sainte Néboule de Béduer, department of Lot, France, regarded as of early Miocene age, a nearly complete cranium, and subsequently, at the same place, a portion of a ramus of a mandible of apparently the same species of animal. These were described by M. Delfortrie in the *Actes de la Société Linnéenne de Bordeaux* for 1872 under the name of *Palæolemur betillei*. The cranium is generally well preserved, but unfortunately the anterior part, containing the incisor and canine teeth, has been broken off. Its affinity to the lemurine animals, especially to the African forms, the *Lorisinæ* and *Galaginæ*, is chiefly shown by the general form of the cranium, the large size and anterior direction of the orbits, the small and narrow muzzle, and the position of the lacrymal foramen outside the anterior edge of the orbit. In size the fossil is intermediate between the potto (*Perodicticus potto*) and *Galago crassicaudatus*. When the specimen came into the hands of M. Gaudry, that experienced and accurate palæontologist, with the rich treasures of the Paris Museum at hand for comparison, recognized that certain more or less fragmentary remains which had long been in the collection, and had been described from the teeth alone, and generally, though doubtfully, referred to the *Ungulata*, were really nothing more than animals of the same group, and probably even the same species as *Palæolemur betillei*. These were *Adapis parisiensis*, Cuvier, from the Paris gypsum, described and figured in the *Ossemens fossiles*, *Aphelotherium duvernoyi*, Gervais, from the same beds, and other specimens from Barthélemy, near Apt. This result was fully acquiesced in by Gervais, who also added *Cœnopithecus lemuroides*, Rütimeyer, to the synonyms of the animal, which henceforth must be called *Adapis parisiensis*, as that was the name first assigned to it.

M. Delfortrie's announcement of a fossil lemur from the south of France was soon followed by that of another species by M. H. Filhol, named *Necrolemur antiquus* (*Comptes Rendus*, 1873, tom. lxxvii. p. 1111), which was afterwards more fully described and figured (*Annales des Sciences Géologiques*, tom. v. No. 4, 1874, and *Recherches sur les Phosphorites du Quercy*, 1876), and a second species of *Adapis*, of considerably larger size, *A. magnus*, Filhol, was added to the group; the latter, of which the skull is upwards of 4 inches in length, resembles M. Delfortrie's in its general characters, but modified much in the way that the skulls of larger animals differ from the smaller ones of the same natural group. The brain-chamber and orbits are relatively smaller, the face larger, the muscular crests more developed, and the constriction between the cerebral and facial portion of the skull more marked. These modifications remove the skull in its general characters still further from the existing lemurs—so much so that M. Filhol refers it and the other species of *Adapis* to a distinct and hitherto unknown zoological type, intermediate between the lemurs and the pachyderms, to which he gives the name of *Pachylemur*. On the other hand he considers the *Necrolemur antiquus* found at St. Antonin, which is a very small species, to be a true lemuroid, more nearly resembling *Galago senegalensis* than any existing species. Unfortunately in all these specimens the anterior part of the skull is so much injured that the character and numbers of the incisor teeth cannot be ascertained, a great want in determining the affinities of these animals. And even if the whole of the skulls were found, as long as nothing is known of the limbs, or of any other bones of the skeleton, the determination of their actual zoological position can only be considered as provisional. All the existing lemurs and pachyderms, or ungulates as they are now generally termed, are so essentially different in structure and mode of life that it is difficult to conceive of a transition from one to the other, and therefore any such forms when found will be full of interest. In skull and teeth characters, as far as they are yet known, these ancient lemur-like animals from France do not deviate sufficiently from the existing lemuroids to justify their separation, but it remains to be proved whether they had the opposable hallux and unguiculate toes of the forms which now inhabit the world, or whether their limbs were of a more generalized type. The discussions which have taken place on their nature at all events show how little reliance can be placed upon the characters of the molar teeth alone in judging of the affinities of an extinct animal.

Perhaps the most important of all the numerous recent palæontological discoveries in the Tertiary beds of the rocky mountain district of North America has been that of animals which their describers believe to be low and generalized forms of the order *Primates*. Their existence was not suspected till 1872, in which year Professor Marsh and Professor Cope almost simultaneously announced the fact. Since that time numerous genera have been assigned to the group, including five which were previously described by Leidy from teeth alone, the nature of which he did not venture to determine. These are nearly all from the Eocene or lowest Miocene formations. Until we receive fuller information regarding the remains of these animals, it is premature to speculate upon their real character or affinities. The difficulty of doing so is at present enhanced by their describers in the provisional accounts already given adopting the old assumption that lemurs and monkeys are animals of the same general type, and speaking of them sometimes as one and sometimes as the other. It is possible that these animals, or some of them, may have been monkeys, in which case they were not lemurs; or they may have been lemurs, in which case they were not monkeys. It is possible also that they may form a connecting link between the two, and so justify their old association in one group. The recently described *Anaptomorphus homunculus* from the Lower Eocene of Wyoming, an animal smaller than *Tarsius spectrum*, is considered by Cope to be "the most simian lemur yet discovered, and probably representing the family from which the true monkeys and men were derived" (*Palæontological Bulletin*, No. 34, February 20, 1882). In this case the lemurs, which, judging by their present distribution, appear to have spread east and west from Madagascar, may have had quite a different origin.

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[1] R. Owen, "On the Aye-aye," in *Trans. Zool. Soc.*, vol. 5, p. 33, 1862; W. Peters, "Ueber die Säugethier-Gattung *Chiromys*," in *Abhand. Königl. Akad. der Wissenschaften*. Berlin, 1865, p. 79.

Literature.—Besides the works and memoirs on particular families and genera referred to above, see St. G. Mivart, "Notes on the Crania and Dentition of the *Lemuridæ*," in *Proc. Zool. Soc.*, 1864 (p. 611–648) and 1867 (p. 960–975); Mivart and Murie, "On the Anatomy of the *Lemuroidea*," in *Trans. Zool. Soc.*, vol. vii., 1872, pp. 1–113; W. Turner, "On the Placentation of the Lemurs," in *Phil. Trans.*, clxvi., pp. 569–587; F. Pollen and D. C. Van Dam, *Recherches sur la Faune de Madagascar*, 2^{me} parte, "Mammifères," 1868. (W. H. F.)

LENA. See SIBERIA.

LENCLOS, NINON DE (1620–1705), was the daughter of a gentleman of good position in Touraine. Her long and eventful life divides into two periods, during the former of which she was the typical Frenchwoman of the gayest and most licentious society of the 17th century, during the latter the recognized leader of the fashion in Paris, and the friend of wits and poets. Of her earlier life the less said the better, and in her defence all that can be pleaded is that she had been educated by her father in the epicurean and sensual beliefs made popular by Montaigne, and that she retained throughout the frank demeanor, and disregard of money, which won from Saint Évremond the remark that she was an *honnête homme*. Against her, and the numerous specious defences set up for her by contemporaneous and subsequent French writers, must be mentioned her absolute want of maternal feeling and even of natural shame. The well-known visit of Queen Christina to her attests the extent of her renown, or infamy, and the inefficacy of the threats of Anne of Austria proves her power. Of a perfectly different character was her later life, when, though she had continued her career of debauchery for a preposterous length of time, she settled down to the social leadership of Paris. Then there were to be found in her salon all that was most witty and refined in France,—"ladies as well as gentlemen of the highest birth," remarks a correspondent to Madame de Sevigné, poets like Molière, abbés like Chateauneuf, Genevese preachers like Turretin, the protegé of Saint Évremond. It became the fashion for young men as well as old to throng round her, and the best of all introductions for a young man who wished to make a figure in society was an introduction to Mdlle. de Lenclos. The cause for this surpassing social success is to be found perhaps as much in her past notoriety, and past intimacy with the great names of the last generation, as in the wit and tact, to which Saint Évremond, and after him Sainte-Beuve, ascribe it. Her long friendship with Saint Évremond must be shortly noticed. They were of the same age, and had been intimate in their youth, and throughout his long exile the wit seems to have kept a kind remembrance of Ninon. The few really authentic letters of Ninon herself are those addressed to her old friend, and the letters of both in the last few years of their equally long lives are exceptionally touching, and unique in the polite compliments with which they try to keep off old age. If Ninon owes part of her posthumous fame to the old wit, she owes at least as much to the young Arouet, who was presented to her as a promising boy poet by the abbé de Chateauneuf, to whom she left 2000 francs to buy books, and who, as Voltaire, was to write a letter on her which was to be the chief authority of many subsequent biographers. Her personal appearance is, according to Sainte-Beuve, best described in a novel of Mdlle. de Scudéry, and the characteristic of it was neither beauty nor wit, but high spirits, and perfect evenness of temperament.

The letters of Ninon published after her death were, according to Voltaire, all spurious, and the only authentic ones are those to Saint Évremond, which can be best studied in Dauxmesnil's edition of *Saint Évremond*, and his notice on her. Sainte-Beuve has an interesting notice of these letters in the *Causeries du Lundi*, vol. iv. Most biographies of Ninon are full of unauthentic stories.

LENFANT, JACQUES (1661–1728), author of numerous works, chiefly in ecclesiastical history, was born at Bazoche (Eure-et-Loir) on April 13, 1661. His father, Paul Lenfant, was Protestant pastor at Bazoche and afterwards at Châtillon-sur-Loing until the revocation of the edict of Nantes, when he removed to Cassel. After studying at Saumur and Geneva, Lenfant completed his theological course at Heidelberg, where in 1684 he was ordained pastor of the French Protestant church, and appointed chaplain to the dowager electress palatine. The French invasion in 1688 compelled his withdrawal to Berlin, where in the following year he was again appointed by Frederick to be one of the ministers of the French Protestant church; this office he continued to hold until his death, ultimately adding to it that of chaplain to the king, with the dignity of consistorialrath. He visited Holland and England in 1707, and had the honor of preaching before Queen Anne, and, it is said, of being invited to become one of her chaplains. In search of materials for his histories he visited Helmstadt in 1712, and Leipsic in 1715 and 1725, but otherwise the course of his life was quite uneventful. He died at Berlin on August 7, 1728.

An exhaustive catalogue of his publications, thirty-two in all, will be found in Chauffepié's *Dictionnaire*, where his personal excellencies are dwelt upon with some fulness and warmth. See also Haag's *France Protestante*. He is now best known by his *Histoire du Concile de Constance, tirée principalement d'Auteurs qui ont assisté au Concile* (Amsterdam, 1714; 2d ed., 1728; English translation, 1730). It is of course largely dependent upon the previous laborious work of Van der Hardt, but has indisputable literary merits peculiar to itself, and in particular has been praised on all sides for its fairness. It was followed by *Histoire du Concile de Pise, et de ce qui s'est passé de plus mémorable depuis ce Concile jusqu' au Concile de Constance* (1724), and (posthumously) by *Histoire de la Guerre des Hussites et du Concile de Basle* (Amst., 1731; German translation, Vienna, 1783–84). Lenfant was one of the chief promoters of the *Bibliothèque Germanique*, begun in 1720: and he was associated with Beausobre in the preparation of the new French translation of the New Testament with original notes, published at Amsterdam in 1718.

LENKORAN, a town in Trans-Caucasia, on the Caspian, at the mouth of a small stream of its own name, and close to a great lagoon. The lighthouse stands in 38° 45′ 38″ N. lat., and 48° 50′ 18″ E. long. Taken by storm on New Year's day, 1813, by General Kotliarevski, Lenkoran was in the same year surrendered by Persia to Russia by the treaty of Gulistan along with the khanate of Talysh, of which it was the capital. In 1867 it had a population of 15,933; but according to the census of 1873 there were only 4779 inhabitants (734 Russians, 232 Armenians). The fort has been dismantled; and in trade the town is being far outstripped by Astara, the custom-house station on the Persian frontier.

The district of Lenkoran (2078 square miles), corresponding to the khanate of Talysh, is highly interesting from its physical peculiarities. It is a thickly wooded mountainous region, shut off from the dry Persian plateau by the Talysh range (7000–8000 feet high), and with a narrow marshy strip along the coast. The climate is exceptionally moist and warm (annual rainfall 52·79 inches; mean temperature in summer 75°, in winter 40°), and fosters the growth of even Indian forms of vegetation. The iron tree (*Parrotia persica*, C. A. Meyer), the silk acacia, *Carpinus betulus*, *Quercus iberica*, the box tree, and the walnut flourish freely, as well as the sumach, the pomegranate, and the *Gleditchia caspica*. The Bengal tiger is not unfrequently met with, and wild boars are abundant. Of the 95,482 inhabitants of Lenkoran, the Talyshians (42,999) form the most interesting and aboriginal element, belonging as they do to the Iranian family, and speaking an independently developed language closely related to Persian. They are of middle height and dark complexion, with generally straight nose, small round skull, small sharp chin, and large full eyes, which are expressive, however, rather of cunning than intelligence. They live exclusively on rice. In the northern half of the district the Tartar element predominates, and there are a number of villages (Pravolnoye, for instance, with 2000 inhabitants) occupied by various Russian sectarians.

LENNEP, a small town of Rhenish Prussia in the district of Düsseldorf, is situated 18 miles east of Düsseldorf and 9 miles south of Barmen, at a height of 1050 feet about the level of the sea. It lies in the heart of one of the busiest industrial districts in Germany, and carries on important manufactures of the finer kinds of cloth, wool, yarn, felt, and other articles. It is the seat of a small chamber of commerce, and possesses a large and well-equipped hospital. Lennep, which was the residence of the counts of Berg from 1226 to 1300, owes the foundation of its prosperity to an influx of Cologne weavers during the 14th century. Population (1880) 8077, about one-fourth of whom are Roman Catholics.

LENNEP, JACOB VAN (1802–1868), Dutch poet and novelist, was born March 24, 1802, at Amsterdam, where his father, David Jacob van Lennep, who also became known as a scholar and poet, was professor of eloquence and the classical languages in the Athenæum. Lennep received his education partly in his native city and partly at Leyden, studying jurisprudence at the latter, and ultimately obtaining the degree of doctor of laws; he then settled as an advocate in Amsterdam. His first poetical efforts had been translations from Byron, of whom he was an ardent admirer, and in 1826 he published a collection of original *Academic Idylls* which had a modified success. He first attained genuine popularity by the *Nederlandsche Legenden*, which reproduced after the manner of Sir W. Scott, though without much psychological depth or literal accuracy, some of the more stirring incidents in the early history of his fatherland. His fame was further raised to a very high pitch by his comedies *Het Dorp aan die Grenzen* and *Het Dorp over die Grenzen*, which had reference to the political events of 1830. In 1829 he had broken ground in a new and hitherto untried field with the publication of *De Pleegzoon* ("The Adopted Son," 1829), the first of a series of historical romances in prose, which have acquired for him in Holland a position somewhat analogous to that which Scott holds throughout the reading world. The series included *De Roos van Dekema* (1837), *Onze Voorouders* (1838), *Ferdinand Huyck* (1840), *Elizabeth Musch* (1850), and *De Lotgevallen van Klaasje Zevenster* (1866), several of which have been translated into German and French, and two ("The Rose of Dekama" and "The Adopted Son") into English. In a closely connected department of literature, his Dutch history for young people (*Geschiedenis van Noord-Nederland aan mijne Kinderne verhaald*) is attractively written. Apart from the two comedies already mentioned, Lennep was the author of numerous dramatic pieces which have found much acceptance on the Dutch stage. For some years Lennep held a judicial appointment, and from 1853 to 1856 he was a member of the second chamber, in which he voted with the Conservative party. He died at Oosterbeek near Arnheim, on August 25, 1868. There is a collective edition of his *Poetische Werken* (13 vols., 1859–1872), and also of his *Romantische Werken* (23 vols., 1855–1872).

LENT (*lenten*, *lente*, from A. S. *lencten*, spring; comp. Du. *lente*, Germ. *lenz*), the ecclesiastical season known in the early Greek Church as *τεσσαρακοστή* (afterwards as *ἡ νηστεία*), and in the Latin Church, from at least the 4th century, as *Quadragesima.*[1] Irenæus, in a passage which, though not free from difficulties, is yet clear enough in its general scope (*apud* Euseb., *H. E.*, v. 24), mentions that the custom of keeping a fast before Easter Sunday was quite old even in his day, but that no uniformity of observance had up to that time been established, some thinking they ought to fast for one day, others for two days, and others having further peculiarities. In Tertullian's day the Good Friday fast at all events was "communis et quasi publica jejunii religio" (*De Orat.*, c. 18) and elsewhere (*De Jejun.* 2) he indicates his opinion that Christians ought to commemorate by a religious fast all the time during which "the bridegroom was taken away from them." This period of fasting was gradually extended, but still without uniformity of praxis. The diversity of usage covered by a common name is referred to by Socrates (*H. E.*, v. 22) as a source of perplexity to him. He tells us that in Rome the custom was to fast three continuous weeks before Easter, Saturdays and Sundays not being included; that in Illyria, Greece, and Alexandria the period of abstinence called *τεσσαρακοστή* extended over six weeks; and that in some other places, which he does not specify, the custom was to begin the fast seven weeks before Easter, but actually to observe it at intervals only for three periods of five days each, and nevertheless still to call it *τεσσαρακοστή*. Cassianus (*Coll.* 21, 5) calls attention to the fact that a fast of seven weeks, when Saturdays and Sundays, except Holy Saturday, are excluded as they ought to be, means a fast of thirty-six days in all, *i.e.*, a tithe of the year,—an idea which seems to have found wide acceptance. Leo I. (*Serm.* 44) alludes to the fast of forty days as having apostolic authority, but the number does not seem to have been taken quite literally. In one of the homilies (*In Evang.*, xvi.) of Gregory the Great, the precise number is fixed as by Cassianus at thirty-six, but this figure is obtained by reckoning from the sixth Sunday before Easter and deducting Sundays only. In the *Corpus Juris Canonici* this passage is reproduced, but with an important change which must have been made before the end of the 8th century; it is to the effect that, in order to make up the sacred number of forty days dedicated to fasting by our Lord, it is necessary to take in as fasts the four days preceding Quadragesima Sunday. As regards the manner of observing Lent, various degrees of strictness have prevailed in the church. Perfect abstinence from all food every fasting day until evening is in theory at least required, and it has also been considered desirable that public worship with sermon should be attended daily, with frequent communion, especially on Saturday and Sunday; public amusements, especially stage plays, are prohibited, and the celebration of religious festivals, as also of birthdays and marriages, is held to be unsuitable; and increased diligence in almsgiving and deeds of charity is enjoined.

LENTIL, the seed of *Lens esculenta*, Mönch, a small annual of the vetch tribe. The plant varies from 6 to 18 inches in height, and has many long ascending branches. The leaves are alternate, with six pairs of oblong-linear, obtuse, mucronate leaflets. The flowers, two to four in number, are of a pale blue color, and are borne in the axils of the leaves, on a slender footstalk equalling the leaves in length; they are produced in June or early in July. The pods are about ½ inch long, broadly oblong, slightly inflated, and contain two seeds, which are of the shape of a doubly convex lens, and about ⅙ inch in diameter. There are several cultivated varieties of the plant, differing in size, hairiness, and color of the leaves, flowers, and seeds. The last may be more or less compressed in shape, and in color may vary from yellow or gray to dark brown; they are also sometimes mottled or speckled. In English commerce two kinds only of lentils are principally met with, viz., the French and the Egyptian. The former are usually vended entire, and are of an ash-gray color externally and of a yellow tint within; the latter are usually sold like split peas, without the seed coat, and consist of the reddish-yellow cotyledons, which are smaller and rounder than those of the French lentil; the seed coat when present is of a dark brown color. Egyptian lentils are chiefly imported from Alexandria. In 1880 there were shipped from that port 25,000 ardebs, or 17,000 quarters, of red lentils, valued at £25,000, of which amount 80 per cent. was taken by Great Britain. Considerable quantities of lentils are also imported into the United States, but are chiefly consumed by the Germans, with whom lentil soup is a favorite dish. The native country of the lentil is not known, although it is supposed to be indigenous to the Himalayas. It was probably one of the first plants brought under cultivation by mankind. The name *'adas* (Heb. עדש) appears to be an original Semitic word, and the red pottage of lentils for which Esau sold his birthright (Gen. xxv. 34) was apparently made from the red Egyptian lentil. This lentil is cultivated in one or other variety in India, Persia, Syria, Egypt, Nubia, and North Africa, and in Europe, along the coast of the Mediterranean, and as far north as Germany, Holland, and France. According to Shaw, *Travels in Barbary*, lentils are dressed in that country in the same manner as beans; and in Egypt and Syria the parched seeds are exposed for sale in shops, and esteemed the best food to carry on long journeys. Lentils form a chief ingredient in the Spanish *puchero*, and are used in a similar way in France and other countries. For this purpose they are usually sold in the shelled state.

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[1] Literally, it would seem, the fortieth day before Easter (comp. *Sexagesima*, *Septuagesima*). From *Quadragesima* comes the Italian *quaresima*, Spanish *cuaresma*, French *carême*.

The reddish variety of the lentil ("lentillon d'hiver") is the kind most esteemed in Paris on account of the superior flavor of its smaller seeds. It is sown in autumn either with a cereal crop or alone, and is cultivated chiefly in the north and east of France. The large or common variety, "lentille large blonde," cultivated in Lorraine and at Gallardon (Eure-et-Loir), and largely in Germany, is the most productive, but is less esteemed. This kind has very small whitish flowers, two or rarely three on a footstalk, and the pods are generally one-seeded, the seeds being of a whitish or cream color, about ⅜ of an inch broad and ⅛ inch thick. A single plant produces from 100 to 150 pods, which are flattened, about ¾ inch long and ½ inch broad. Another variety, with seeds similar in form and color to the last, but of much smaller size, is known as the "lentillon de Mars." It is sown in spring. This variety and the "lentille large" are both sometimes called the "lentille à la reine." A small variety, "lentille verte du Puy," cultivated chiefly in the departments of Haute Loire and Cantal, is also grown as a vegetable and for forage. The Egyptian lentil was introduced into Britain in 1820. It has blue flowers. Another species of lentil, *E. monanthos*, L., is grown in France about Orleans and elsewhere under the name of "jarosse" and "jarande." It is, according to M. Vilmorin, one of the best kinds of green food to grow on a poor dry sandy soil; on calcareous soil it does not succeed so well. It is usually sown in autumn with a little rye or winter oats, at the rate of a hectolitre to a hectare.

The lentil also prefers a light warm sandy soil; on rich land it runs to leaf and produces but few pods. The seeds are sown in March or April or early in May, according to the climate of the country, as they cannot endure night frosts. If for fodder they are sown broadcast, but in drills if the ripe seeds are required. The pods are gathered in August or September, as soon as they begin to turn brown,—the plants being pulled up like flax while the foliage is still green, and on a dry day lest the pods split in drying and loss of seed takes place. Lentils keep best in the husk so far as flavor is concerned, and will keep good in this way for two years either for sowing or for food. An acre of ground yields on an average about 11 cwt. of seed and 30 cwt. of straw. The amount and character of the mineral matter requisite in the soil may be judged from the analysis of the ash, which in the seeds has as its chief ingredients—potash 34·6 per cent., soda 9·5, lime 6·3, phosphoric acid 36·2, chloride of sodium 7·6, while in the straw the percentages are—potash 10·8, lime 52·3, silica 17·6, phosphoric acid 12·3, chloride of sodium 2·1.

Lentils have recently attracted some notice among vegetarians as a food material. A Hindoo proverb says, "Rice is good, but lentils are my life." But in England they have been reputed difficult of digestion and apt to disorder the bowels and injure the sight. The husk of the seed is certainly indigestible, and to cook lentils properly requires at least two and a half hours, but undoubtedly they are richer in nutritious matter than almost any other kind of pulse, containing, according to Payen's analysis, 25·2 per cent. of nitrogenous matter (legumin), 56 per cent. of starch, and 2·6 per cent of fatty matter. Fresenius's analysis differs in giving only 35 per cent. of starch; Einhoff gives 32·81 of starch and 37·82 per cent. of nitrogenous matter. Lentils are more properly the food of the poor in all countries where they are grown, and have often been spurned when better food could be obtained, hence the proverb "Dives factus jam desiit gaudere lente." The seeds are said to be good for pigeons, or mixed in a ground state with potatoes or barley for fattening pigs. The herbage is highly esteemed as green food for suckling ewes and all kinds of cattle (being said to increase the yield of milk), also for calves and lambs. Haller says that lentils are so flatulent as to kill horses. They were also believed to be the cause of severe scrofulous disorders common in Egypt. This bad reputation may possibly be due to the substitution of the seeds of the bitter vetch or tare lentil, *Ervum Ervilia*, L., a plant which closely resembles the true lentil in height, habit, flower, and pod, but whose seeds are without doubt possessed of deleterious properties—producing weakness, or, according to Lindley, even paralysis of the extremities in horses which have partaken of them.

A few years ago some cases of poisoning of pigs were traced by Mr. W. Southall of Birmingham to the use of the seed of this plant in their food; it had been imported from Turkey under the name of *rovi*, and was sold in England under the name of Egyptian pease. The chief symptom produced was severe vomiting, followed by speedy death. The poisonous principle seems to reside chiefly in the bitter seed coat, and can apparently be removed by steeping in water, since Gerard, speaking of the "bitter vetch" (*Ervum Ervilia*), says "kine in Asia and in most other countries do eat thereof, being made sweet by steeping in water." The seed of *Ervum Ervilia* is about the same size and almost exactly of the same reddish-brown color as that of the Egyptian lentil, and when the seed coat is removed they are both of the same orange red hue, but the former is not so bright as the latter. The shape is the best means of distinguishing the two seeds, that of *E. Ervilia* being obtusely triangular.

Sea-lentil is a name sometimes applied to the gulfweed *Sargassum vulgare*.

See Bentley and Trimen, *Medicinal Plants*, No. 76; *Pharmaceutical Journal* (3), vol. x. p. 481; Watts, *Dictionary of Chemistry*, vol. iii. pp. 568–71; Yvon, *Cours Complet d'Agriculture*, xiv. p. 672.

LENTINI. See LEONTINI.

LEO I., who alone of Roman pontiffs shares with Gregory I. the surname of THE GREAT, pope from 440 to 461, was a native of Rome, or, according to a less probable account, of Volterra in Tuscany. Of his family or of his early education nothing is known; that he was highly cultivated according to the standards of his time is obvious, but it does not appear that he could write Greek, or even that he understood that language. No certain traces of his early ecclesiastical career have been discovered. In one of the letters (*Ep.* 104) of Augustine, an acolyte named Leo is mentioned as having been in 418 the bearer of a communication from Sixtus of Rome (afterwards pope of that name) to Aurelius of Carthage against the Pelagians; but it is possible that this Leo is rather to be identified with the Leo a priest who is recorded to have been sent by Pope Celestine to Africa with reference to the matter of Apiarius about the year 425. In 429, when the first unmistakable reference to Pope Leo occurs, he was still only a deacon, but already a man of commanding influence; it was at his suggestion that the *De Incarnatione* of the aged Cassianus, having reference to the Nestorian heresy, was composed in that year, and some two years later (about 431) we find Cyril of Alexandria writing to him that he might prevent the Roman Church from lending its support in any way to the ambitious schemes of Juvenal of Jerusalem. In 440, while Leo was in Gaul, whither he had been sent to compose some differences between Aetius and another general named Albinus, Pope Sixtus III. died, and the absent deacon, or rather archdeacon, was forthwith unanimously chosen to succeed him, and received consecration on his return six weeks afterwards (September 29). In 443 he began to take measures against the Manichæans (who since the capture of Carthage by Genseric in 439 had become very numerous at Rome), and in the following year he was able to report to the Italian bishops that some of the heretics had returned to Catholicism, while a large number had been sentenced to perpetual banishment "in accordance with the constitutions of the Christian emperors," and others had fled; in seeking these out the help of the provincial clergy was sought. It was during the earlier years of Leo's pontificate that the events in Gaul occurred which resulted in his triumph over Hilarius of Arles, signalized by the edict of Valentinian III. (445), denouncing the contumacy of the Gallic bishop, and enacting "that nothing should be done in Gaul, contrary to ancient usage, without the authority of the bishop of Rome, and that the decree of the apostolic see should henceforth be law." In 447 he held the correspondence with Turribius of Astorga which led to the condemnation of the Priscillianists by the Spanish national church, and to the putting to death of Priscillian—an act which met with Leo's approval. In 448 he received with commendation a letter from Eutyches, the Constantinopolitan monk, complaining of the revival of the Nestorian heresy there; and in the following year Eutyches wrote his circular, appealing against the sentence which at the instance of Eusebius of Dorylæum had been passed against him at a synod held in Constantinople under the presidency of the patriarch Flavian, and asking papal support at the œcumenical council at that time under summons to meet at Ephesus. The result of a correspondence was that Leo by his legates sent to Flavian that famous epistle in which he sets forth with great fulness of detail the doctrine ever since recognized as orthodox regarding the union of the two natures in the one person of Jesus Christ. The narrative of the events at the "robber" synod at Ephesus belongs to general church history rather than to the biography of Leo; suffice it to say that his letter, though submitted, was not read by the assembled fathers, and that the papal legates had some difficulty in escaping with their lives from the violence of the theologians who, not content with deposing Flavian and Eusebius, shouted for the dividing of those who divided Christ. When the news of the result of this œcumenical council (œcumenical in every circumstance except that it was not presided over by the pope) reached Rome, Leo wrote to Theodosius "with groanings and tears," requesting the emperor to sanction another council, to be held this time, however, in Italy. In this petition he was supported by Valentinian III., by the empress-mother Galla Placidia, and by the empress Eudoxia, but the appeal was made in vain. A change in the position of affairs, however, was brought about by the accession in the following year of Marcian, who three days after coming to the throne published an edict bringing within the scope of the penal laws against heretics the supporters of the dogmas of Apollinaris and Eutyches. To convoke a synod in which greater orthodoxy might reasonably be expected was in these circumstances no longer difficult, but all Leo's efforts to secure that the meeting should take place on Italian soil were unavailing. When the synod of Chalcedon assembled in 451, the papal legates were treated with great respect, being provided with seats on the immediate right of the president, and Leo's former letter to Flavian was adopted by acclamation as formulating the creed of the universal church on the subject of the person of Christ. Among the reasons urged by Leo for holding this council in Italy had been the threatening attitude of the Huns; the dreaded irruption took place in the following year (452). After Aquileia had succumbed to Attila's long siege, the conqueror set out for Rome. Near the confluence of the Mincio and the Po he was met by Leo, whose eloquence persuaded him to turn back. Legend has sought to enhance the impressiveness of the occurrence by an unnecessarily imagined miracle. The pope was less successful with Genseric when the Vandal chief arrived under the walls of Rome in 455, but he secured a promise that there should be no incendiarism or murder, and that three of the oldest basilicas should be exempt from plunder,—a promise which seems to have been faithfully observed. The death of Leo occurred in 461, according to the Roman breviary on April 11, on which day the festival of "Pope Leo, confessor and doctor of the church" is celebrated (duplex). The title of "doctor ecclesiæ" was given by Benedict XIV. The successor of Leo was Hilarius or Hilarus, who had been one of the papal legates at the "robber" synod in 449.

As bishop of the diocese of Rome, Leo distinguished himself above all his predecessors by his preaching, to which he devoted himself with great zeal and success. From his short and pithy *Sermones* many of the lessons now to be found in the Roman breviary have been taken. Viewed in conjunction with his voluminous correspondence, the sermons, sufficiently explain the secret of his greatness, which chiefly lay in the extraordinary strength and purity of his convictions as to the primacy of the successors of St. Peter at a time when the civil and ecclesiastical troubles of the civilized world made men willing enough to submit themselves to any authority whatsoever that could establish its right to exist by courage, honesty, and knowledge of affairs. The works of Leo I. were first collectively edited by Quesnel (Lyons, 1700), and again, on the basis of this, in what is now the standard edition by Ballerini (Venice, 1753–56). Ninety-three *Sermones* and one hundred and seventy-three *Epistolæ* occupy the first volume; the second contains the *Liber Sacramentorum*, usually attributed to Leo, and the *De Vocatione Omnium Gentium*, also ascribed, by Quesnel and others, to him, but more probably the production of a certain Prosper, of whom nothing further is known. The works of Hilary of Arles are appended.

LEO II., pope from August, 682, to July, 683, was a Sicilian by birth, and succeeded Agatho I. Agatho had been represented at the sixth œcumenical council (that of Constantinople in 680), where Pope Honorius I. was anathematized for his views in the Monothelite controversy as a favorer of heresy, and the only fact of permanent historical interest with regard to Leo is that he wrote once and again in approbation of the decision of the council and in condemnation of Honorius, whom he regarded as one who "profana proditione immaculatam fidem subvertere conatus est." In their bearing upon the question of papal infallibility these words have excited considerable attention and controversy, and prominence is given to the circumstance that in the Greek text of the letter to the emperor in which the phrase occurs the milder expression παρεχώρησεν ("subverti permisit") is used for "subvertere conatus est." This Hefele in his *Conciliengeschichte* (iii. 294) regards as alone expressing the true meaning of Leo. It was during Leo's pontificate that the dependence of the see of Ravenna upon that of Rome was finally settled by imperial edict. Benedict II. succeeded him.

LEO III., whose pontificate (795–816) covered the last eighteen years of the reign of Charlemagne, was a native of Rome, and having been unanimously chosen successor of Adrian I. on December 26, 795, was consecrated to the office on the following day. His first act was to send to Charles as patrician the standard of Rome along with the keys of the sepulchre of St. Peter and of the city; a gracious and condescending letter in reply made it still more clear where all real power at that moment lay. For more than three years his term of office was quite uneventful; but at the end of that period the feelings of disappointment which had secretly been rankling in the breast of Paschalis and Campulus, nephews of Adrian I., who had received from him the offices of *primicerius* and *sacellarius* respectively, suddenly manifested themselves in an organized attack upon Leo as he was riding in procession through the city on St. George's day (April 23, 799); the object of his assailants was, by depriving him of his eyes and tongue, to disqualify him for the papal office, and, although they were unsuccessful in this attempt, he found it necessary to accept the protection of Winegis, the Frankish duke of Spoleto, who came to the rescue. Having vainly requested the presence of Charles in Rome, Leo went beyond the Alps to meet the king at Paderborn; he was received with much ceremony and respect, but his enemies having sent in certain written charges, of which the character is not now known except that they were of a serious nature, Charles decided to appoint both the pope and his accusers to appear as parties before him when he should have arrived in Rome. Leo returned in great state to his diocese, and was received with honor; Charles, who did not arrive until November in the following year, lost no time in assuming the office of a judge, and the final result of his investigation was the acquittal of the pope, who at the same time, however, was permitted or rather required to clear himself by the oath of compurgation. The coronation of the emperor—an act the precise meaning of which does not fall to be discussed here—followed two days afterwards; the effect of it was to bring out with increased clearness the personally subordinate position of Leo. The decision of the emperor, however, secured for Leo's pontificate an external peace which was only broken after the accession of Louis the Pious. His enemies began to renew their attacks; the violent repression of a conspiracy led to an open rebellion at Rome; serious charges were once more brought against him, when he was overtaken by death in 816. It was under this pontificate that Felix of Urgel, the adoptianist, was anathematized (798) by a Roman synod. Leo at another synod held in Rome in 810 admitted the dogmatic correctness of the "filioque," but deprecated its introduction into the creed. On this point, however, the Frankish Church persevered in the course it had already initiated. Leo's successor was Stephen IV.

LEO IV., pope from 847 to 855, was a Roman by birth, and was unanimously chosen to succeed Sergius II. His pontificate was chiefly distinguished by his efforts to repair the damage done by the Saracens during the reign of his predecessor to various churches of the city, especially those of St. Peter and St. Paul. It was he who built and fortified the suburb on the right bank of the Tiber still known as the Civitas Leonina. A frightful conflagration, which he is said to have extinguished by his prayers, is the subject of Raphael's great work in the Sala dell' Incendio of the Vatican. He held three synods, one of them (in 850) distinguished by the presence of Louis II., but none of them otherwise of importance. The history of the papal struggle with Hincmar of Rheims, which began during Leo's pontificate, belongs rather to that of Nicolas I. Benedict III. was Leo's immediate successor.

LEO V., a native of Ardea, was pope for some thirty days in 903 after the death of Benedict IV. He was succeeded by Sergius III.

LEO VI. succeeded John X. in 928, and reigned seven months and a few days. He was succeeded by Stephen VIII.

LEO VII., pope from 936 to 939, was preceded by John XI., and followed by Stephen IX.

LEO VIII., pope from 963 to 965, a Roman by birth, held the lay office of "protoscrinius" when he was elected to the papal chair at the instance of Otho the Great by the Roman synod which deposed John XII. in December, 963. Having been hurried with unseemly haste through all the intermediate orders, he received consecration two days after his election, which was unacceptable to the people. In February, 964, the emperor having withdrawn from the city, Leo found it necessary to seek safety in flight, whereupon he was deposed by a synod held under the presidency of John XII. On the sudden death of the latter, the populace chose Benedict V. as his successor; but Otho, returning and laying siege to the city, compelled their acceptance of Leo. It is usually said that, at the synod which deposed Benedict, Leo conceded to the emperor and his successors as sovereign of Italy full rights of investiture, but the genuineness of the document on which this allegation rests is more than doubtful. Leo VIII. was succeeded by John XIII.

LEO IX., pope from 1049 to 1054, was a native of Upper Alsace, where he was born June 21, 1002. His proper name was Bruno; the family to which he belonged was of noble rank, and through his father he was related to the emperor Conrad II. He was educated at Toul, where he successively became canon and (1026) bishop; in the latter capacity he rendered important political services to his relative Conrad II., and afterwards to Henry III., and at the same time he became widely known as an earnest and reforming ecclesiastic by the zeal he showed in spreading the rule of the order of Cluny. On the death of Damasus II., Bruno was, in December, 1048, with the concurrence both of the emperor and of the Roman delegates, selected his successor by an assembly at Worms: he stipulated, however, as a condition of his acceptance that he should first proceed to Rome and be canonically elected by the voice of clergy and people. Setting out shortly after Christmas, he had a meeting with abbot Hugo of Cluny at Besançon, where he was joined by the young monk Hildebrand, who afterwards became Pope Gregory VII.; arriving in pilgrim garb at Rome in the following February, he was received with much cordiality, and at his consecration assumed the name of Leo IX. One of his first public acts was to hold the well-known Easter synod of 1049, at which celibacy of the clergy (down to the rank of subdeacon) was anew enjoined, and where he at least succeeded in making clear how strongly his own convictions went against every kind of simony. The greater part of the year that followed was occupied in one of those progresses through Italy, Germany, and France which form so marked a feature in Leo's pontificate. After presiding over a synod at Pavia, he joined the emperor Henry III. in Saxony, and accompanied him to Cologne and Aix-la-Chapelle; to Rheims he also summoned a meeting of the higher clergy, which, although there were many abstentions, was largely attended, and by which several important reforming decrees were passed. At Mainz also he held a council, at which the Italian and French as well as the German clergy were represented, and ambassadors of the Greek emperor were present; here too simony and the marriage of the clergy were the principal matters dealt with. After his return to Rome he held (April 29, 1050) another Easter synod, which was occupied largely with the controversy about the teachings of Berengarius of Tours; in the same year he presided over provincial synods at Salerno, Siponto, and Vercelli, and in September revisited Germany, returning to Rome in time for a third Easter synod, at which the question of the reordination of those who had been ordained by simonists was considered. He next joined the emperor at Pressburg, and vainly sought to secure the submission of the Hungarians; at Ratisbon, Bamberg, and Worms the papal presence was marked by various ecclesiastical solemnities; but at Mainz, in a dispute about the ordination of a deacon between the archbishop and the pope, the latter had to give way. After a fourth Easter synod in 1053, Leo set out against the Normans in the south with an army of Italians and German volunteers, but the forces sustained a total defeat at Astagnum near Civitella (June 18, 1053); on going out, however, from the city to meet the enemy he was received with every token of submission, relief from the pressure of his ban was implored, and fidelity and homage were sworn. From June, 1053, to March, 1054, he was nevertheless detained at Benevento in honorable captivity; he did not long survive his return to Rome, where he died on April 19, 1054. He was succeeded by Victor II.

LEO X. (Giovanni de' Medici, 1475–1523), the only pope who has bestowed his own name upon his age, and one of the few whose original extraction has corresponded in some measure with the splendor of the pontifical dignity, was the second son of Lorenzo de' Medici, called the Magnificent, and was born at Florence, December 11, 1475. Like his contemporary, Henry VIII., he was from the first destined for the ecclesiastical condition; he received the tonsure at seven, held benefices at eight, and ere he was thirteen negotiations were in active progress for his elevation to the cardinalate. Innocent VIII., the reigning pope, was bound to Lorenzo by domestic ties and a common policy and interest; in October, 1488, Giovanni was created a cardinal under the condition that he should not be publicly recognized as such for three years. The interval was devoted to the study of theology and canon law, pursuits less congenial to the young prince of the church than the elegant literature for which he inherited his father's taste and in which he had already made great progress under the tuition of Politian and Bibbiena. In March, 1492, he was formally admitted into the sacred college, and took up his residence in Rome, receiving a letter of advice from his parent which ranks among the wisest and weightiest compositions of its class. Within a few months his prospects were clouded by the nearly simultaneous decease of his father and the pope, a double bereavement closing the era of peace which Lorenzo's prudent policy had given to Italy, and inaugurating a period of foreign invasion and domestic strife. One of the first consequences of the French irruption into Italy, which shortly ensued, was the expulsion of the Medici family from Florence (November, 1494). After having resisted to the best of his ability, the Cardinal de' Medici found a refuge at Bologna, and, seeing himself deprived for the time of political importance, and obnoxious to Innocent's successor, Alexander VI., undertook a journey in foreign countries with a party of friends. Upon his return he settled at Rome, withdrawing himself from notice as much as possible, and disarming the jealousy of Alexander by his unaffected devotion to literary pursuits. The accession of Julius II., and the death of his elder brother Piero in the battle of the Garigliano (December, 1503), restored him to consequence; but little is recorded of him until 1511, when Julius appointed him legate at Bologna, an office which gave him the nominal direction of the combined Spanish and papal army then besieging that city. The siege failed, and two months afterwards the allies were totally defeated by the French under Gaston de Foix in the famous battle of Ravenna (April 11, 1512), and the Cardinal de' Medici himself was taken prisoner. The French victory produced none of the anticipated results; within a short time the conquerors were even obliged to evacuate Milan, carrying their captive with them. In the confusion of the retreat the cardinal effected his escape, and fled to Mantua, where he derived encouragement from the prediction of a chiromancer, who promised him the papacy (Gauricus, *Tractat. Astrol.*, fol. 20, a passage overlooked by Leo's biographers). Being reappointed to his legation, he took quiet possession of Bologna; within a few months his family were restored to Florence by the Spanish and papal troops, and the death of Julius II. on February 21, 1513, raised him most unexpectedly to the papacy on March 11 following, at the age of only thirty-seven years. It seems difficult to assign any adequate reason for an election so contrary to traditional observance and the private interests of all the more conspicuous members of the conclave; but it has never been attributed to simony. The new pope assumed the name of Leo X. Before his coronation, as first pointed out by Lord Acton, he was required to enter into certain engagements, from most of which he speedily absolved himself. Among these was a promise to issue no brief for collecting money for the repair of St. Peter's. Had this pledge been observed, the Reformation might have been deferred for some time, and its course might have been materially different.

At Leo's accession the probability of a religious revolution was contemplated by none. The attention of his immediate predecessors had long been engrossed by the temporal concerns of the papacy. These were apparently in a flourishing, but actually in a precarious condition. The guiding principle of Leo's policy was to preserve the conquests which he had inherited from Alexander VI. and Julius II. The establishment of his family in Florence diminished, although it did not remove, the temptation to create a principality in their interest, as Alexander had done, and his temper rather inclined him to aggrandize the papacy by diplomacy than to emulate the martial exploits of Julius. The preservation, however, of the acquisitions of these pontiffs required and taxed the abilities of a consummate statesman. These were not wanting to Leo, and it is to his credit that he seldom suffered the love of art and letters, which was his ruling passion, and which became his especial distinction among the princes of his age, to divert his attention from public affairs at a time of extraordinary anxiety and vicissitude. Scarcely had he ascended the pontifical throne when the storm burst in the shape of a determined effort of the French king to repossess himself of the duchy of Milan. An army of Swiss, called into the field by Leo's diplomacy, repelled the invasion, and Italy enjoyed peace until the death of Louis XII., two years subsequently, brought to the throne a young prince who only lived for military glory, and whose entire reign was dominated by the ambition of recovering Milan and Naples. On September 13, 1515, Francis I. totally defeated the Swiss at Marignano. One of the first consequences of the battle, which reduced Leo to submission by placing the Medici in Florence at the mercy of the victor, was the loss of Parma and Piacenza. These duchies, but recently acquired by Julius II., were reunited to Milan, and Leo, temporizing in the true spirit of Italian statecraft, consented to a public interview with Francis, and became apparently his ally. Little as the pope's professions were to be depended upon, Francis thus gained the substantial advantage of a concordat seriously restricting the liberties of the Church of France. Leo meanwhile endeavored to indemnify himself for the loss of Parma and Piacenza by seizing upon the duchy of Urbino for the benefit of his nephew Lorenzo, an enterprise fully as unscrupulous as any of the similar exploits of Cæsar Borgia, and by no means executed with equal ability. After a severe struggle, however, Leo's arms triumphed for the time, but the undertaking proved as injurious to his credit as to his exchequer, and the financial exhaustion which it occasioned helped to prepare the great disaster of his reign. Another unfortunate occurrence of this period was a plot of several cardinals to poison the pope, which led to the execution of one and the imprisonment of several others. Leo has been accused of excessive severity, but apparently without reason, although he may be censured for having held out expectations of pardon which he did not intend to fulfil. This conspiracy probably made him distrustful of the sacred college as then constituted, and led to one of the most remarkable acts of his pontificate, the creation of thirty-one cardinals in a single day. This dangerous stretch of authority made him absolute master in his own court for the remainder of his reign, and it must be admitted that most of the new cardinals were men of distinguished merit. A much more momentous event was now at hand, which, however, belongs more properly to the biography of Luther than that of Leo. On All Saints' eve, 1517, the daring protest of Luther against the intolerable impostures and rapacity of the papal vendors of indulgences, commissioned by Leo to raise money for the rebuilding of St. Peter's, gave the signal for the Reformation. Leo was at first amused. "The axe," he said, alluding to the danger he had lately escaped from the conspiracy of the cardinals, "is taken from the root, and laid to the branches." When at length his eyes were opened he followed the policy of mingled menace and cajolery which was alone possible where the secular arm was unavailable, and which might probably have succeeded with a man of different mould from Luther. By 1520 the breach had become irreparable, and an invincible fatality had linked the name of the most ostentatious of the popes with the profoundest humiliation of the church.

Leo died before the full extent of the calamity was apparent, and amid a full tide of political prosperity which would have easily consoled him for the diminution of his spiritual prerogatives. He had profited by the general tranquillity to expel the petty tyrants of the ecclesiastical states. Perugia, Sinigaglia, Fermo had been added to the domains of the church, and Ferrara had narrowly escaped. The death of his nephew Lorenzo about the same time made him the virtual ruler of Florence also. Abroad, his policy had apparently received a check by the election of Charles V. as emperor, but the continued rivalry between Charles and his competitor Francis soon placed the dearest wish of his heart within his reach. "Could I recover Parma and Piacenza for the church," he had said to the Cardinal de' Medici, "I would willingly lay down my life." His wish was granted him. Allying himself with Charles, he contributed efficaciously to the expulsion of the French from Milan in November, 1521. Parma and Piacenza returned to the Holy See, and there was talk of the Medici replacing the Sforzas on the ducal throne of Milan. The news reached Leo at his villa of Malliana on a November night. Overjoyed, his mind engrossed by ambitious projects, he long paced a chamber through whose open window streamed the chill and malarious air of the adjoining woods. He returned to Rome in apparent health, but on the 24th of November withdrew indisposed to his apartments, and on December 1 expired with such suddenness that the last sacraments could not be administered. Poison was generally suspected, but the circumstances alleged in support of this belief wear the aspect of inventions, and seem inconsistent with the universal dismay excited by his decease. There was more ground for this consternation than men fully knew. The most fortunate and magnificent of the popes had bequeathed his successors a religious schism and a bankrupt exchequer. If, however, his profusion had impoverished the church and indirectly occasioned the destruction of her visible unity, he had raised her to the highest rank as the apparent patron of whatever contributed to extend knowledge or to refine and embellish life. If he had not kindled the genius of Raphael, employed equally by his predecessor, he had recognized and fostered it, and in so doing had apparently reconciled antique art with Christianity, and effaced the reproach of indifference or hostility to culture which for fifteen centuries had more or less weighed upon the latter. As a patron of literature Leo's merits had been even more conspicuous; every Italian man of letters, in an age of singular intellectual brilliancy, had tasted or might have hoped to taste of his bounty; had Italy been Europe, the scholars and authors elsewhere forward in revolt would have been indissolubly attached to the Church of Rome. The essential paganism of the Renaissance art and literature was not then perceived; and even now that it is fully understood the prestige which Leo gave the church remains but little impaired. The hostility of the Renaissance of Catholicism has been unanswerably shown by Catholic writers themselves, but the popular imagination only notes that Raphael and Michelangelo wrought in the name of religion, and at the bidding of a pope. However severely, then, Leo may be judged from the strictly sacerdotal point of view, sacerdotalism itself cannot deny its obligations to him; while, from the point of view of liberal culture, he appears as near perfection in his ecclesiastical character as that character admits.

His personal disposition has been the subject of much controversy. "Among all the individuals who have attracted the attention of mankind, there is perhaps no one whose character has stood in so doubtful a light as that of Leo X." This exaggerated dictum of Roscoe's at all events expresses the fact that men's views of Leo's character have been colored in a more than ordinary degree by party spirit. To one class he represents the ideal of the papacy as a civilizing and beneficent institution; to another —comprising Catholics as well as Protestants—he is the personification of its worldliness and apostasy. The merit or demerit of his actions will be variously estimated to the end of time. The leading traits of his character, however, are matters of fact, which prepossessions should not be allowed to distort, and it may be confidently affirmed that they were mostly amiable and laudable. He was constitutionally kind, compassionate, and bountiful,—endowed with Florentine prudence and circumspection, but cast altogether in a more liberal mould than the mercantile race from which he sprung. The best of the Medici except his father Lorenzo, he is in many points more humanly interesting than the latter, and the disadvantage at which he occasionally appears is mainly attributable to his being less perfectly equipped by nature for the part assigned to him by fortune. His geniality sometimes degenerated into indecorum, and in a certain degree injured the credit of the church. His æsthetic pantheism, though inspired by a real religious sentiment, fixed the reproach of paganism upon her at the precise moment when an evangelical reaction was springing up. The best possible pope for the age that was going out, he was the worst possible for the age that was coming in: hence the splendors of his administration were ephemeral and its disasters lasting. If his reputation as a pope and a statesman is thus ambiguous, no such deduction need be made from his serener fame as a patron of letters and art. In this respect he stands almost alone, except for such rare examples as his father and the modern kings of Bavaria, as a prince who did not merely strike a tacit bargain with men of genius, setting his patronage against their flattery, but one who entered into their pursuits from a genuine congeniality of taste and temperament, and aided them efficaciously not only as their patron but as their companion. Unlike most exalted patrons of literature, he was a scholar first and a sovereign afterwards; hence his contact with the best intellect of his age was far more direct and personal than that of an Augustus or a Louis XIV. Great as were the obligations conferred upon individuals by his tact and discernment, it is no doubt true that the intellectual movement of his age arose and could well have subsisted without him. It is none the less true that, if not the source of that light, his court was the focus to which it converged, and which gave it back with a lustre which still renders the era that bears his name, in its literary and artistic aspects, one of the brightest periods in the history of mankind.

The life of Leo was written shortly after his death by Paolo Giovio, bishop of Nocera, who had known him intimately. Roscoe's celebrated biography, though sometimes diffuse and sometimes trite, is in the main a work of great merit, and very agreeable from the entire sympathy between the author and the age he depicts and the subject of his biography. It has received much illustration from the notes of the German and Italian translators, Henke and Bossi, but requires to be re-edited with the aid of the numerous publications from archives which have taken place since Roscoe's time. Audin's French life is a poor performance—partial, mainly borrowed from Roscoe, and disfigured by unsuccessful efforts after the picturesque. (R. G.)

LEO XI. (Alessandro de' Medici) was chosen, under French influence, to succeed Clement VIII. as pope on April 1, 1605, and died on April 27 of the same year. His successor was Paul V.

LEO XII. (Annibale della Genga), pope from 1823 to 1829, a native of Romagna, was born on August 22, 1760. In 1790 he first gained public recognition of his talents by the success with which he accomplished the delicate task laid upon him by Pius VI. of pronouncing a funeral discourse over the emperor Joseph II.; in 1793 he was sent as nuncio to Lucerne with the title of archbishop of Tyre; in the following year he went, also as nuncio, to Cologne; in 1805 he attended the diet of Ratisbon as papal plenipotentiary; and in 1808 he shared with Caprara a difficult mission to France. Some years of retirement at the abbey of Monticelli now followed; but in 1814 he was made the bearer of the pope's congratulations to Louis XVIII.; in 1816 he became cardinal priest of Sta. Maria Maggiore, receiving also the bishopric of Sinigaglia, while in 1820 he became cardinal vicarius. On September 28, 1823, he was chosen to fill the vacancy caused by the death of Pius VII.; at the time it was believed that he had not long to live, and, in point of fact, on the 23d day of the following December his condition became so serious that the last sacraments were administered to him; suddenly, however, he recovered. One of his first cares was for the due observance of the approaching jubilee year, and on May 27, 1824, the bull was sent forth which invited all Christendom to Rome in the following December; but foreign governments responded coldly to the appeals made for their co-operation in forwarding pilgrims, and even Leo's own subjects viewed the preparations made in their neighborhood with indifference or aversion, and the most determined efforts of the papal government did not succeed in averting a somewhat ridiculous failure. Throughout his pontificate Leo showed himself a man of simple tastes and laborious habits; his diplomatic relations with the European powers were on the whole characterized by firmness, tact, and moderation, and perhaps the most unfavorable criticism to be made upon his domestic policy is that it was unpractical in its meddlesomeness and unstatesmanlike in its severity. He died on February 10, 1829, and was succeeded by Pius VIII.

LEO I., Flavius, surnamed Magnus and Thrax, emperor of the East, was born about 400 A. D., in the country of the Bessi, Thrace, and succeeded Marcian in February, 457. At the time of his elevation he was an obscure military tribune, but had become steward to Aspar, patrician and commander of the guards, who might himself have aspired to the purple had he not been tainted with the Arian heresy. In recommending his servant to the soldiers, who proclaimed him emperor, Aspar hoped through him to be able to exercise the reality of power. The election of Leo was ratified by the senate; his coronation by Anatolius, the patriarch of Constantinople, is said to have been the earliest instance of such an ecclesiastical ceremony. The precise nature of the military success against the barbarians which, according to the chronicles, the new emperor achieved in the first year of his reign is not accurately known. Of the more conspicuous incidents of his subsequent life, the first in chronological order is his intervention in the politico-religious troubles in Egypt, where the Eutychians had gained the upper hand, and, encouraged by the Arianizing Aspar, had made their own nominee, Timotheus Ailurus, patriarch of Alexandria. Leo made peace by deposing and banishing the new patriarch, and, when reminded by Aspar that it ill became a wearer of the purple to be guilty (as in this case he had been) of promise-breaking, retorted that it was equally unbecoming that a prince should be compelled to resign his own judgment and the public interest to the will of a subject. In 466 the Huns, invading Dacia, were defeated by Leo's generals Anthemius and Anagastus, and again by the latter in 468. In 468 Leo, in concert with Anthemius, whom in the intervening year he had caused to be made emperor of the West, equipped a naval armament against the Vandals of Africa, who, under Genseric, had long been the scourge of Italy and the Mediterranean. The large fleet of more than one thousand vessels was intrusted to the command of Leo's brother-in-law Basiliscus, who, after a prosperous passage, disembarked his troops safely at Cape Bona within 40 miles of Carthage, but weakly granted a truce of five days to the enemy; during the interval, favored by the wind and the darkness of the night, the fleet of Genseric, with several fireships in tow, attacked the Roman vessels, burning and sinking one half of them, and thus causing the entire failure of the expedition. A widespread belief that the Arian Aspar had somehow helped to bring about this disastrous defeat furnished Leo with a pretext for getting rid of this dangerous kingmaker, who accordingly was treacherously put to death, along with one of his sons, in 471. To avenge (as they alleged) the murder, the Goths invaded Thrace, and ravaged the country almost to the walls of the capital. In October, 473, Leo associated with himself his child grandson Leo II., and in the following year he died (February 3, 474); his successor survived him for a few months only. The somewhat misleading surname of Great borne by Leo I. is due solely to the obsequious gratitude of the orthodox party; by the Arians he was, not without some show of justice, nicknamed Macellarius ("butcher").

LEO III., Flavius, surnamed The Isaurian, a native of Isauria, born about 680, was originally called Conon, a name which he dropped after he had risen to military distinction. In 713 he received from Anastasius II. the command of the eastern army; and, when that emperor was deposed by Theodosius III. in 716, Leo, marching to Constantinople, compelled the usurper to resign, and was himself made emperor amid much popular enthusiasm, in March, 718. The internal troubles of the empire had meanwhile permitted the advance of the Arabs, who in large numbers invested the capital by land and sea in the following August; the siege was not raised until 720. Relieved from this pressing danger, and also in 721 from a conspiracy originating with the deposed emperor Anastasius II., Leo speedily inaugurated the aggressive religious policy with which his name is associated, by promulgating, in 722, the edicts commanding the baptism of Jews and Montanists throughout the empire, and in 726 that against the "idolatry of image worship," which was destined ultimately to produce so important effects on the relations of Italy and the West with Byzantium. Instigated by Pope Gregory II., the Italians refused to obey the command to remove the pictures from their churches; and when Paulus, the newly-appointed exarch of Ravenna, sought to employ force, he was defeated and slain. A revolt which had broken out in the Cyclades and the Peloponnesus was with difficulty quelled, and an insurrection in Constantinople was only repressed after much bloodshed (730). In November, 730, a council was held by Gregory II. at Rome, in which anathemas were pronounced against the destroyers of images, and therefore, by implication at least, against Leo. He retaliated by severing the Trans-Adriatic provinces from the Roman patriarchate, and by confiscating large possessions of the Roman see in Calabria and Sicily. Another council under Gregory III., in 732, joined in a solemn excommunication of all iconoclasts, and image worship was set up in Rome on a more splendid scale than had previously been known. The emperor made a last effort to relieve his exarch Eutychius, shut up in Ravenna, and to bring the pope and Italy to obedience; but the great fleet which he sent was wrecked in the Adriatic, and with it the exarchate became practically lost to the empire. The closing years of Leo's reign were disturbed by troubles with the Arabs; and 740 was made memorable by a great earthquake which devastated Constantinople, Thrace, and Bithynia. He died in 741.

LEO V., Flavius, surnamed The Armenian, served as general under Nicephorus I., but was banished for treachery in 811. Shortly afterwards he was recalled and appointed commander of the eastern army by Michael I. After gaining some distinction in war with the Arabs in 812, he accompanied his sovereign, in 813, on an expedition against Crum, king of the Bulgarians. Taking advantage of the disaffection of the army during a battle with the enemy near Adrianople, he withdrew with the forces under his command, leaving Michael to total defeat. Shortly afterwards he was crowned at Constantinople without opposition (813). In 814, and again in the following year, he inflicted decisive defeats upon the Bulgarians. He then began to show great zeal against the image worshippers, but such was his severity that even his closest friend, Michael the Stammerer, who had done much to help him to the throne, ultimately turned against him. Michael was convicted of conspiracy and condemned to death, but by the intervention of his friends, who assassinated Leo in the palace chapel on Christmas Eve, 820, was raised from prison to the throne.

LEO VI., Flavius, surnamed Sapiens and Philosophus, succeeded his father, Basil I., in 886, and died in 911. One of his first acts was to depose the well-known Photius, patriarch of Constantinople, who had been his tutor. The rest of his biography, so far as recorded, tells of unimportant wars with barbarians and struggles with churchmen. In explanation of his somewhat absurd surname, all that can be said, as Gibbon has remarked, is "that the son of Basil was less ignorant than the greater part of his contemporaries in church and state, that his education had been directed by the learned Photius, and that several books of profane and ecclesiastical science were composed by the pen, or in the name, of the imperial philosopher." His works include a treatise on military tactics (*De Apparatu Bellico*, translated by Sir John Cheke in

1554, and frequently since), seventeen *Oracula*, in iambic verse, on the destinies of future emperors and patriarchs of Constantinople, thirty-three *Orations*, chiefly on theological subjects, and some epigrams in the Greek *Anthology*.

LEO, JOHANNES, usually called LEO AFRICANUS, sometimes ELIBERITANUS (*i. e.*, of Granada), is best known as the author of a valuable *Africæ Descriptio*, which long ranked as almost the only authority in regard more especially to the Sudan. Born probably at Granada, of a noble Moorish stock, Alhasan ibn Mohammed Abwazzan Alfasi (for this was his real designation) received an excellent education at Fez, where his family settled after the expulsion from Spain. He was still in his sixteenth year when he began a course of travel which extended, not only through the northern and central parts of Africa (where he had advanced to the south-east of Lake Chad), but also into Arabia, Syria, Persia, Armenia, Tartary, and portions of Europe. As he was returning from Egypt about 1517, he was captured by pirates near the island of Gerba, and he was ultimately presented as a slave to Leo X. The pope no sooner discovered what manner of man he was than he assigned him a pension; and having persuaded him to profess the Christian faith, he stood sponsor at his baptism, and bestowed on him his own names, Johannes and Leo. The new convert, having made himself acquainted with Latin and Italian, not only taught Arabic to Ægidius Antoninus, bishop of Viterbo, and others, but wrote books in both tongues. He appears to have returned to Africa, and to have put off his Christianity, before his death; but the later part of his career is involved in obscurity. He was still alive in 1526.

The *Africæ Descriptio* was originally written in Arabic, but the MS. (at one time in the library of Vincenzo Pinelli, 1535–1601) is not known to be extant. The author's own translation into passable Italian was first published by Ramusio, *Navigationi e Viaggi*. Versions of this or of the widely used Latin translation by F. Florianus have appeared in English, French, Dutch, etc. For notices of Leo's other works see Lorsbach's edition (Herborn, 1801).

LEOBSCHÜTZ (Bohemian, *Hlubczyce*), a town in the Prussian province of Silesia, circle of Oppeln, is situated on the Zinna, about 20 miles to the north-west of Ratibor. It carries on a considerable trade in wool, flax, and grain, its markets for these commodities being very numerously attended. The principal industries are carriage-building, wool-spinning, and glass-making. The town contains three Roman Catholic churches, a Protestant church, a synagogue, a new town-hall, and a gymnasium. Leobschütz is known to have existed in the 10th century, and from 1524 to 1623 was capital of the principality of Jägerndorf, which was divided between Prussia and Austria in 1742. Population in 1880, 12,015.

LEOCHARES, one of the sculptors of the younger Attic school in the fine period of Greek art. He is called a young man in a pseudo-Platonic epistle which must be later than 366 B.C. He worked on the Mausoleum along with Scopas, Bryaxis, Timotheos, and Pythis about 356 B.C.; the west side of the frieze, of which all the extant fragments are in the British Museum, was entrusted to him. He made the statue of Isocrates which was erected at Athens about 354 B.C. Many other portrait statues are known to have been his work. Along with Lysippus he represented Alexander the Great engaged in a lion hunt. This group was in bronze, whereas another in the Philippeion at Olympia, representing the family of Philip and Alexander, was in ivory and gold. Finally, an inscription records that he made the statues of an Athenian family. Though nothing is recorded of the character of these works, it may be gathered from the list that they were idealized portraits; chryselephantine statues were always ideal. Leochares was also the sculptor of many purely ideal works. These comprise three statues of Zeus, of which one was on the Acropolis, one at the Piræeus, and the third was carried away to Rome, where Pliny saw it on the Capitol; he is also recorded to have carved three statues of Apollo, one of which was bought by Dionysius of Syracuse. Absolutely nothing is known of the characters of these works; but we are more fortunate in regard to his masterpiece, the Rape of Ganymede, of which many imitations have been preserved to us sufficient to give some idea of its real character. Ganymede, characterized as a shepherd by crook and syrinx, has been resting under a tree, when the eagle swoops down and bears him off direct heavenwards; the looks of both are directed upwards. Ganymede, a youth of perfect beauty, does not struggle, but yields himself completely to his captor, so that his body hangs down in easy, graceful lines. The eagle, with magnificent outstretched wings, conscious, as Pliny says, "what his burden is and to whom he bears it," grasps the boy gently with his talons, and seems to swoop straight upwards, unencumbered by the weight. The problem of supporting the figures in the air, clumsily solved in the imitation preserved at St. Mark's in Venice by hanging the group up with a rope, was skilfully overcome by means of the tree from beneath which the boy has been seized; while the dog beneath, looking up after his master, both gives an appearance of naturalness to the whole scene, and suggests more vividly the idea that the boy is far above the ground. The great skill of the group lay in the manner in which the idea of swift easy motion upwards was expressed; while the widespread wings of the eagle and the drooping form of the boy gave a beautiful outline to the whole. Overbeck (*Gesch. der Griech. Plast.*, ii. 51) has well expressed the distinction between the fine character of this work and the sensualism of a later class of similar groups, where the eagle is obviously Zeus himself and not a mere messenger. The colossal acrolithic statue of Ares at Halicarnassus is sometimes attributed to Leochares, sometimes to Timotheos.

On the share of Leochares in the Mausoleum and on the style of the sculptures, see Newton, *Halicarnassus, Cnidus, and Branchidæ*. On the inscriptions mentioning works of Leochares, see Overbeck, *Schriftquellen*. See also Jahn, *Archæol. Beitr.*, p. 20.

LEOMINSTER, a municipal and parliamentary borough and market-town of England in the county of Hereford, is situated in a rich agricultural country on the Lug, 150 miles west-north-west of London and 12 north of Hereford. The town has regular and spacious streets, and some fine old timber houses lend picturesqueness to its appearance. The parish church, which is of mixed architecture, including the fine Norman nave of the old priory church, and contains some of the most beautiful examples of window tracery in England, was restored in 1866, and enlarged by the addition of a south nave in 1879. The other public buildings are the corn exchange, erected in 1859 at a cost of £4000, and the town-hall, to make room for which, in 1855, the Butter Cross, a beautiful example of old timber work of the date 1663, was removed to form a private dwelling house. The principal industries of the town are leather and woollen manufactures, iron and brass founding, glove and hat making, and the manufacture of agricultural implements. Leominster originated in a monastery founded by Merwald king of Mercia, who had a castle near the town, where a fortress stood till 1055, when it was demolished by the Welsh. The town received a charter of incorporation from Queen Mary, and has sent members to Parliament since the 23d of Edward I.; in 1868 its representation was reduced from two members to one. The limits of the municipal and the parliamentary boroughs are identical, the population in 1871 being 5863, which in 1881 had increased to 6042.

See the *Histories* by Price (1795) and Townsend (1863), and a paper by E. A. Freeman in *Archæologia Cambrensis* 1853.

LEON, one of the forty-nine provinces of Spain, is bounded on the N. by Oviedo, on the E. by Palencia, on the S. by Valladolid and Zamora, and on the W. by

Orense and Lugo, and has an area of 6166 square miles, with a population (in 1877) of 350,210. Its boundaries on the north and west, formed respectively by the central ridge and southerly offshoots of the great Cantabrian chain, are strongly marked; towards the south-east it merges imperceptibly into the Castilian plateau, the line of demarcation being for the most part merely conventional. It belongs partly to the Miño and partly to the Duero river system, these being separated by the montañas de Leon, which extend in a continuous wall (with passes at Manzanal and Poncebadon) from north to south-west. To the Miño flow the Sil, Boeza, Burbia, Cua, Valcarce; the principal tributaries of the Duero are the Esla (with its affluents the Tuerto, Orbigo, Bernesga, Torio, Cuereno, and Ceo) and the Valderaduey. To the north-west of the montañas de Leon is the district known as the Vierzo, a richly wooded pastoral and highland district, which in its lower valleys produces grain, fruit, and wine in abundance. The Tierra del Campo in the west of the province is fairly productive, but in need of irrigation. The hills of Leon were wrought for gold in the time of the Romans; iron is still obtained to some extent; and coal and antimony also occur. The commerce and industries of the province are unimportant. Besides Leon, the capital, the only towns of any note are Astorga and Ponferrada, respectively the Asturica Augusta and the Interamnium Flavium of the Romans. There is railway communication with Madrid; but the line from Leon to Gijon at present terminates, on the south side of the pass, at Busdongo, while that to Coruña does not extend farther than Brañuelas.

The province was anciently inhabited by the Vettones and Callaici; after the Roman conquest it formed part of Hispania Tarraconensis. Among the Christian kingdoms which arose in Spain as the Saracenic irruption of the 8th century receded, Leon was one of the oldest, after that of Asturias, the title of king of Leon having been first assumed by Ordoño in 913. Ferdinand I. (the Great) of Castile united the crowns of Castile and Leon in the 11th century; the two were again separated in the 12th, until a final union took place (1230) in the person of St. Ferdinand. The limits of the kingdom varied with the alternations of success and defeat in war, but roughly speaking it may be said to have embraced what are now the provinces of Leon, Palencia, Valladolid, Zamora, and Salamanca. The province of Leon prior to 1833 included Leon, Zamora, and Salamanca.

LEON, the capital of the above province, is pleasantly situated upon a rising ground in the angle formed by the Torio and Bernesga, which here unite to form the Leon, a tributary of the Esla; its distance north-west from Madrid is 258 miles. The town, which is surrounded by old and dilapidated walls, everywhere presents an aspect of ruin and decay. Many of the buildings are fine. Of these the most important is the cathedral, founded about 1195; it is built in the pointed Gothic style, of a warm cream-colored stone, and is remarkable for its simplicity, lightness, and strength. The collegiate church of San Isidro was founded in 1063, and consecrated in 1149; it is Byzantine in character. The church belonging to the convent of San Marcos, ordered by Ferdinand V. in 1514, was begun by Charles V. in 1537, and consecrated in 1541. Other buildings of less architectural importance are the town-house, the episcopal palace, and that of the Guzman family. As might be expected from the ecclesiastical character of Leon, there are a variety of religious and charitable institutions; the industries of the place are linen weaving, glove making, and the knitting of caps and stockings, but the trade is insignificant. The population in 1877 was 11,515.

Leon (Arab., *Liyun*) owes its name to the Legio Septima Gemina of Galba, which, under the later emperors at least, had its headquarters there. The place is mentioned under this name in the *Itin. Ant.* About 540 it fell into the hands of the Gothic king Leovigildo, and in 717 it capitulated to the Saracens. Retaken about 742, it ultimately, in the beginning of the 10th century, became the capital of the kingdom of Leon About 996 it was taken by Almansur, but on his death, which occurred soon afterwards, it reverted to the Spaniards. It was the seat of several ecclesiastical councils, one of which was held under Alphonso V., a second in 1090, and others in 1106, 1114, 1134, 1228, and 1288.

LEON, a city of Mexico, in the state of Guanajuato, the chief town of a department, and in population second only to the capital of the republic, from which it is distant about 100 miles. It is situated on the right bank of the Rio Torbio, in the midst of a fertile and flourishing region, and is altogether one of the best built and most prosperous places in the country, with a large trade in grain and other agricultural produce, and a number of considerable industries—cotton and woollen weaving, tanning, and saddlery. For some time Leon has aspired to become the chief town of a new state, and even to take the place of Mexico as the national capital. The opening of the railways south-east to Mexico and north-east to the Rio Grande will further stimulate its development. The foundation of Leon dates from 1576, and it has ranked as a city since 1836, but the beginning of its present prosperity belongs only to the middle of the century.

LEON, the chief city of a department of the same name in the republic of Nicaragua, situated in an extensive plain about midway between the great inland lake of Nicaragua and the Pacific Ocean. It is connected by rail (1881) with Corinto on the coast (which has taken the place of Realejo, its former port); and the line is being extended to Leon Viejo on Lake Managua and thence to Granada. The city is spread over so wide an area that Squier, after a three months' residence, found himself discovering new and secluded portions. Its public buildings are among the finest of Central America. The cathedral (1746–1774) is a strong piece of masonry, with a roof of massive arches, which has several times been used as a fortress during the civil wars. The old episcopal palace (1678), the new episcopal palace (1873), and the college of St. Ramon (1678) also deserve to be mentioned. The population is estimated at from 20,000 to 30,000. Contiguous to Leon, and practically one with it, is the Indian pueblo of Subtiaba, which has its own public buildings, and among the rest a church which almost rivals the cathedral.

At the time of the Spanish conquest Subtiaba was the residence of the great cacique of Nagrando, and the seat of an important temple. The city of Leon, founded by Hernandez de Cordova in 1523, was originally situated at the head of the western bay of Lake Managua, and was not removed to its present position till 1610. Thomas Gage, who visited it in 1665, describes it as a splendid city; and in 1685 it yielded rich booty to Dampier and his company. See Squier, *Central America*, vol. i.; and Scherzer, *Free States of Central America*.

LEON, LUIS PONCE DE (1528–1591), usually known as Fray Luis de Leon, Spanish religious writer, was born about 1528, most probably at Granada, entered the university of Salamanca, where Melchior Cano was a few years his senior, at the age of fourteen, and in 1544 became a member of the Augustinian community there. His academical promotion was comparatively rapid; in 1561 he obtained by public competition a theological chair at Salamanca, to which in 1571 was added that of sacred literature. His views in exegesis and Biblical criticism were so far in advance of those of the majority of his immediate contemporaries that he was denounced to the Inquisition for having written a too secular translation of the book of Canticles, and for maintaining the possibility of correcting the text of the Vulgate. In March, 1572, he was consequently thrown into prison at Valladolid, where his confinement lasted until December, 1576; the charges against him were then abandoned, and he was released with an exhortation to circumspection, moderation, and prudence. He at once resumed his former posts at Salamanca, and the remainder of his days were passed in comparative peace. In 1580 a Latin commentary on Canticles was published, and in 1583–85 he gave to the world three books of a treatise on the names of Christ, which he had written in prison. In 1583 also appeared the most popular of his prose works, a treatise entitled *La Perfecta Casada* ("The Perfect Wife") for the use of a lady newly married. Shortly before his death, which occurred at Madrigal on August 23, 1591, his appointment to be vicar-general of the Augustinian order was sanctioned by the pope.

It is chiefly as a poet that Fray Luis de Leon is now remembered and admitted to a high place among the classic authors of Spain. His poetical works include historical translations of all the *Eclogues* and two of the *Georgics* of Virgil, some thirty odes of Horace, forty psalms, and passages from the Greek and Italian, all characterized by much spirit and grace of style. The original pieces, which are chiefly religious, not merely possess the technical merits of idiom and versification which perhaps only Castilian ears can appreciate, but in many cases give beautiful expression to feelings which are shared by the whole of the Christian world. Of one in particular, the ode "De la Vida del Cielo," Hallam has justly remarked that it is "an exquisite piece of lyric poetry, which in its peculiar line of devout aspiration has perhaps never been excelled." The works of Luis de Leon include a Spanish commentary on Canticles, which was not published until 1798; a translation, in Spanish octaves, of the same book, first printed in 1806; and an exposition of Job, which first appeared in 1779.

The first collective edition of *Obras proprias y traducciones* was published by Quevedo at Madrid in 1631; another, fuller and more carefully edited, appeared at Valencia in 1761; the latest and best is that of Merino (*Obras reconocidas y cotejadas con varios manuscritos*, 6 vols., Madrid, 1804-16). His original poems, with a German translation, by Schlüter and Storck, appeared at Münster in 1853. There are two recent German monographs on Luis de Leon (Wilkens, *Fray Luis de Leon*, Halle, 1866; and Reusch, *Luis de Leon u. die Spanische Inquisition*, 1873), and one in Spanish (José Gonzales de Tejada, *Vida de Fray Luis de Leon*, Madrid, 1863).

LEONARDO (or LIONARDO) DA VINCI was born in 1452 and died in 1519, having during his life excelled in almost every honorable human attainment and pursuit, the commercial and political excepted. Considering the range of his speculative as well as that of his practical powers, he seems certainly the man whose genius has the best right to be called universal of any that have ever lived. In the fine arts, he was the most accomplished painter of his generation and one of the most accomplished of the world, a distinguished sculptor, architect, and musician, and a luminous and pregnant critic. In inventions and experimental philosophy, he was a great mechanician and engineer, an anatomist, a botanist, a physiologist, an astronomer, a chemist, a geologist and geographer,—an insatiable and successful explorer, in a word, along the whole range of the physical and mathematical sciences when most of those sciences were new. Unfortunately he paid the penalty of his universality. The multifariousness and the equal balance of his faculties caused him to labor promiscuously in all fields of effort. He set himself to perform tasks and to solve problems too arduous and too manifold for the strength of any single life. The consequence was that in art he was able to carry few undertakings to completion, and in science to bring no fully matured researches to the light. But the works of art which he did produce were of an excellence unapproached by his contemporaries, and only rivalled by men who came a generation after him, and profited by his example; while in science, both theoretical and applied, his unpublished writings and the records of his inventions prove him to have anticipated at a hundred points the great masters of reasoned discovery in the ensuing age. No wonder, therefore, if there has always been a mysterious attraction about his name. He stands out to after times in the character of a great if only half-effectual magician, one pre-eminent less by performance than by power. He has been called the Faust of the Italian Renaissance. The description would be just if the legend of Faust had conferred upon its hero the artist's gift of creation, as well as the ingenuity of the mechanical inventor, and the philosopher's passion for truth. As it is, these three powers, the shaping or artistic, the contriving or mechanical, and the reasoning or philosophical, had never even been imagined as existing, still less have they ever been known actually to exist, in combination, in the same measure in which they were all combined in Leonardo.

The man thus extraordinarily gifted was the son of a Florentine lawyer, born out of wedlock by a peasant mother. The place of his birth was Vinci, a "castle" or fortified village in the Florentine territory near Empoli, from which his father's family derived its name. The Christian name of his father was Piero (the son of Antonio the son of Piero the son of Guido, all of whom had been men of law like their descendant). Leonardo's mother was called Caterina. Her relations with Ser Piero da Vinci seem to have come to an end almost immediately upon the birth of their son. She was soon afterwards married in her own rank of life. Ser Piero on his part was four times married, and had by his last two wives nine sons and two daughters; but the boy Leonardo had from the first been acknowledged by his father, who brought him up in his own house, principally, no doubt, at Florence. In that city Ser Piero followed his profession, and was after a while appointed notary to the signory, or governing council of the state, a post which several of his forefathers had filled before him. The son born to him before marriage grew up into a youth of manifest and shining promise. To signal beauty and activity of person he joined a winning charm of temper and manners, a tact for all societies, and an aptitude for all accomplishments. An inexhaustible energy lay beneath this amiable surface. Among the multifarious pursuits to which he set his hand, the favorite were modelling and drawing. His father, perceiving this, sought the advice of an acquaintance, Andrea del Verrocchio, who at once recognized the boy's vocation, and was selected by Ser Piero to be his master.

Verrocchio, as is well known, although not one of the great creative or inventive forces in the art of this age at Florence, was a thoroughly capable and spirited craftsman alike as goldsmith, sculptor, and painter, while in teaching he was particularly distinguished. In his studio Leonardo worked for several years in the company of Lorenzo di Credi and other less celebrated pupils. He had soon learnt all that his master had to teach—more than all, if we are to believe the oft-told tale of the figure, or figures, executed by the pupil in the picture of Christ's Baptism designed by the master for the monks of Vallombrosa. The work in question is now in the Academy of Florence. According to Vasari the angel kneeling on the left, with a drapery over its right arm, was put in by Leonardo, and when Verrocchio saw it his sense of its superiority to his own work caused him to forswear painting for ever after. The latter part of the story is certainly false. Moreover, a closer examination seems to detect the hand of Leonardo, not only in the figure of the angel, but also in that of Christ and in the landscape background, which are designed with extreme refinement, and painted in the new medium of oil, while the remainder of the picture has been executed by Verrocchio in his accustomed vehicle of tempera. The work was probably produced between 1480 and 1482, when Leonardo was from eighteen to twenty years of age. By the latter date we find him enrolled in the lists of the painters' guild at Florence. Here he continued to live and work probably for eight or nine years longer. Up till 1477 he is still spoken of as a pupil or apprentice of Verrocchio; but in 1478 he receives an independent commission from the signory, and in 1480 another from the monks of San Donato in Scopeto. He had in the meanwhile been taken into special favor by Lorenzo the Magnificent. The only memorials now existing of Leonardo's industry during this period consist of a number of scattered drawings and studies, most of them physiognomical, in chalk, pen, and silver point, besides two painted panels. One of these is a large and richly composed picture, or rather a finished preparation in monochrome for such a picture, of the Adoration of the Kings; this may have been done for the monks of San Donato, and is now in the Uffizi; the other is a similar preparation for a St. Jerome, now in the Vatican gallery at Rome. We possess, however, the record of an abundance of other work which has perished. Leonardo was not one of those artists who sought in the imitation of antique models the means of restoring art to its perfection. He hardly regarded the antique at all, and was an exclusive student of nature. From his earliest days he had flung himself upon that study with an unprecedented passion of delight and curiosity. In drawing from life he had found the way to unite precision with freedom, the subtlest accuracy of definition with vital movement and flow of line, as no draughtsman had been able to unite them before. He was the first painter to recognize light and shade as among the most significant and attractive of the world's appearances, and as elements of the utmost importance in his art, the earlier schools having with one consent neglected the elements of light and shade in favor of the elements of color and line. But Leonardo was not a student of the broad, regular, patent appearances only of the world; its fugitive, fantastic, unaccustomed appearances attracted him most of all. Strange shapes of hills and rocks, rare plants and animals, unusual faces and figures of men, questionable smiles, and expressions, whether beautiful or grotesque, far-fetched objects and curiosities, these were the things which he most loved to pore upon and keep in memory. Neither did he stop at mere appearances of any kind, but, having stamped the image of things upon his brain, went on indefatigably to probe their hidden laws and causes. The laws of light and shade, the laws of "perspective," including optics and the physiology of the eye, the laws of human and animal anatomy and muscular movement, and of the growth and structure of plants, all these and much more furnished food almost from the beginning to his insatiable spirit of inquiry. The evidence of his preferences and preoccupations is contained in the list of the lost works which he produced during this period. One of these was a painting of Adam and Eve in opaque water-colors; and in this, besides the beauty of the figures, the infinite truth and elaboration of the foliage and animals in the background are celebrated in terms which bring to mind the treatment of the subject by Albert Dürer, in his famous engraving done thirty years later. Again, a peasant of Vinci having in his simplicity asked Ser Piero to get a picture painted for him on a wooden shield, the father is said to have laughingly handed on the commission to his son, who thereupon shut himself up with all the noxious insects and grotesque reptiles he could find, observed and drew and dissected them assiduously, and produced at last a picture of a dragon compounded of their various shapes and aspects, which was so fierce and so life-like as to terrify all who saw it. With equal research and no less effect he painted on another occasion the head of a snaky-haired Medusa.[1] Lastly, Leonardo is related to have modelled in clay and cast in plaster, about this time, several heads of smiling women and children. In addition to these labors and researches, he was full of new ideas concerning both the laws and the applications of mechanical forces. His architectural and engineering projects were of a daring which amazed even the fellow-citizens of Alberti and Brunelleschi. History presents few figures more attractive to the mind's eye than that of Leonardo during this period of his all-capable and dazzling youth. There was nothing about him, as there was afterwards about Michelangelo, dark-tempered, secret, or morose; he was open and genial with all men. From time to time, indeed, he might shut himself up for a season in complete intellectual absorption, as when he toiled among his bats and wasps and lizards, forgetful of rest and food, and insensible to the noisomeness of their corruption; but anon we have to picture him as coming out and gathering about him a tatterdemalion company, and jesting with them until they were in fits of laughter, for the sake of observing their burlesque physiognomies; or anon as standing radiant in his rose-colored cloak and his rich gold hair among the throng of young and old on the piazza, and holding them spell-bound while he expatiated on his plan for lifting the venerable baptistery of St. John, the *bel San Giovanni* of Dante, up bodily from its foundations, and planting it anew on a stately basement of marble. Unluckily it is to the written biographies and to imagination that we have to trust exclusively for our picture. No portrait of Leonardo as he appeared during this period of his life has come down to us.

The interval between 1480 and 1487 is one during which the movements of our master are obscure, and can only be told conjecturally. Up to the former date we know with certainty that he was working at Florence, under the patronage of Lorenzo de' Medici. By the latter date he had definitely passed into the service of Duke Ludovico Sforza, called il Moro, at Milan. The main determining cause of his removal would seem to have been his selection by Ludovico for the task of erecting a great memorial statue in bronze to the honor of his victorious father, the condottiere Francesco Sforza. The project of such a monument had been already entertained by the last duke, Ludovico's elder brother. After Ludovico had possessed himself of the regency in 1480, he appears to have revived the scheme, and to have invited various artists to compete for its execution. One who complied with the invitation was the Florentine Antonio del Pollaiuolo, by whom a sketch for the monument is still preserved at Munich. It would seem as if the competition had been won by Leonardo, but a considerable time had been allowed to elapse before the work was actually put in hand. The question then arises, Was it during this period of postponement that Leonardo went on his mysterious travels to the East? The earlier biographers know nothing of these travels; recent investigation of Leonardo's MSS. has brought them to light. It has been not inaptly conjectured that the speculations of transcendental Platonism, which absorbed at this time the thoughts and the conversation of the Medicean circle, were uncongenial to the essentially experimental cast of Leonardo's mind, and that he was not sorry to escape from the atmosphere of Florence. At any rate his devouring curiosity would have made welcome the opportunity of enlarging his knowledge of men and countries by Eastern travel, even at the cost, which to one of his free-thinking habits would not have been great, of a temporary compliance with Islamite observances. Certain it is that he took service as engineer with the sultan of "Babylon," which in the geographical nomenclature of those days meant Cairo, and in the course of his mission visited Egypt, Cyprus, Constantinople, the coasts of Asia Minor, especially the Cilician region about Mount Taurus, and Armenia. This biographical discovery adds to the career of Leonardo a characteristic touch of adventurous and far-sought experience. Perhaps it was his acquaintance with the Levant which made him adopt the Oriental mode of writing from right to left, a habit which some of his biographers have put down to his love of mystification, and others explain more simply by the fact (to which his friend Luca Pacioli bears explicit testimony) that he was left-handed. The probable date of Leonardo's Eastern travels falls between 1480 and 1483–84. By the last-named year, if not sooner, he was certainly back in Florence, whence he wrote to Ludovico il Moro at Milan a letter making him the formal offer of his services. The draft of this letter is still extant. It does not altogether tally with the statements of the earliest biographers, that Leonardo was recommended by Lorenzo de Medici to the duke regent particularly for his accomplishments in music. Vasari indeed says expressly that Leonardo was the bearer to Ludovico of a lyre of his invention, ingeniously fashioned of silver in the form of a horse's head. In the autograph draft of the letter to which we have referred Leonardo rests his own title to patronage chiefly on his capabilities in military engineering. After explaining these under nine different heads, he speaks under a tenth of his proficiency as a civil engineer and architect, and adds a brief paragraph with reference to what he can do in painting and sculpture, undertaking in particular to carry out in a fitting manner the monument to Francesco Sforza. We shall probably be safe in fixing between the years 1484 and 1485 as the date of his definitive removal to Milan.

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[1] A picture of this subject at the Uffizi still does duty for the original of Leonardo, but is in all likelihood merely the production of some later artist to whom the descriptions of his work have given the cue. In like manner, the Madonna in the Borghese gallery at Rome, in which occurs the motive of a bottle beaded with drops of dew, though it may well be the same painting which Vasari admired in the possession of Clement VII., is unquestionably the work, not of Leonardo, to whom Vasari ascribes it, but of his fellow-pupil Lorenzo di Credi. Altogether spurious, it may here be said, is the small Madonna which is made to pass for an early work of Leonardo in the gallery at Dresden.

From this time for the next fourteen or fifteen years (until the summer of 1499) Leonardo continued, with very brief intervals of absence, to reside in high favor and continual employment at the court of Ludovico il Moro. His occupations were as manifold as his capacities. He superintended the construction of military engines, and seems to have been occasionally present at sieges and on campaigns. He devised and carried out works of irrigation and other engineering schemes in the territory of the duchy. He designed a cupola for the cathedral of Milan, and was consulted on the works of Certosa of Pavia. He managed with ingenuity and splendor the masques, pageants, and ceremonial shows and festivals of the court. Withal he continued incessantly to accumulate observations and speculations in natural philosophy, working especially at anatomy with Marcantonio della Torre, and at geometry and optics with Fra Luca Pacioli, for whose book *De Divina Proportione* he designed the figures. He made excursions into the Alps, and studied and drew with minute fidelity the distribution and formation of the mountain masses. He was placed at the head of a school or "Academy" of arts and sciences, where he gathered about him a number of distinguished colleagues and eager disciples. His pupils in painting included the sons of several noble families of the city and territory.

Among the more immediate scholars of Leonardo may be mentioned Antonio Boltraffio, Marco d'Oggionno, Gian Petrino, and the master's special friend and favorite, Salai or Salaino. But by far the most important painter formed under Leonardo's influence at Milan was the admirable Bernardino Luini. Other disciples or adherents of his school were Bazzi of Siena, called Il Sodoma, Gaudenzio Ferrari, Andrea Solario, Bernardino dei Conti, and Ambrogio Preda or de Predis. Several of the pupils or adherents here mentioned belong, however, to a later period of the master's life than that with which we are now concerned.

Leonardo's own chief undertakings in art during his residence at the court of Ludovico il Moro were two in number, namely, the equestrian monument of Francesco Sforza and the mural painting of the Last Supper. For the former he had probably made some preparatory sketches and models before he left Florence. After his arrival at Milan the work seems to have proceeded with many interruptions, and according to a MS. note of his own to have been finally and actively resumed in 1490. In the Royal Library at Windsor are preserved a whole series of small experimental studies for the monument. Leonardo was a great lover and student of horses, and would never be without some of the noble race in his stable. It is difficult to retrace the stages of development marked by the several sketches in question, or their relations to the final design. But it seems as if Leonardo had first proposed to represent his hero as mounted on a charger violently prancing or rearing above a fallen enemy, and had in the end decided to adopt a quieter action, more nearly resembling that of the work upon which Verrocchio was simultaneously engaged at Venice. Some difficulties must have been encountered in the casting, or there would have been no meaning in the words of Michelangelo when twelve years afterwards he is said to have taunted Leonardo with incapacity on that account. But contemporary writings are explicit to the effect that the group of horse and rider, 26 feet in height, was actually cast in bronze, and set up to the admiration and delight of the people, under a triumphal arch constructed for the purpose, during the festivities held at Milan in 1493 on the occasion of the marriage of the emperor Maximilian to a bride of the house of Sforza. Within ten years the glory of that house had departed. Ludovico, twice overthrown by the invaders whom he had himself called into Italy, lay languishing in a French prison, and his father's statue had served as a butt to the Gascon archers of the army of Louis XII. In 1501 the duke Ercole d'Este sought leave from the French governor of Milan to have the statue removed to his own city; but nothing seems to have come of the project; and within a few years Leonardo's master-work in sculpture had between mischief and neglect been irretrievably destroyed.

Only a little less disastrous is the fate which has overtaken the second great enterprise of Leonardo's life at Milan, his painting of the Last Supper. This, with the Madonna di San Sisto and Michelangelo's Last Judgment, is the third most celebrated picture of the world. It was painted, twenty years the earliest of the three, on the refectory wall of the convent of Santa Maria delle Grazie at Milan, where its defaced remains are still an object of pilgrimage and wonder. The commission for the work came partly from the duke and partly from the monks of the convent. Leonardo is said to have consumed upwards of ten years upon his task, a circumstance which is not surprising when we consider his fastidious spirit and the multiplicity of other calls upon his time. But the monks were impatient, and could not make allowance for the intervals of apparent idleness, intervals really of brooding and searching and meditation, which were incidental to Leonardo's way of work. On one occasion it became necessary for the duke himself, whose dealings with his gifted servant seem to have been consistently intelligent and kind, to take the painter's part against the prior of the convent. But in working out his conception of the scene, and in devising the pictorial means for its presentment, Leonardo allowed his craving for quintessential excellence to overmaster him. He could not rest satisfied without those richnesses and refinements of effect which are unattainable in the ordinary method of mural painting, that is, in fresco, but must needs contrive by his chemistry a method for painting on the wall in oil. Neither could any of the traditional ideals of art content him in the representation of the scene. He must toil and ponder until he had realized a more absolute set of types, and grouped them in more masterly and speaking actions, than had ever been attempted before. The master type of all, that of Christ, it is said that he could never even realize to the height of his conception at all, but left it to the last uncompleted. Unhappily Leonardo's chemistry was unequal to his purpose, and his work had begun to peel and stain within a few years of its execution. The operation of time and damp has since been accelerated at intervals by the vandalism of men. After almost disappearing, the picture has been revived once and again, latterly either from copies or from engravings taken during the earlier periods of its deterioration, until now there is probably not a vestige of the original workmanship remaining. Nevertheless, through all these veils of injury and disguise, it is still possible in some measure to appreciate the power of that creation which became from the first, and has ever since remained, the typical representation for all Christendom of the sacrament of Christ's Supper.

Goethe in his famous criticism has said all that needs to be said of the essential character of the work. The painter has departed from precedent in grouping the company of disciples, with their Master in the midst, along the far side and the two ends of a long, narrow table, and in leaving the near or service side of the table towards the spectator free. The chamber is seen in a perfectly symmetrical perspective, its rear wall pierced by three plain openings which admit the sense of quiet distance and mystery from the open landscape beyond; by the central of these openings, which is the widest of the three, the head and shoulders of the Saviour are framed in. On his right and left are ranged the disciples in equal numbers. The serenity of the holy company has within a moment been broken by the words of their Master, "One of you shall betray Me." In the agitation of their consciences and affections, the disciples have started into groups or clusters along the table, some standing, some still remaining seated. There are four of these groups, of three disciples each, and each group is harmoniously interlinked by some natural connecting action with the next. Leonardo, though no student of the Greeks, has perfectly carried out the Greek principle of expressive variety in particulars subordinated to general symmetry. The relations of his groups to one another, and of each figure within the several groups to its neighbor and to the central figure of Christ, are not only triumphs of technical design, they are evidences of a complete science of human character, emotion, and physiognomy held at the service of a nobly inspired and nobly directed art. The furniture and accessories of the chamber, very simply conceived, have been rendered with scrupulous exactness and distinctness; yet they leave to the human and dramatic elements the absolute mastery of the scene. Neither do the academical draperies of the personages impair the sense of imaginative truth with which the representation impresses us. Our first glance at the ruins of this famous picture makes us feel, and study does but strengthen the conviction, that the painter rose to the height of his argument, and realized worthily and for good this momentous scene in the spiritual history of mankind.

Of authentic preparatory studies for this work there remain but few. There is a sheet at the Louvre containing some nude sketches for the arrangement of the disciples about the table, and another of great interest at South Kensington, on which the painter has noted in writing the several dramatic motives which he proposes to embody in the disciples. At Windsor and Milan are a few finished studies in red chalk for the heads. A highly-reputed series of black crayon drawings of the same heads, of which the greater portion is at Weimar, has no just claim to originality. Of the other pictures and sculptures which Leonardo is known to have produced while in the service of the duke, such as the painting of the Nativity, sent as a present to the emperor Maximilian, and the portraits of Lucrezia Crivelli and Cecilia Gallerani, one of the duke's mistresses, no trace remains, nor is there sufficient reason for accepting the recently suggested attribution to Leonardo of an admirably wrought bust now preserved in the Louvre, of which the features are those of Ludovico's wife, the duchess Beatrice.

These services, especially the maintenance of his celebrated Academy, required on the part of Leonardo no inconsiderable outlay. On the other hand, the payments received by him seem to have been neither adequate nor regular, at all events during the latter part of his residence at the ducal court, when the exigencies of war and policy were already pressing hard upon Ludovico. Leonardo had finished his Last Supper between 1497 and 1499. In the spring of the latter year we find that he received, in consideration of payments due, the gift of a vineyard outside the city. Within a month or two his patron had fallen. Milan was taken and held in hostile occupation by the French. A contemporary historian has related with what admiration the invading monarch, Louis XII., when he entered the refectory of Sta. Maria delle Grazie, fixed his gaze on the work of Leonardo, and how he desired, were it possible, that it should be transported across the Alps to France. But by this time or soon afterwards the painter himself had left Milan. In the spring of 1500 we hear of him working at Venice, where, among other things, he painted (not, it appears, from life) a portrait of Isabella Gonzaga, marchioness of Mantua. The well-known head in the manner of Leonardo at the Louvre, commonly known as the *Belle Ferronnière*, has sometimes been identified as the portrait in question; but not on sufficient grounds. Early in the next year, 1501, Leonardo was once more in Florence; and thither the same marchioness, Isabella Gonzaga, sent an envoy to endeavor to attach him to her service. His answer was not unfavorable, but the envoy reported that, though recently engaged upon one or two small pictures, he was for the moment indifferent to the brush, and wholly absorbed in mathematics. In the end he attached himself, not to the court of Mantua, but to the service of Cæsar Borgia, then in the plenitude of his criminal power, and almost within reach of the realization of his huge ambitions. Leonardo's new patron had been one of the worst enemies of the fallen Ludovico, and had entered Milan as a conqueror in the suite of the French king. But artists and men of letters formed, in those days, a caste apart, and changed service not less readily than did the *condottieri* or hired military commanders. Between the beginning of 1502 and the catastrophe which overtook the house of Borgia in the summer of 1503, Leonardo travelled as engineer in the employ of Duke Cæsar over a great part of Central Italy. In Umbria and the Marches, he visited Urbino, Pesaro, Rimini, Cesena, Cesenatico, Buonconvento, Perugia, and Foligno; in Tuscany, he was at Chiusi, at Siena, at Piombino on the coast over against Elba, and southward at least as far as Orvieto and Lake Bolsena, or even, it would appear, as far as Rome. He has left notes and drawings taken at each of the stations we have named, besides a set of six large-scale maps drawn minutely with his own hand, and including nearly the whole territory of Tuscany and the Maremma between the Apennines and the Tyrrhene Sea. His excursions seem to have come to an end early in 1503, as by March of that year we find him once more in Florence.

To the period of three years' wandering which followed Leonardo's departure from Milan there ensued another period of three years, during which he lived a settled life at Florence. He was now fifty-one years of age, and the most famous artist of Italy, though within a year or two the young Michelangelo was destined to challenge his supremacy, and the still younger Raphael to apprehend and assimilate the secrets of his skill, as he did those of the skill of every great predecessor and every distinguished rival in succession. The first important commission put into Leonardo's hands at Florence was that for an altar-piece for the church of the Servite monks (Santa Maria dell' Annunziata). The work had been already entrusted to Filippino Lippi, who had even made some beginning with it, but willingly gave up his claim in favor of his illustrious fellow-citizen. The monks undertook to lodge and nourish Leonardo in their convent while he carried on the work. After long premeditation he began, and prepared that admirable cartoon in black chalk which is now the treasured possession of the Royal Academy in London. The Virgin, partly seated on the left knee of St. Anne, holds by the body the infant Christ, who leans across the figure of the elder woman, and lifts his hand in benediction of the little St. John leaning against her knee. In the lines and management of the composition there is not less charm than there is research. The elder mother smiles upon her daughter, and the daughter smiles upon her child, each with a look of loving prescience and rapt self-congratulation which is the sweetest of all those mysterious expressions that Leonardo loved to seize and to perpetuate. When the cartoon was finished and exhibited, all Florence came flocking in delight to see and praise it. Between fastidiousness and preoccupation Leonardo, however, carried the undertaking no farther, and the work was put once more into the hands of Filippino Lippi, and on his death into those of Perugino. Leonardo's next great enterprise at Florence was a historical painting for the Palace of the Signory. He had been on the commission of artists appointed to determine where Michelangelo's statue of David should be placed, and now he was chosen, along with his young rival, to finish a mural picture for the new Hall of Council. Each painter chose a battle subject: Michelangelo, as is well known, the surprise of the Florentine forces in the act of bathing near Pisa; Leonardo, an episode in the victory of the generals of the republic over Niccolo Picciuino at Anghiari, in the upper valley of the Tiber. In one of the sections of the *Treatise on Painting*, Leonardo has detailed at length, and obviously from his own observation, the pictorial aspects of a battle. His choice of such a subject was certainly not made from any love of warfare or indifference to its horrors. In the writings of Leonardo there occur almost as many trenchant sayings on life and human affairs as on art and natural law; and of war he has disposed in two words as a "bestial frenzy" (*pazzia bestialissima*). In his design for the Hall of Council, Leonardo set himself to depict this frenzy at its fiercest. He chose the moment of a terrific struggle for the colors between the opposing sides; hence the work became known in the history of art as the Battle of the Standard. Judging by the accounts of those who saw it, the tumultuous entanglement of men and horses, and the expressions of martial fury and despair, must in this case have been combined and rendered with a mastery not less commanding than had been the looks and gestures of soul's perplexity and dismay among the peaceful company on the convent wall at Milan. Leonardo had finished his cartoon in less than two years (1504–1505), and when it was exhibited along with that of Michelangelo, the two rival works seemed to all men a new revelation of the powers of art, and served as a model and example to the students of that generation, as the frescoes of Masaccio in the Carmine had served to those of two generations earlier. The young Raphael is well known to have been one of those who profited by what they saw. Other Florentine artists who were especially influenced at this time by Leonardo were Fra Bartolommeo, Jacopo da Pontormo, Ridolfo del Ghirlandajo; and in sculpture Baccio Bandinelli and Rustici. He also speaks of having among his pupils G. F. Penni, called "Il Fattore," a certain Lorenzo, and a German Jacopo, who cannot be further identified. His favorite assistant Salai had, we know, accompanied him from Milan, and remained with him.

Leonardo lost no time in proceeding to the execution of his design upon the mural surface; this time he had devised a technical method of which he regarded the success as certain; the colors were to be laid on a specially prepared ground, and then fixed by heat, in some way analogous to the processes of encaustic or enamel. When portions of the work were done the heat was applied, by means of fires lighted on platforms, but it was found to take effect unequally, and the result was a failure more or less complete. Leonardo abandoned the work in chagrin, and presently betook himself to Milan. Payments for his great battle-picture had been made to him in advance, and the gonfaliere Piero Soderini complained on behalf of the signory that Leonardo had treated them ill. When, however, he soon afterwards honorably offered to refund the amount, the offer was not less honorably declined. The unfinished painting before long disappeared from the wall. The cartoon also, no less than the competing cartoon of Michelangelo, has perished. Our only memorials of the work are a few preliminary sketches, an engraving executed by Lucensi in 1558, not from the original but from a copy, and the far more celebrated engraving of Edelinck after a study made by Rubens, in his own essentially personal, obstreperous, un-Italian manner, of a portion only of the composition. During the years between 1500 and 1505 Leonardo was also engaged at intervals upon the portraits of two ladies of the city—Ginevra Benci, and Lisa di Antonio Maria di Noldo Gherardina, the wife of Zanobi del Giocondo, commonly called *Mona* (*i. e.*, Madonna) *Lisa* or *la Gioconda*. The first of these portraits is lost; the second was bought by Francis I. for four thousand gold florins, and is now one of the glories of the Louvre. In Madonna Lisa Leonardo seems to have found a sitter whose features possessed in a singular degree the intellectual charm in which he delighted, and in whose smile was realized that inward, haunting, mysterious expression which had always been his ideal. He worked, it is said, at her portrait during some portion of four successive years, causing music to be played during the sittings that the rapt expression might not fade from off her countenance, and laboring by all the means of which he was master to bring his work to perfection. It remains perhaps the most striking example of his powers. The richness of coloring on which Vasari expatiates has indeed flown, partly from injury, partly because in his preference for effects of light and shade the painter was accustomed to model his figures on a dark ground, and that in this picture the ground has to a large extent come through. Nevertheless, in its brown and faded state, the portrait is pre-eminent alike for fascination of expression, for refinement and precision of drawing, and for the romantic invention of its background, wherein a far-seen champaign with bridged rivers and winding roads is bounded by a fantastic coast of islands and rock-bound estuaries.

During these years of work at Florence, Leonardo's father died at a good old age in that city. Some stray notes, in which the painter mentions a visit to "Caterina" in the hospital, and inscribes the amount of expenses paid "for the funeral of Caterina," though they are of uncertain date, prove too that when Leonardo's peasant mother drew near her end her illustrious son was there to tend her. From his half brothers, the legitimate children of Ser Piero, Leonardo after their father's death experienced unkindness. They were all much younger than himself. One of them, who followed his father's profession, made himself the champion of the others in disputing Leonardo's claim to his share, first in the paternal inheritance, and then in that which had been left to be divided between the brothers and sisters by an uncle. The litigation thus set on foot lasted for several years, and the annoyances attending it, with his disappointment at the failure of his great wall-painting, may have been among the causes which determined Leonardo to go back to Milan. Return thither he at all events did, with leave obtained from the signory, and attended by his faithful Salai, in the summer of 1506. For nearly nine years after that he seems to have made the Lombard city his principal home, residing sometimes on his own vineyard and sometimes in the villa of a wealthy young friend and disciple, Francesco Melzi. The French remained in occupation at Milan until 1513, and Leonardo held the title of court painter and engineer to the French king, Louis XII., the transfer of his services having been formally requested by that monarch from the Florentine signory. The record of his occupations and performances during this period is meagre. He was several times, and for considerable periods at a time, in Florence, on business connected with the litigation above mentioned. From thence he writes at the beginning of 1511 to the French governor of Milan, asking about the payment of his salary, and saying that he means to bring with him on his return two pictures of the Madonna, of different sizes. But there can be no doubt that his thoughts became with his advancing years ever more and more engrossed in the problems of natural science. To this time belong a large proportion of the vast collections in which are accumulated the results of his observation and research.

There are only three extant pictures which we can with probability assign to this, the second Milanese period of Leonardo's career, and to what points within the period it is hard to say. Two of these are replicas or rather variations of the same theme, the Virgin and Child with St. John the Baptist and an angel, in a landscape of fantastic rocks and flowery grottoes by the sea-shore. The composition is known as the *Vierge aux Rochers*. The most celebrated version of it is that formerly in the collection of Francis I., and now in the Louvre. The other version wa painted, according to Lomazzo, for the Capella della Concezione at Milan, where it was purchased in 1796 by Gavin Hamilton, and by him sold to the earl of Suffolk, from the hands of whose descendant it has lately passed into the National Gallery. Both of these paintings seem to betray signs of the handiwork of the master himself, assisted probably in each case by pupils. Both have suffered, the French example most from repainting, the English most from blackening. On the whole, of these two admirable and fascinating pictures, the English example may be pronounced to be both of the higher authenticity and the greater beauty, having the advantage of the French especially in the difference of position in the right hand of the kneeling angel. The third picture conjecturally referred to about this date is also at the Louvre, and again represents a holy family. Leonardo has recurred to the motive on which he had founded his design for the Church of the Servites at Florence, in so far as he has seated the Virgin in the lap of St. Anne, whom he depicts smiling at the happy intercourse of her mystic grandchild and his mother. But this time the Virgin stoops across as she sits, to lift the child from the ground on which he stands fondling a lamb. John the Baptist is absent, and the background is a pastoral landscape bounded towards the horizon by lagoons and mountains. The picture is unequally finished—minutely in some parts, and in others carelessly enough.

A great change took place in the affairs of Milan at the close of the year 1512. The French supremacy came to an end, and Maximilian Sforza, the son of Ludovico, returned for a few years to rule over the reduced dominions of his father. All affairs were thrown into confusion, and Milan ceased to be a desirable place of abode for Leonardo and his scholars. In the meantime Giovanni de' Medici, the son of the painter's ancient patron Lorenzo, was elected pope under the title of Leo X., and continued with still greater magnificence the encouragement of art and artists of which his warlike predecessor Julius had set the example. On the 24th September, 1514, Leonardo too set out for Rome from Milan with a company of his pupils. The youngest brother of the pope, Giuliano de' Medici, was his friend, but it is not true that Leonardo, as Vasari says, had accompanied Giuliano to Rome on the occasion of his brother's elevation to the papal chair. Ill success attended the now ageing master during his stay in the shadow of St. Peter's. He is said, indeed, to have delighted the pope, who was himself something of an alchemist, by his experiments and ingenuities in science, and especially by a kind of zoological toys, which he had invented by way of pastime, as well as mechanical tricks played upon living animals. But when, having received a commission for a picture, he was found distilling for himself a new medium of oils and herbs before he had begun the design, the pope was convinced, not quite unreasonably, that nothing serious would come of it. The hostility of Michelangelo, with whom Leonardo was in competition for the façade of San Lorenzo at Florence, may also have done something towards hindering the employment of the elder master on any important works. At all events no such employment came to him, and he seems, while he was at Rome, to have painted nothing but two small panels, one of a child, the other of a Madonna, for an official of the papal court.

By the end of the year 1515 Leonardo had left Rome and returned once more to Milan. In the meantime the brief rule of Maximilian Sforza had been terminated by the victory at Marignano of Francis I., who prevailed on Leonardo, by this time in his sixty-fourth year, to enter his service and return with him to France. It was in the beginning of 1516 that the painter crossed the Alps, taking with him his friend, the youthful Francesco Melzi. The Château Cloux in Touraine, near Amboise, was appointed for his place of residence. But his race was nearly run. In France he projected some canal works, and painted two pictures of classical mythology, which have been lost, a Leda and a Pomona; and that was all. He desired to put in order some of his vast accumulations of MS. notes and researches, but soon discovered that he who had been endeavoring so insatiably for all these years, in his own words, to learn to live had only been learning to die. That form of strength and beauty, and that exquisitely shaping and all-searching mind, were dissolved before decay or infirmity impaired them. Leonardo died at Cloux, in the sixty-seventh year of his age, on the 2d of May, 1519. King Francis, then at his court of St. Germain en Laye, is said to have wept for the loss of such a servant; that he was present beside the death-bed and held the dying painter in his arms is a familiar but an untrue tale.

The contents of our narrative will have justified the definition of Leonardo with which we set out, as a genius all but universal and a man pre-eminently great, yet great rather by power than by performance. Thus, in painting, there have come down to us no more than ten undisputed works from his hand; and among those ten are included the picture by his master Verrocchio in which Leonardo had only a share, as well as the cartoon at the Royal Academy, and the unfinished panels at the Uffizi and the Borghese gallery. Of the remaining well certified works of Leonardo, one is at the National Gallery (the Suffolk *Vierge aux Rochers*), the others are the second *Vierge aux Rochers*, the Virgin and Child with St. Anne, the portrait of Mona Lisa, and the young John the Baptist, all at the Louvre. The remains of the fresco said to have been painted by Leonardo and Melzi together, in the villa which belonged to the latter at Vaprio near Milan, are too fragmentary and disputable to be counted. Of works, in addition to these, ordinarily claimed for Leonardo's hand, the best and nearest to his manner, if not actually his, is the portrait commonly known as *La Belle Ferronnière*, also at the Louvre, which students conjecture to be in reality that of the marchioness of Mantua, others that of Lucrezia Crivelli. Another highly reputed picture in the manner of Leonardo is the *Vierge au Bas-relief* at Gatton Park; another version, however, of the same theme, said to be in no way inferior to that at Gatton, exists at Milan, and is there rightly attributed to Cesare da Sesto. The multitude of smiling daughters of Herodias, allegorical Floras, and the like, besides some admirable religious pictures (including the Christ preaching to the Doctors, at the National Gallery), which are currently attributed in public and private galleries to Leonardo, belong really to the various pupils or imitators of his school—the greatest number to Bernardino Luini, who added to a peculiar grace and suavity of his own much of the great master's intellectual power and exquisiteness of choice and finish. Such as they are, the meagre original remains of Leonardo's craft in painting are enough to establish his place in history as the earliest complete painter of the Renaissance. In his work there are no longer to be perceived, as there are in that of all his contemporaries, any of the engaging imperfections of childhood; there is no longer any disproportion between the conception and its embodiment. He had wrestled with nature from the cradle, and for the purposes of pictorial representation had mastered her. He could draw with that ineffable left hand of his (the words are those of his friend Luca Pacioli) a line firmer, finer, and truer than has been drawn by the hand of any other man, excepting perhaps Albert Dürer. Further, Leonardo carried the refinement of solid modelling in light and shade to the same high point to which he carried the refinements of linear definition. Color he left where he found it, or rather perhaps, by his predilection for effects of light and shade, did something towards bringing about the degradation of color. Of character and action he was an unrivalled master—preferring for his own pleasure the more far-fetched and enigmatical, sometimes even the grotesque among human types and expressions, but capable on occasion, as in his master-work of the Last Supper, of laying aside curiosity and strangeness, and treating a great theme in a great and classical spirit. If these qualities can be sufficiently discerned in the few extant paintings of this master, it is only by the study of his drawings and sketches that his industry and fertility in the graphic art can be appreciated. These are very numerous as well as very various in kind, and are widely scattered among different possessors, occurring sometimes apart from and sometimes in connection with the sheets of his MS. notes and writings (see note below).

Passing from Leonardo's achievements in art to his attainments and inventions in science, a subject on which the present writer has no authority for speaking at first hand, it appears that, in this sphere also, the spirit of fanciful curiosity and ingenuity coexisted in Leonardo with an incomparably just and powerful grasp of natural fact and natural law. Gossiping biographers like best to speak of his mechanical birds, of his mechanical walking lion stuffed with lilies, of the lizard which he fitted with horns and artificial eyes and oscillating wings filled with quicksilver, and the like; but serious students assure us that he was one of the very greatest and most clear-sighted as well as one of the earliest of natural philosophers. They declare him to have been the founder of the study of the anatomy and structural classification of plants; the founder, or at least the chief reviver, of the science of hydraulics; to have anticipated many of the geometrical discoveries of Commandin, Autolycus, and Tartaglia; to have divined or gone far towards divining the laws of gravitation, the earth's rotation, and the molecular composition of water, the motion of waves, and even the undulatory theory of light and heat. He discovered the construction of the eye and the optical laws of vision, and invented the camera obscura. Among useful appliances he invented the saw which is still in use in the marble quarries of Carrara, and a rope-making machine said to be better than any even yet in use. He investigated the composition of explosives and the application of steam power; he perceived that boats could be made to go by steam, and designed both steam-cannon and cannon to be loaded at the breech. He made innumerable designs for engines of war, and plans of tunnels and canals for traffic. A few of his practical inventions were carried out in his time, but both of these and of his speculative researches the vast majority, lying buried in unpublished MSS., remained after his death unknown or forgotten. The discoveries which he had made wholesale were left to be rediscovered piecemeal by the men of narrower genius who came after him.

So much for the intellectual side of Leonardo's character and career. As a moral being we are less able to discern what he was like. The man who carried in his brain so many images of subtle beauty, as well as half the hidden science of the future, must have lived spiritually, in the main, alone. Of things communicable he was at the same time, as we have said, communicative—a genial companion, a generous and loyal friend, ready and eloquent of discourse, and impressing all with whom he was brought in contact by the power and the charm of genius. We see him living on terms of constant affection with his father, tending the last hours of his mother, and in disputes with his brothers not the aggressor but the sufferer from aggression. We see him open-handed in giving, not grasping in getting —"poor," he says, "is the man of many wants;" not prone to resentment—"the best shield against injustice is to double the cloak of long-suffering;" zealous in labor above all men—"as a day well spent gives joyful sleep, so does a life well spent give joyful death." With these instincts and maxims, his moral experience is not likely to have been deeply troubled. In matters of religion he seems to have had some share of the philosophical scepticism of a later age. In matters of the heart, if any consoling or any disturbing passion played a part in his life, we do not know it; we know only of affectionate relations with friends and pupils, of public and private regard mixed in the days of his youth with dazzled admiration, and in those of his age with something of reverential awe.

Of the presence and aspect of this illustrious man we have, as has been said, no record belonging to the earlier period of his life except that of the written descriptions which celebrate his beauty. The portraits which we possess represent him in after years, as he may have appeared during his second residence at Milan, when the character of sage and archimage had fully imprinted itself on his countenance. The features are grand, clear, and deeply lined, the mouth firmly set and almost stern, the eyes strong and intent beneath their bushy eyebrows, the hair long and white, descending and commingling with a majestic beard. The most authentic sheet which thus represents him is a drawing nearly in full face, unquestionably by his own hand, at Turin. Other studies, but none of such high quality as this, represent the same features in profile. On both the full-face and the profile drawings many painted portraits have been founded, some of them done by nearly contemporary hands; but none can with safety be attributed to the master himself.

The materials for a definitive life of Leonardo are at present wanting. They may be expected to be in great part supplied by the promised publication of Dr. J. P. Richter, *The Literary Works of Leonardo da Vinci*. In the meantime the results of recent investigation may be best gathered from the same writer's biography of the painter (London, 1880), supplemented by his "Leonardo-Studien" in Lützow's *Zeitschrift für bildende Kunst*, 1880, 1881; and by Ivan Lermolieff (Sig. Giov. Morelli) in his *Werke Italienischen Meister in München, Dresden, u. Berlin*, 1880, p. 107 *sq.* See also Karl Woermann in Woltmann and Woermann, *Geschichte der Malerei*, vol. ii., p. 541 *sq.* On several matters of fact the authorities above named must be regarded as superseding all earlier biographies. The principal of these, taking them in the chronological order of their composition, are as follows· P. Jovius, "Vita Leonardi Vincii," printed in Tiraboschi *Storia della Lett. italiana*, t. vii., 1718–19; "Breve vita di Leonardo da Vinci, scritta da un Anonimo di 1500," printed by G. Milanesi in the *Archivio Storico Ital.*, 1872, p. 222 *sq.*; Vasari in his celebrated *Lives;* and Lomazzo in his *Trattato dell' arte della pittura* (1584), and *Idea del tempio della pittura* (2d ed., 1590). From this time no contribution of importance was added until the work of Amoretti, which has formed the foundation of all later researches (C. Amoretti, *Memorie Storiche sulla vita, etc., di Lionardo da Vinci*, 2d ed., Milan, 1804). The other chief contributions of new material have been contained in Fumagalli, *Scuola di Leonardo da Vinci*, 1811; Gaye, *Carteggio d'Artisti*, 1839, vol. i. pp. 223, 224; the Lemonnier edition of Vasari, 1851, vol. vii. p. 11 *sq.*; the new edition of the same by G. Milanesi, vol. iv. p. 17 *sq.*; G. L. Calvi, *Notizie dei professori di belle arti*, etc., Milan, 1869; and Gust. Uzielli, *Ricerche intorno a Leonardo da Vinci*, Florence, 1872. The best general handlings of the subject, antecedent to those mentioned at the beginning of our list, have been in France, by Arsène Houssaye, *Histoire de Léonard de Vinci*, 2d ed., Paris, 1876; and Charles Clément, *Raphael, Léonardo de Vinci, et Michelange*, 4th ed., Paris, 1879; in Germany, by G. F. Waagen, *Kleine Schriften*, Stuttgart, 1875; W. Lübke, *Gesch. der Ital. Malerei*, vol. ii.; and C. Brun in Dohme's *Kunst u. Künstler*, vol. iii., No. 61; in England, Mrs. Heaton, *Life of Leonardo da Vinci*, London, 1874. With regard to the scientific attainments and achievements of Leonardo the authorities are J. B. Venturi, *Essai sur les ouvrages physico-mathématiques de Léonard de Vinci*, Paris, 1797; Marx, *Ueber M. A. Torre u. Leonardo da Vinci*, Göttingen, 1848; Libri, *Histoire des Sciences Mathématiques en Italie*, vol. ii.; Lombardini, *Dell' Origine et del Progresso della Scienza idraulica*, Milan, 1872; G. Mongeri, G. Govi, and C. Boito, *Saggio delle opere de Leonardo da Vinci*, Milan, 1872 (a summary of the conclusions of these writers is given in an essay by C. E. Black in Mrs. Heaton's biography); and lastly, H. Grothe, *Lionardo da Vinci als Ingenieur u. Philosoph*, Berlin, 1874.

The celebrated *Treatise on Painting*, which has hitherto been the only published portion of Leonardo's writings, consists of brief didactic chapters, or more properly paragraphs, of practical direction or critical remark on all the branches and all the conditions of a painter's practice. The original MS. draft of Leonardo has been lost, though a great number of notes for it are scattered through the various extant volumes of his MSS. The work has been printed in two different forms; one of these is an abridged version consisting of 365 sections; the first edition of it was published in Paris in 1551, the last, translated into English by J. F. Rigaud, in London, 1877. The other is a more extended version, in 912 sections, divided into eight books; this was printed in 1817 by Greg. Manzi at Rome, from a 17th century MS. which he had discovered in the Vatican Library; a German translation from the same MS. has been edited by G. H. Ludwig in Eitelberger's series of *Quellen-*

schriften für Kunstgeschichte. On the history of the book in general see Max Jordan, *Das Malerbuch des Leonardo da Vinci*, Leipsic, 1873.

The MSS., writings, sketches, and memoranda of Leonardo have undergone many vicissitudes since they were bequeathed in the mass by their author to his friend and *famulus* Francesco Melzi. Within fifty years of Leonardo's death the son of their inheritor had allowed them to pass out of his hands, and they were in the possession partly of the sculptor Pompeo Leoni, and partly in that of Dr. Guido Mazenta. By 1637 a considerable portion of them were again reunited in the Ambrosian Library at Milan. During the domination of the French under Bonaparte, these treasures were brought to France, and the greater part of them were not reclaimed. Milan, indeed, possesses that immense composite volume of Leonardo's MSS. which is perhaps the most valuable of them all, and is called from its bulk the *Codice Atlantico*. Fourteen volumes more are in the library of the Institute at Paris. A number of others are dispersed in various English collections—the most important in the Royal Library at Windsor, some at the British Museum and South Kensington, and others in the private collections of Holkham Hall and Ashburnham House. The well-known sonnet, beginning "Chi non può quel che vuol, quel che può voglia," which has been quoted since the 16th century as of Leonardo's writing, has recently been proved to have been written fifty years before his time (see G. Uzielli in the journal *Il Buonarroti*, 1875). (S. C.)

LEONIDAS ("Son of the Lion") was a very common Greek name. The most famous person who bore it was a king of Sparta, seventeenth of the Agid line. He had been king for one year when Xerxes invaded Greece, 480 B. C. The congress of the Greek states bent on resistance, which met at the isthmus of Corinth, sent Leonidas with a force of at least 8000 men to hold the narrow pass of Thermopylæ against the Persians (see GREECE). When the Persians, through the treacherous aid of Ephialtes, had turned the pass, Leonidas dismissed all his army except the 300 Spartan citizens, 700 Thespians, and the Theban contingent, which was suspected of treachery. Every man[*] of the Lacedæmonians and Thespians died on the field, while the Thebans laid down their arms. A monument was erected on the spot where the Greeks made their final struggle. It was a lion, and we may compare with it the lion set up by the Thebans on the battlefield at Chæronea to commemorate the sacred band who were all slain there 338 B. C. There is no foundation for the common story that Leonidas had only three hundred men with him at Thermopylæ.

There were also two Greek poets named Leonidas. The elder was born at Tarentum, and lived in the time of Pyrrhus; he spent a wandering life of poverty. There remain over a hundred of his epigrams, chiefly inscriptions on works of art, or dedicatory offerings, which are among the best of their kind, showing much ingenuity of thought and cleverness of expression. The other was born at Alexandria, and came to live in Rome, where he obtained great reputation in the time of Nero. His epigrams are destitute of merit. The only ingenuity displayed in them is that some of them have an equal number of letters in every verse.

LEONTINI, a town in the south-east of Sicily, was founded by the Chalcidians from Naxos (730 B. C.). Its history is so interwoven with that of its more powerful neighbor Syracuse that it can hardly be treated separately. The people of Leontini were more than once transferred to Syracuse, but the town was always refounded.[1] It was situated in a very fertile district, and was a wealthy place, as is proved by its numerous coins, on which ears of corn are a frequent type. The *locus classicus* for the topography of the ancient city is Polybius, vii. 6. The most distinguished name in literature belonging to Leontini is that of the sophist Gorgias. It continued to exist throughout the Roman and mediæval periods, and still preserves the old name slightly altered as Lentini.

LEOPARD, a name now commonly given to a well-known animal, called pard (πάρδος and πάρδαλις) or panther (πάνθηρ) by the ancients. Leopard (*leo-pardus*) was a later term, originally applied, it is believed, to the animal now known as the cheetah or hunting leopard, upon the supposition that it was a creature intermediate between the lion and the true pard. If so it has been completely transferred to the more common species, and though in this sense a perfectly unnecessary and unmeaning term, has gradually superseded those by which this was originally known. Pard, so commonly used by Elizabethan authors, is now nearly obsolete in the English language, and panther has either become synonymous with leopard, or is used vaguely for any similar large feline animal, even the puma of America.

Leopard.

Owing to their extensive geographical range, and the great variations, both in size, form, and coloration, to which leopards are subject, zoologists have scarcely decided whether all the forms popularly referred to this animal should be regarded as specifically alike, or whether they should constitute several distinct species, but the prevailing opinion at present is in favor of the former view. The attempts to separate a larger and more robust variety, under the name of panther, from a smaller and more graceful form, to which the term leopard might properly be restricted, have failed owing to the existence of intermediate conditions which cannot be assigned definitely to either one or the other form. The most marked anatomical difference yet noted in different varieties of leopard is in the length of the tail as compared with that of the body, even the number of the caudal vertebræ showing variation, though within what limits, and whether correlated with other characters, has not yet been clearly ascertained. The fur of those specimens which inhabit the most northern confines of its range of distribution, as North China, is longer and softer, and the markings are consequently less distinct than on those from more congenial climates, and the well-marked variation thus produced has given rise to the idea of specific distinction.

Treating the species as one, it is the *Felis pardus*, Linn., of most systematic authors, belonging to the family *Felidæ* (for the characters of which see MAMMALIA), and is one of the most typical members of the genus *Felis*, both in its structure and habits. It belongs to that section of the genus (which includes most of its larger members, as the lion and the tiger) in which the hyoid bone is loosely connected with the skull, owing to imperfect ossification of its anterior arch, and in which the pupil of the eye when contracted under the influence of light is circular, not linear as in the smaller cats. The teeth consist on each side of three small incisors, and a formidable large, conical, sharp-pointed canine above and below, and three premolars and one molar above, and two premolars and one molar below, all except the very small upper true molar with sharp compressed trenchant crowns. The skull can scarcely be distinguished, except by its inferior size, from that of the lion. There are seven cervical, thirteen dorsal, seven lumbar, three sacral, and usually twenty-three caudal vertebræ. The toes, five on the forefoot (of which the first or pollex is much shorter than the others) and four on the hind foot, are all armed with powerful, sharp-pointed, much-curved, compressed, retractile claws. The size of different individuals, as before said, varies greatly, the head and body usually measuring from 3½ to 4½ feet in length, and the tail from 2½ to 3 feet, but specimens have been met with which fall short of or exceed these limits. The ground color of the fur varies from a pale fawn to a rufous buff, graduating into a pure white on the under parts and inside of the limbs. This is spotted over with dark brown or black; the spots on the back and sides being arranged in rosettes or broken rings, which vary greatly in size and distinctness in different individuals, but are without the central spot seen in those of the jaguar. The spots on the under parts and limbs are simple and blacker than those on the other parts of the body. The bases of the ears behind are black, the tips buff. The upper side of the tail is buff, spotted with broken rings like the back, its under surface white with simple spots. The hair of the cubs is longer than that of the adults, its ground color less bright, and its spots less distinct. Perfectly black leopards, which, however, in certain lights show the characteristic markings on the fur, are not uncommon. These appear to be examples of *melanism*, occurring as individual variations, sometimes in one cub out of a litter of which the rest are normally colored, and therefore not indicating a distinct race, much less a species. These are met with chiefly in southern Asia. We are not aware of any recorded case from Africa, but the wild animals of that continent are not so well known.

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[1] The restoration of the Leontine exiles was one of the alleged reasons for the Athenian expedition against Syracuse, 417 B. C.

[*] [Aristodemus of Lacedæmon escaped, the traditions say.—AM. ED.]

In habits the leopard resembles the other large catlike animals, yielding to none in the ferocity and bloodthirstiness of its disposition. It is exceedingly quick and active in its movements, but seizes its prey by waiting in ambush or stealthily approaching to within springing distance, when it suddenly rushes upon it and tears it to the ground with its powerful claws and teeth. It preys upon almost any animal it can overcome, such as antelopes, deer, sheep, goats, monkeys, peafowl, and is said to have a special liking for dogs. It not unfrequently attacks human beings in India, chiefly children and old women, but instances have been known of a leopard becoming a regular "man-eater." When favorable opportunities occur, it often kills many more victims than it can devour at once, apparently to gratify its propensity for killing, or only for the sake of their fresh blood. It generally inhabits woody districts, and can climb high trees with facility when necessary for its safety when hunted, but usually lives on or near the ground, among rocks, bushes, and roots and low branches of large trees.

The present geographical range of the leopard is very extensive, as it is met with in various suitable localties, where not too much interfered with by human cultivation, throughout the greater part of Africa from Algeria to the Cape Colony, and through the whole of the south of Asia from Palestine to China, including all India south of the Himalayas, and the islands of Ceylon, Java, Sumatra, and Borneo. Fossil bones and teeth, indistinguishable from those of existing leopards, have been found in cave deposits of Pleistocene age in Spain, France, Germany, and England. The evidence of the former existence of the leopard in England is described at length by Boyd Dawkins and Sandford in their *British Pleistocene Mammalia* (Palæontographical Society, 1872). (W. H. F.)

LEOPARDI, GIACOMO (1798–1837), the one Italian poet of the 19th century who has taken an uncontested place among the classics of the language, was born at Recanati in the March of Ancona, June 29, 1798. All the circumstances of his parentage and education conspired to foster his precocious and sensitive genius at the expense of his physical and mental health. His family was ancient and patrician, but so deeply embarrassed as to be only rescued from ruin by the energy of his mother, who had taken the control of business matters entirely into her own hands, and whose engrossing devotion to her undertaking seems to have almost dried up the springs of maternal tenderness. Count Monaldo Leopardi, the father, a mere nullity in his own household, secluded himself in his extensive library, to which his nervous, sickly, and deformed son had free access, and which absorbed him exclusively in the absence of any intelligent sympathy from his parents, any companionship except that of his brothers and sisters, or any recreation in the dullest of Italian towns. The lad spent his days over grammars and dictionaries learning Latin with little assistance, and Greek and the principal modern languages with none at all. Any ordinarily clever boy would have emerged from this discipline a mere pedant and bookworm. Leopardi came forth a Hellene, not merely a consummate Greek scholar, but penetrated with the classical conception of life, and a master of antique form and style. At sixteen he composed a Latin treatise on the Roman rhetoricians of the 2d century, a commentary on Porphyry's life of Plotinus, and a history of astronomy: at seventeen he wrote on the popular errors of the ancients, citing more than four hundred authors. A little later he imposed upon the first scholars of Italy by two odes in the manner of Anacreon. At eighteen he produced a poem of considerable length, the "Appressamento alla Morte." which, after being lost for many years, has recently been discovered and published by Signor Zanino Volta. It is a vision of the omnipotence of death, modelled upon Petrarch, but more truly inspired by Dante, and in its conception, machinery, and general tone offering a remarkable resemblance to Shelley's "Triumph of Life," written six years subsequently, and of which Leopardi probably never heard. This juvenile work was succeeded (1819) by two lyrical compositions which at once placed the author upon the height which he maintained ever afterwards. The ode to Italy, and that on the monument to Dante erected at Florence, gave voice to the dismay and affliction with which Italy, aroused by the French Revolution from the torpor of the 17th and 18th centuries, contemplated her forlorn and degraded condition, her political impotence, her degeneracy in arts and arms, and the frivolity or stagnation of her intellectual life. They were the outcry of a student who had found an ideal of national existence in his books, and to whose disappointment everything in his own circumstances lent additional poignancy. But there is nothing unmanly or morbid in the expression of these sentiments, and the odes are surprisingly exempt from the failings characteristic of young poets. They are remarkably chaste in diction, close and nervous in style, sparing in fancy, and almost destitute of simile and metaphor, antique in spirit, yet pervaded by modern ideas, combining Landor's dignity with a considerable infusion of the passion of Byron. These qualities continued to characterize Leopardi's poetical writings throughout his life. A third ode, on Cardinal Mai's discoveries of ancient MSS., lamented in the same spirit of indignant sorrow the decadence of

Italian literature. The publication of these pieces widened the breach between Leopardi and his father, a well-meaning but apparently dull and apathetic man, who had lived into the 19th century without imbibing any of its spirit, and who provoked his son's contempt by a superstition unpardonable in a scholar of real learning. Very probably from a mistaken idea of duty to his son, very probably, too, from his own entire dependence in pecuniary matters upon his wife, he for a long time obstinately refused Leopardi funds, recreation, change of scene, everything that could have contributed to combat the growing pessimism which eventually became nothing less than monomaniacal. The affection of his brothers and sister afforded him some consolation, and he found intellectual sympathy in the eminent scholar and patriot Pietro Giordani, with whom he assiduously corresponded at this period, partly on the ways and means of escaping from "this hermitage, or rather seraglio, where the delights of civil society and the advantages of solitary life are alike wanting." This forms the keynote of numerous letters of complaint and lamentation, as touching but as effeminate in their pathos as those of the banished Ovid. It must be remembered in fairness that the weakness of Leopardi's eyesight frequently deprived him for months together of the resource of study. At length (1822) his father allowed him to repair to Rome, where, though cheered by the encouragement of Bunsen and Niebuhr, he found little satisfaction in the trifling pedantry that passed for philology and archæology, while his sceptical opinions prevented his taking orders, the indispensable condition of public employment in the papal states. Dispirited, and with exhausted means, he returned to Recanati, where he spent three miserable years, brightened only by the production of several more lyrical masterpieces, which appeared in 1824. The most remarkable is perhaps the *Bruto Minore*, the condensation of his philosophy of despair. In 1825 he accepted an engagement to edit Cicero and Petrarch for the publisher Stella at Milan, and took up his residence at Bologna, where his life was for a time made almost cheerful by the friendship of the countess Malvezzi. In 1827 appeared the *Operette Morali*, consisting principally of dialogues and his imaginary biography of Filippo Ottonieri, which have given him a fame as a prose writer hardly inferior to his celebrity as a poet. Modern literature has few productions so eminently classical in form and spirit, so symmetrical in construction and faultless in style. Lucian is evidently the model; but the wit and irony which were playthings to Lucian are terribly earnest with Leopardi. Leopardi's invention is fully equal to Lucian's, and his only drawback in comparison with his exemplar is that, while the latter's campaign against pretence and imposture commands hearty sympathy, Leopardi's philosophical creed is a repulsive hedonism in the disguise of austere stoicism. His Icelander rebuking Nature for his cruelty and inhospitality, his Soul protesting against the original wrong of creation, his Familiar Spirit explaining the impossibility of making his master happy for a single instant—all, in fact, of the chief interlocutors in these dialogues profess the same unmitigated pessimism, claim emancipation from every illusion that renders life tolerable to the vulgar, and assert or imply a vast moral and intellectual superiority over unenlightened mankind. When, however, we come to inquire what it is the privation of which renders them miserable, we find it is nothing but pleasurable sensation, fame, fortune, or some other external thing which a lofty code of ethics would deny to be either indefeasibly due to man or essential to his felicity. A page of *Sartor Resartus* scatters Leopardi's sophistry to the winds, and leaves nothing of his dialogues but the consummate literary skill that would render the least fragment precious. As works of art they are a possession for ever, as contributions to moral philosophy they are worthless, and apart from their literary qualities can only escape condemnation if regarded as lyrical expressions of emotion, the wail extorted from a diseased mind by a diseased body. "Filippo Ottonieri" is a portrait of an imaginary philosopher, imitated from the biography of a real sage in Lucian's *Demonax*. Lucian has shown us the philosopher he wished to copy, Leopardi has truly depicted the philosopher he was. Nothing can be more striking or more tragical than the picture of the man superior to his fellows in every quality of head and heart, and yet condemned to sterility and impotence because he has, as he imagines, gone a step too far on the road to truth, and illusions exist for him no more. The little tract is full of remarks on life and character of surprising depth and justice, manifesting what powers of observation as well as reflection were possessed by the sickly youth who had seen so little of the world.

Want of means soon drove Leopardi back to Recanati, where, deaf, half-blind, sleepless, tortured by incessant pain, at war with himself and every one around him except his sister, he spent the two most unhappy years of his unhappy life. In May, 1831, he escaped to Florence, where he formed the acquaintance of a young Swiss philologist, M. de Sinner. To him he confided his unpublished philological writings, with a view to their appearance in Germany. Sinner showed himself culpably remiss in the execution of his trust, and it is no adequate extenuation of his negligence that these treatises were of less value than Leopardi may have thought. Though continually reclaimed by the latter's friends after his death, they were never published by Sinner, but were purchased after his decease by the Italian Government, and, together with Leopardi's correspondence with the Swiss philologist, have been partially edited by M. Aulard. In 1831 appeared a new edition of Leopardi's poems, comprising several new pieces of the highest merit. These are in general less austerely classical than his earlier compositions, and evince a greater tendency to description, and a keener interest in the works and ways of ordinary mankind. "The Resurrection," composed on occasion of his unexpected recovery, is a model of concentrated energy of diction, and "The Song of the Wandering Shepherd in Asia" is one of the highest flights of modern lyric poetry. The range of the author's ideas is still restricted, but his style and melody are unsurpassable. Shortly after the publication of these pieces (October, 1831) Leopardi was driven from Florence to Rome by an unhappy attachment, the history and object of which have remained unknown. His feelings are powerfully expressed in two poems, "To Himself" and "Aspasia," which seem, however, to breathe wounded pride at least as much as wounded love. In 1832 Leopardi returned to Florence, and there formed acquaintance with a young Neapolitan, Antonio Ranieri, himself an author of merit, and destined to enact towards him the part performed by Severn towards Keats, an enviable title to renown if Ranieri had not in his old age tarnished it by assuming the relation of Trelawny to the deceased Byron. Leopardi accompanied Ranieri and his sister to Naples, and under their care enjoyed four years of comparative tranquillity. He made the acquaintance of the German poet Platen, his sole modern rival in the classical perfection of form, and composed "La Ginestra," the most consummate of all his lyrical masterpieces, strongly resembling Shelley's "Mont Blanc," but more perfect in expression. He also wrote at Naples "The Sequel to the Battle of the Frogs and Mice," his most sustained effort, a satire in ottava rima on the abortive Neapolitan revolution of 1820, clever and humorous, but obscure from the local character of the allusions. The more painful and distasteful details of his Neapolitan residence may be found by those who care to seek for them in the deplorable publication of Ranieri's peevish old age (*Sette Anni di Sodalizio*). The decay of his constitution continued; he became dropsical; and a sudden crisis of his malady, unanticipated by himself alone, put an end to his life-long sufferings on June 15, 1837.

Leopardi's sole but sufficient apology for the effeminacy of endless complaints, and an extremely low view of the conditions of human happiness, is to have been a poor invalid tortured by incessant pain, who in demanding pleasurable sensations for mankind was but craving what was indeed an absolute necessity for himself. With all his dramatic skill in dialogue, the cast of his mind was essentially subjective; he was wholly incapable of placing himself at any other point of view than his own. His philosophical opinions accordingly possess merely a personal interest, and are valueless except as illustrations of human nature in abnormal circumstances. The patriotic spirit of his earliest poems, the brief gleam of happiness he enjoyed in female society at Bologna, reveal how different might have been his history and the spirit of his writings had his physical organization qualified him for either love or action. Bereft of every possibility of healthy energy, it is no wonder that he should have sunk into a despairing quietism, a solace probably to himself, and only hurtful to others if represented as a powerful intellect's deliberate and unbiased solution of the problem of the universe. Leopardi's perfect literary expression owes nothing to the nature of the ideas it is employed in embellishing, and is, indeed, most conspicuous when he stands upon common ground with other poets. Thus the magnificent description of the setting of the moon in "Il Tramonto della Luna" is finer than the reflections it ushers in, and his crowning work, "La Ginestra," owes most of its impressiveness to the assemblage of noble and picturesque objects which the poet summons as witnesses to the frailty of man. In the presence of Vesuvius and Pompeii such meditations seem natural, and, after all, the association of the destinies of mankind with the revolutions of nature produces rather a sentiment of grave and chastened exaltation than the self-abasement enforced by the poet. This natural and moral sublimity raises it above Leopardi's other lyrics, which in point of poetical feeling and literary workmanship are for the most part nearly on a par. They are truly classic—not, as with Platen, by a laborious imitation of antique metres, but, as with Shelley and Landor and the English neo-classic poets, by a perfect appropriation of the classical spirit. As with the ancients, their range of sentiment is narrow but their form perfect; there is probably no other modern writer in whom it would be so impossible to alter a line without detriment. The same perfection characterizes Leopardi's prose writings, and his letters would be hardly less admirable but for the hollow professions and inflated compliments exacted by the conventional proprieties of Italian correspondence. The insincerity of his letters to his father is especially painful; and his professed yearning for death is strangely associated with a frantic dread of cholera. Censure, however, is silent in the contemplation of his moral and physical sufferings; and his intimates unanimously attest the attractiveness of his personal character save for some infirmities that should never have been dragged to light. As a precocious and at the same time enduring genius he can only be compared to Pascal, whom he greatly resembles in many respects.

The poems which constitute Leopardi's principal title to immortality are only forty-one in number, and some of these are merely fragmentary. They may for the most part be described as odes, meditative soliloquies, or impassioned addresses, generally couched in a lyrical form, although a few are in magnificent blank verse. Some idea of the style and spirit of the former might be obtained by imagining the thoughts of the last book of Spenser's *Faerie Queene* in the metre of his *Epithalamium*. They were first edited complete by Ranieri at Florence in 1845, forming, along with the *Operette Morali*, the first volume of a proposed edition of Leopardi's works, which does not, however, include the "Sequel to the Battle of the Frogs and Mice," first printed at Paris in 1842, nor the recently discovered writings. Vols. ii.–iv. contain the philological essays and translations, with some letters, and vols. v. and vi. the remainder of the correspondence. The juvenile essays preserved in his father's library at Recanati were edited by Cugnoni in 1879, with the consent of the family. Leopardi's biography is mainly in his letters, which his recent historians (Brandes, Bouché-Leclercq, Rosa) have merely wrought up with the addition of criticisms, excellent in their way, more particularly Brandes's, but generally much overrating his significance in the history of human thought. Mr. Gladstone's essay (*Quart. Rev.*, 1850), since reprinted in vol. ii. of the author's *Gleanings*, is, on the other hand, too much pervaded by the theological spirit, but is in the main a pattern of generous and discriminating eulogy. Ranieri's infelicitous contribution to his friend's biography has been mentioned; a recent publication by the countess Teresa Leopardi, widow of Leopardi's brother Carlo, has done much to correct misconceptions respecting the circumstances and feelings of his family. There are excellent German translations of his poems by Heyse and Brandes; it is very improbable that there will ever be an adequate one in English. A translation of his essays and dialogues by Mr. C. Edwards has, however, just appeared (1882), and most of the dialogues have been rendered into our language with extraordinary felicity by Mr. James Thomson, author of *The City of Dreadful Night*. It is much to be hoped that these versions may ere long be disinterred from the files of the *National Reformer*, and made generally accessible. (R. G.)

LEOPOLD I. (1640–1705), Holy Roman emperor, the second son of the emperor Ferdinand III. and Maria Anna of Spain, was born June 9, 1640. He became king of Hungary in 1655, and king of Bohemia in 1658, in which year he also received the imperial crown, the electors having chosen him in preference to Louis XIV. of France. Leopold had been educated for the church, and throughout life he had the tastes and sympathies of the churchman rather than those of a secular ruler. He secluded himself as much as possible from the world, and would have preferred to live in peace, yet his long reign was destined to be one of the most agitated periods in German history. It happened that he had in Louis XIV. a rival of extraordinary power, and Leopold was in no respect a match for his craft, ambition, and audacity. The serious difficulties of Leopold's career began in 1662, when the mismanagement of his ministers in regard to Transylvania made war with Turkey inevitable. The Turks invaded Hungary, and, having seized Grosswardein and Neuhäusel, broke into Moravia and Silesia. The princes of the empire, who had been made virtually independent by the results of the Thirty Years' War, watched the progress of the struggle with indifference; but in 1663, Leopold having made a personal appeal to them in the diet at Ratisbon, they were induced to grant him aid. On the 1st of August, 1664, Montecuculi defeated the Turks at St. Gotthard on the Raab, and had the war been prosecuted with energy much future disaster would probably have been prevented. The emperor, however, made no further use of his victory than to induce the Turks to accept an armistice for twenty years. He allowed them to retain Grosswardein and Neuhäusel, and their candidate for the principality of Transylvania was formally recognized. In 1672 Leopold came for the first time into direct collision with Louis XIV. As it seemed highly probable that the French king would not be content with the conquest of Holland, Leopold, as head of his hereditary territories and as emperor, associated himself with Brandenburg and Spain for the support of the Dutch. For some time, in consequence of the intrigues of Prince Lobkowitz, the emperor's minister, the war was conducted indolently by the Germans; and early in 1675 Turenne gained a series of brilliant victories in Alsace. Later in the same year Turenne was slain, and his army defeated at Sassbach; and Montecuculi forced his way across the French frontier. The treaty of Nimeguen having been signed by the Dutch in 1678, the emperor concluded peace in 1679. The French retained Freiburg in Breisgau; and soon afterwards Louis XIV., instead of giving up towns which he had undertaken to resign, seized many new cities and districts. To these acts of robbery he gave an appearance of legality by instituting so-called "Chambers of Reunion." The German people bitterly resented his aggression, but the princes declined to interfere, and the energies of the emperor were fully occupied elsewhere. His system of government in Hungary was arbitrary and tyrannical, and in 1682 the Hungarians, headed by Emeric Tökölyi, broke into open revolt. They were encouraged by Louis XIV., who stirred up the Turks to join them in attacking Austria. In 1683 a Turkish army of 200,000 men, led by the grand vizier Kara Mustapha, entered Hungary, and pushed on to Vienna, which they besieged from the 14th of July till the 12th of September. The German princes were unwilling to act even in such an emergency as this, but at last an imperial army under the electors of Bavaria and Saxony marched towards Vienna, and they were joined by John Sobieski of Poland with a corps of 26,000 men. These troops, in association with the emperor's army under Duke Charles of Lorraine, attacked the Turks on the 12th of September, 1683, at the Kalenberg, near Vienna. The Turks were so effectually defeated that they were soon driven from Hungary. Another great victory was gained over them at Mohacz in 1687; and in 1697 they were defeated by Prince Eugene at Zenta. In 1699 the treaty of Carlowitz was signed, whereby the emperor became complete master of the districts which the Turks had conquered in Hungary. Twelve years before (1687), the Hungarians, worn out by the struggle, had submitted to the emperor at the diet of Pressburg, the monarchy being made hereditary in the house of Hapsburg instead of elective. This settlement had scarcely been concluded when the emperor was involved in new troubles by the French invasion of the Palatinate in 1688. On this occasion Louis XIV. had to account with an antagonist of a very different character from the emperor Leopold. William of Orange, when raised to the throne of England, made it the object of his life to break the supremacy of France; and through his efforts was formed the Grand Alliance, which for more than eight years carried on war by sea and land. The emperor did not approve of the treaty of Ryswick (1697), but after the withdrawal of his allies he had no alternative but to consent to the establishment of peace. Louis was compelled to cede most of the acquisitions he had made after the treaty of Nimeguen, but retained Strasburg. In 1701 began the war of the Spanish succession, waged by Leopold in defence of the claims of his second son Charles against those of Philip of Anjou, grandson of Louis XIV. In this war Leopold was supported by the empire, and by England, Holland, and Prussia. It opened with several victories gained by Prince Eugene; but afterwards King Joseph and the margrave of Baden were repeatedly defeated, and the emperor was weakened by a renewal of the movement for national independence in Hungary. His confidence was revived by the battle of Blenheim, but he did not live to see the full results of that great victory. On the 5th of May, 1705, he died of dropsy in the chest. He was a man of ungainly appearance, the most prominent feature of his face being his large hanging under-lip. The life of his court was regulated in accordance with the strictest rules of Spanish etiquette, but in his relations to his family a naturally kind disposition often broke through the crust of rigid conventions. Although one of the most intolerant sovereigns of his age, he gave considerable attention to science, and took a prominent part in the establishment of the universities of Innsbruck, Olmütz, Halle, and Breslau. Early in his reign he allowed his judgment to be controlled by his cabinet, but he never placed implicit trust in any minister after the discovery that Lobkowitz had been in communication with the French. He was married three times, and two of his sons became emperors—Joseph I. and Charles VI. (J. SI.)

LEOPOLD II. (1747–1792), Holy Roman emperor, was born on the 5th of May, 1747. After the death of his father, the emperor Francis I., in 1765, he became grand-duke of Tuscany, a country which he ruled for twenty-five years in a thoroughly enlightened spirit. Earlier than his brother, Joseph II., he saw the necessity of ecclesiastical reform, but he effected with moderation and good sense the changes which he considered advisable. Agriculture, industry, and commerce he encouraged in accordance with the ideas of his age, and Tuscany owed to him a well-conceived criminal code. He had even prepared a scheme for instituting representative government in Tuscany when, in 1790, he succeeded Joseph II. in the hereditary lands of the house of Hapsburg and in the empire. Joseph, with all his good intentions, had left his hereditary states in much confusion; and vigor and prudence were essential for the re-establishment of order. The chief difficulty was in the Netherlands, which were disinclined to respond to Leopold's advances. He despatched an army against them, and it entered Brussels on the 3d of December, 1791. The country was then at his mercy; but he acted with great discretion, restoring certain ancient rights which Joseph, in his zeal for improvement, had withdrawn. In Hungary, too, the emperor succeeded in calming popular excitement; and on the 4th of August, 1791, the treaty of Sistova was signed, bringing to an end the unlucky war which Joseph had waged with the Turks. The violence of the French Revolutionists produced a bad effect on the internal policy of Leopold, who supposed that it was necessary, not only to introduce a secret police, but to limit the freedom of the press. The same influences led him to conciliate Prussia, which had been always on its guard against Austria since the establishment of the Confederation of Princes by Frederick the Great. On the 27th of August, 1791, the emperor and the king of Prussia met at Pillnitz; and it was agreed that they should act together for the deliverance of Louis XVI. of France. In pursuance of this understanding a defensive and offensive treaty of alliance between Austria and Prussia was concluded on the 7th of February, 1792; but the emperor's schemes were suddenly broken by death. He died on the 1st of March, 1792, and was succeeded by his son, the emperor Francis II.

LEOPOLD I. (1790–1865), king of the Belgians, was the fourth son of Francis, duke of Saxe-Coburg-Saalfeld, and thus the uncle of Queen Victoria of England. His youth was chiefly spent in the Russian military service; he commanded a battalion at Lützen, Bautzen, and Leipsic, entered Paris with the allied sovereigns, and accompanied them to England. In May, 1816, he married the Princess Charlotte, only child of the Prince Regent (who died in the following year), having previously been created duke of Kendal in the English peerage. In 1830 he declined the crown of Greece, but was elected to the throne of Belgium in June, 1831. For the subsequent events of his life see BELGUIM, vol. iii. p. 456 *sq.*

LEOPOLD I. (1676–1747), duke of Anhalt-Dessau, *der alte Dessauer*, a famous Prussian general, was born at Dessau, July 3, 1676. Possessing great physical energy and an absorbing interest in military affairs, he at an early age displayed capacity for commands of high responsibility. On the death of his father in 1693 he succeeded him as colonel of a regiment in the service of Brandenburg, and, having rendered invaluable assistance at the capture of Namur by William III. of Orange in 1696, he obtained the rank of major-general. Returning shortly afterwards to his principality, he conceived a passionate attachment for the daughter of an apothecary, whom he raised to the rank of nobility and made his wife on reaching his majority. During the years that he now spent in his principality, he won the ardent affection of the mass of the people, both by his considerate regard for their welfare and by the influence of his strong personality. In command of a division of twelve thousand men at Blenheim in 1704, Leopold so acted in a critical contingency as practically to turn the scales of victory; and in Eugene's Italian campaigns he was conspicuous at the battle of Cassano in 1705, the storming of Turin in 1706, and in other affairs of minor importance. After serving as a volunteer at Malplaquet in 1709, he received an independent command from Prussia, and rendered important assistance to Marlborough against Villars. Created field-marshal in 1715, he gained the special confidence of Frederick William I., and it was in no small degree to his instructions in military tactics, and the splendid perfection to which he had brought the small army of Prussia, that the great military triumphs of Frederick II. were due. His more important military inventions are the iron ramrod and the equal step. As a general he specially excelled in stratagems and surprises, in which he was greatly aided by his daring and impetuous energy. These qualities were specially displayed in the surprise and bloodless capture of Mörs castle in 1712, the seizure during night of the island of Rügen in 1715, the formation in 1741 of the famous entrenched camp at Göttin near Magdeburg, where with an army of thirty-six thousand men he was prepared for events either in Saxony or Hanover, the defeat of the Austrians at Neustadt in 1744, and the expulsion of the Saxons, though superior both in numbers and artillery, from a strongly entrenched position at Kesselsdorf in 1745. He died 7th April, 1747. Leopold is graphically portrayed in Carlyle's *Frederick*, where he is spoken of as "a man of vast dumb faculty, dumb but fertile, deep—no end of imagination, no end of ingenuities—with as much mother wit as in whole talking parliaments."

See also the *Lives* by Varnhagen von Ense, 3d edition 1872, Hosäus, 1876, and Siebigk, 1876; and Crousatz, *Militärische Denkwürdigkeiten des Fürsten Leopold von Anhalt-Dessau*, 1875.

LEPANTO (the Italian form of the modern Greek Epakto), known in ancient times as Naupactus, a name which has recently been revived in official documents, is a town in the nomarchy of Acarnania and Ætolia, Greece, situated on a bay on the north side of the straits of Lepanto, by which the gulf of the same name is connected with that of Patras. It stands on the south-eastern and southern slopes of one of the spurs of Mount Rigani; the surrounding plain is well watered and fertile, but the harbor, once the best on the northern coast of the Corinthian Gulf, is now almost entirely choked up, and is accessible only to the smallest craft. Lepanto is an episcopal see; the population of the deme of Naupactus in 1879 was 5295.

According to traditional etymology, Naupactus derived its name from the circumstance that here the Heraclidæ built the fleet with which they invaded the Peloponnesus. The place is first mentioned in actual history as having been taken from the Locri Ozolæ by the Athenians, who settled it with Messenian helots at the close of the third Messenian war (455 B. C.), and who made it their chief military and naval station in western Greece during the war of the Peloponnesus. After Ægospotami it was successively held by the Locrians, Achæans, and Ætolians, and finally, after a siege of two months, it fell into the hands of the Romans, 191 B. C. It was still a flourishing place in the time of Pausanias, but according to Procopius it was destroyed by an earthquake in the reign of Justinian. In the Middle Ages it fell into the hands of the Venetians, who fortified it so strongly that in 1477 it successfully resisted a four months' siege by a Turkish army thirty thousand strong; in 1499, however, it was taken by Bajazet II. The mouth of the Gulf of Lepanto was the scene of the great sea fight in which the naval power of Turkey was for the time being destroyed by the united papal, Spanish, and Venetian forces (October 7, 1571). See John of Austria. In 1678 it was recaptured by the Venetians, but was again restored in 1699 by the treaty of Carlowitz to the Turks; in the war of independence it finally became Greek once more (March, 1829).

LEPIDOSIREN is the name of one of the most remarkable genera of fishes, of which one species (*Lepidosiren paradoxa*) has been found in tributaries of the river Amazon, and the other (*Lepidosiren annectens*) occurs in the systems of all the large rivers of tropical Africa. The latter species differs in some points, notably in having six instead of five branchial arches, from *L. paradoxa*, and therefore has been generically separated by Owen under the name of *Protopterus*,—which name likewise is in common use. Together with the Australian *Ceratodus*, the lepidosirens are the only living representatives of a very old type of fishes, the *Dipnoi*, which reaches back to the Devonian age, thus giving us an insight into the organization of fishes of which nothing but some obscure and fragmentary impressions of the hard parts are preserved. The body of *Lepidosiren* is eel-shaped, and covered with small thin scales. A single vertical fin surrounds the posterior part of the body and the tail; the paired fins are reduced to two pairs of long threads, internally supported by a series of small cartilages. The dentition is very characteristic, and consists of a pair of conical pointed vomerine teeth, and a pair of large cuspidate and ribbed molar teeth on the palate and in the lower jaw. The skeleton is notochordal; and lungs are present in addition to gills. From this latter fact it may be inferred that the lepidosirens can breathe air as well as water; and, although they have never been observed to leave the water voluntarily, either in a state of nature or in captivity, they rise from time to time to the surface to fill their lungs with a fresh supply of air; further, when, during the hot season, the water of the tanks in which they live changes into mud, branchial respiration is entirely superseded by pulmonal. Of the habits of *Lepidosiren paradoxa* scarcely anything is known; only a few specimens have been found by naturalists, and neither Bates nor Wallace succeeded in obtaining one. This species, therefore, is one of the greatest desiderata in zoological museums. The African species, on the other hand, is common in the upper Nile, in the central lake-region, on the Zambesi, and in all the rivers of the west coast. Baker states that in some districts of central Africa the lepidosiren is so abundant as to form an article of food, fresh and dried. Specimens living in pools which dry up during the hot season bury themselves in the mud, and form an oval cavity, the inside of which is lined with a protecting coat of hardened mucus, and in which they wait, coiled up and in a torpid condition, for the return of the rainy season. These retreats are discovered by the natives by a circular opening at the upper surface, which is closed by the mucous film. If the capsules are not broken, the fishes, imbedded in the clay-balls, can be transported to Europe, and emerge from their prison on being placed in tepid water. Both species attain to a length of 6 feet, and feed on frogs, fishes, and other aquatic animals. For the details of the organization of the *Lepidosiren* see the article Ichthyology.

LEPIDUS, M. Æmilius, a member of the second Roman triumvirate, was a son of M. Æmilius Lepidus, who had been consul in 137 B. C. He joined the party of Cæsar in the civil wars, and was by the dictator thrice nominated *magister equitum* and raised to the consulship 46 B. C. He was a man of great wealth and influence, and it was probably more on this ground than on account of his ability that Cæsar raised him to such honors. In the beginning of 44 B. C. he was sent to Gallia Narbonensis, but before he had left the city with his army Cæsar was murdered. Lepidus, as commander of the only army near Rome, became a man of great importance in the troubles which followed. Taking part with Antony, he joined in the reconciliation which the latter effected with the senatorial party, and afterwards sided with him when open war broke out. Antony, after his defeat at Mutina, joined Lepidus in Gaul, and in August, 43 B. C., Octavian, who had forced the senate to make him consul, effected an arrangement with Antony and Lepidus, and the triumvirate was organized at Bononia. Antony and Octavian soon reduced Lepidus to an inferior position. His province of Gaul and Spain was taken from him; and, though he was included in the triumvirate when it was renewed in 37 B. C., his power was only nominal. He made an effort in the following year to regain some reality of power, conquered part of Sicily, and claimed the whole island as his province, but Octavian found means to sap the fidelity of his soldiers, and he was obliged to supplicate for his life. He was allowed to retain his fortune and the office of *pontifex maximus*, to which he had been appointed in 44 B. C., but had to retire into private life. He died 13 B. C.

Lepidus was the *cognomen* of a Roman family in the patrician *gens Æmilia*. The first of this name of whom anything is recorded is M. Æmilius Lepidus, consul 285 B. C. From this time onwards the family continued in an almost unbroken series of distinguished men till in the 1st century after Christ it disappears. Another M. Æmilius Lepidus was one of the three ambassadors sent to Egypt as *tutores* of the infant king Ptolemy V. He was consul in 187 and 175, censor 179, pontifex maximus from 180 onwards, and was six times chosen by the censors *princeps* *senatus.* He died in 152. It is uncertain whether he is the Lepidus who is commemorated on a coin of the *gens Æmilia* as having slain an enemy and saved a citizen's life at the age of fifteen, while still dressed in the boy's *toga prætexta.* Another of the same name was consul 137 B. C. Being sent to Spain to conduct the Numantine war, he began against the will of the senate to attack the Vaccæi. This enterprise was so unsuccessful that he was deprived of his command in 136 and condemned to pay a fine. He was among the greatest of the earlier Roman orators, and Cicero praises him for having introduced the well-constructed sentence and even flow of language from Greek into Roman oratory. He contributed much to forming the style of Tiberius Gracchus.

Another of the same name was infamous for his oppressive prætorship in Sicily (81 B. C.). In the civil wars he sided with Sulla and bought much of the confiscated property of the Marian partisans. Afterwards he became leader of the popular party, and was with the help of Pompey elected consul for 78 B. C., against the will of Sulla. When the dictator died, Lepidus tried in vain to prevent the burial of his body in the Campus Martius, and to alter the constitution established by him. His colleague Lutatius Catulus found a tribune to place his veto on Lepidus's proposals; and the quarrel between the two parties in the state became so inflamed that the senate made the consuls swear not to take up arms. Lepidus was then ordered by the senate to go to his province, Transalpine Gaul; but he stopped in Etruria on his way from the city and began to levy an army. He was declared a public enemy early in 77 B. C., and forthwith marched against Rome. A battle took place in the Campus Martius, Pompey and Catulus commanding the senatorial army, and Lepidus was defeated. He sailed to Sardinia, where he was also repulsed; and soon after he died. One of his two sons was L. Æmilius Paullus, consul 50, who built during his ædileship in 55 the Basilica Æmilia in the forum.

LEPROSY (*Lepra Arabum*, *Elephantiasis Græcorum*, *Aussatz*, *Spedalskhed*), the greatest disease of mediæval Christendom, is identified, on the one hand, with a disease endemic from the earliest historical times (1500 B. C.) in the delta and valley of the Nile, and on the other hand with a disease now common in Asia, Africa, South America, the West Indies, and certain isolated localities of Europe. An authentic representation of the leprosy of the Middle Ages exists in a picture at Munich by Holbein, painted at Augsburg in 1516; St. Elizabeth gives bread and wine to a prostrate group of lepers, including a bearded man whose face is covered with large round reddish knobs, an old woman whose arm is covered with brown blotches, the leg swathed in bandages through which matter oozes, the bare knee also marked with discolored spots, and on the head a white rag or plaster, and, thirdly, a young man whose neck and face (especially round the somewhat hairless eyebrows) are spotted with brown patches of various size. It is conjectured by Virchow that the painter had made studies of lepers from the leper-houses then existing at Augsburg. These external characters of mediæval leprosy agree with the descriptions of it by the ancients, and with the pictures of modern leprosy given by Danielssen and Boeck for Norway, by various authors for sporadic European cases, by Anderson for Malacca, by Carter for India, by Wolff for Madeira, and by Hillis for British Guiana. There has been some confusion in the technical naming of the disease; it is called *Elephantiasis* (*Leontiasis*, *Satyriasis*) by the Greek writers, and *Lepra* by the Arabians. The latter term has been generally adopted in modern books, but in England the name of *Lepra* is applied (after Willan) to an entirely different disease of the skin.

History.—Egypt was regarded by the ancients (positively by Lucretius) as the country whence leprosy came. It was probably endemic among the Hebrews when they migrated from Egypt. The minute diagnostic indications given in Lev. xiii. appear to relate to true leprosy and to other diseases that might be mistaken for it, and the frequently recurring word Sâra'ath (translated "leprosy") is best taken in a generic sense; those cases in which progress would show itself at so short intervals as seven days, and those cases for which the ceremonial of cleansing was provided, could hardly have been cases of leprosy, a disease always incurable, and with stages reckoned rather by months or years than by weeks. Herodotus knew of leprosy as existing in Persia. The earlier Greek and Latin writers speak of it as a foreign disease, but it became established in Greece and Italy in the 1st century B. C.; Pliny implies that it was introduced by the army of Pompey returning from Syria. The disease soon appeared in the Roman colonies of Spain, Gaul, and Britain. The Lombard king Rothar (7th century) made laws regulating the marriage of lepers, and similar laws were made by Pippin and Charlemagne. Leper-houses existed at Verdun, Metz, and Maestricht in the 7th century, at St. Gall in the 8th, and at Canterbury in the 11th. It was amidst the stir and movement of the crusades that leprosy grew to be epidemic in western Europe; it attacked the people in great numbers and in all ranks (including members of royal families). Leper-houses (mostly religious and dedicated to St. Lazarus, but in northern Europe more secular and dedicated to St. George) were founded in every considerable town; the total number of these in Europe was loosely estimated by Matthew Paris at 19,000, the number in France is independently estimated at 2000, and (according to Sir J. Y. Simpson) there were 95 houses of the first class in England (of these 7 at Norwich and 5 at Lynn), and several in Ireland and Scotland. The isolation of lepers was strictly enforced by law and popular sentiment. They wore a special costume, usually a long gray gown with hood drawn over the face, and carried a wooden clapper to give warning of their approach. They were forbidden to enter inns, churches, mills, or bakehouses, to touch healthy persons or eat with them, to wash in the streams, or to walk in narrow footpaths. Their outcast state was signified by the German name (*Aussatz*); the Chronicle of Limburg (under the year 1374) speaks of a famous monkish poet, whose songs all Germany was singing, as one "*der ward von den Leuten aussätzig, und war nicht rein.*" The disease began to decline (first in Italy) in the 15th century, and had mostly disappeared in the 17th. A leper-house was founded in Edinburgh (at Greenside) as late as 1591, and it was not till 1741 (others give 1798) that the last known leper died in Shetland.

Present Geographical Distribution.—Survivals of the great mediæval outbreak are found on the west coast of Norway (about two thousand lepers; leper hospital at Bergen founded 1277, now added to), in the Baltic provinces of Russia (leper hospitals founded at Riga in 1220 and Revel 1237, not now in use), on the Riviera (a small and diminishing number), on the Sicilian coasts, and in certain coast provinces of Spain and Portugal (leper hospital at Lisbon since the 13th century). Sporadic cases of home origin have also been described for Hungary and Roumania; the cases occurring in England and France are in persons who have been born or have lived in the East or West Indies. The disease is met with also in Iceland, along the Caspian and delta of the Volga, along the Black Sea, and in islands of the Levant (especially Scio and Crete). It is common all over the East from Syria to Japan and Kamchatka, in Egypt and North African states, in West Africa from the Senegal to the Congo, in Cape Colony, Madagascar, Mauritius, Isle de Bourbon, St. Helena, Madeira, Canaries and Azores, Brazil, Central America, the West Indies, Mexico, New Brunswick (small isolated French colony), and especially in the Hawaiian Islands. Leprosy has been found among Chinese immigrants in the United States as far east as Chicago, and in Queensland. Leper hospitals (with inmates numbering from two hundred downwards) are kept up in several of the West Indian colonies, at Tracadie (New Brunswick), at Cape Town, in Mauritius, at Malacca and Singapore, at Colombo, at Madras, Cochin, and Bangalore, at Bombay and Rajkot, and at Calcutta, Benares, and Agra. There are also leper hospitals at Bergen (3), Molde and Trondhjem, at San Remo, at Oporto, Coimbra, and Lisbon, at Terceira (Azores), Las Palmas (Grand Canary) since 15th century, and Funchal (Madeira) since about 1500, at Pernambuco, Bahia, and Rio, at Honolulu, at Macao (for two hundred years) and Canton, in Java (several) and in Amboyna, at Scio (since 1445), Scutari, Damascus, and Jerusalem. A ruined convent at Ramleh accommodates thirty lepers or more, and a mosque at Nablus is occupied by about seventy. In several of the above instances the leper hospital is built upon an outlying island. Leper villages occur in China and Japan, and in Persia. Leper communities exist in Crete, but the largest of them is now mostly occupied by a non-leprous population. Throughout the East, including British India, the hospital accommodation for lepers is only casual, and isolation is not carried out to the same extent as during the prevalence of the disease in Europe.

Definition, Characters, Pathology, and Causation.—Leprosy is an incurable constitutional disease, marked externally by discolored patches and nodules on the skin, and deeply implicating the structure and function of the peripheral nervous system. Like the infections, it has a prodromal stage, which is uncertain in its character, and is measured rather by months or years than by days or weeks; the chief premonitory symptoms are unaccountable lassitude and mental depression, pains in the limbs and joints, febrile periods (cold and hot fits), loss of appetite, and nausea. That stage is followed by the "periodically eruptive stage," during which blotches on the skin come and go: sooner or later these erythematous congestions and exudations leave either permanent spots, brown or blanched, which are often without feeling, or they leave nodules. The disease diverges into two main varieties, the spotted (*Lepra maculosa*) and the nodular (*Lepra tuberculosa*). The two kinds are found side by side in the same population, and sometimes in the same person. The maculæ arise in the place of former recurrent spots, and are often raised indurations; when the pigmentation deepens, the disease is *L. maculosa nigra;* when the spots become blanched, it is *L. maculosa alba* or white leprosy. Anæsthesia, which very generally goes with the leprous process, is especially marked in the blanched spots, hence the name *L. anæsthetica.* Anæsthetic spots are apt to have bullæ forming on them (*pemphigus leprosus*), their periodical eruption being attended with fever. The nodules (characteristic of the other form) generally arise also in the situation of old blotches; they are at first small scattered points, but they grow and coalesce to the size of lentils, hazel nuts, or walnuts. While the maculæ of leprosy may occur in any part, the nodules are most apt to form on the face (brows, eyelids, ears, wings of the nose, lips, cheeks), causing thickening of all the features (*Leontiasis, Satyriasis*); but they often occur on the hands and feet, and sometimes over the whole body. The nodules, from being exposed to the weather and to injuries, often ulcerate, and the ulcers, like those of syphilis and lupus, tend to spread. Maculæ, especially on the limbs, are liable to slighter ulcerations followed by incrustation. Deep ulceration and necrosis occur at the joints of the fingers and toes, which may drop off joint by joint, leaving a well-healed stump (*L. mutilans*). Certain mucous membranes thicken, become nodulated, and ulcerate, viz., the conjunctiva corneæ (causing *pannus leprosus*), and the lining of the mouth, nose, throat, and larynx (causing hoarseness). The external groups of lymphatic glands enlarge; leprous affections of the viscera also are described. The peripheral nerves are the subject of thickenings and degenerations like those in the skin. The new-formed tissue in all situations is granulation-like, as in syphilis and lupus; and leprosy, with those two diseases, is treated of by Virchow under the head of granuloma. By some the nervous lesions (including an alleged affection of the spinal cord) are taken to be primary, while the changes in the skin and other parts (with anæsthesia) are held to be secondary and due to disordered innervation. Leprosy has been claimed as one of the diseases caused by parasites, on several occasions by old writers in the gross sense, and recently by observers who have found innumerable minute bacillus-rods within the cells of the leprous new growth. The essential cause of leprosy is unknown. It probably arose in the Delta and valley of the Nile in prehistoric times, and under similar climatic and telluric conditions in other (chiefly intertropical) countries; and the most memorable fact in its history is its rise and subsidence as an epidemic disease in Europe. It is now endemic (chiefly but not exclusively) among peoples who inhabit the sea-coast or the estuaries of rivers, who live much on fish (often putrid), and who intermarry closely. The old opinion that leprosy is contagious is now generally discredited.

Literature.—For history and geographical distribution, see Hirsch, *Handbuch der historisch-geographischen Pathologie*, 1st ed., Erlangen, 1860 (with exhaustive literature). For pathology, Virchow, *Die krankhaften Geschwülste*, Berlin, 1863–77, vol. ii. For clinical histories, R. Liveing, *Elephantiasis Græcorum or True Leprosy*, London, 1873, chap. iv. For mediæval leprosy—in Germany, Virchow, in *Virchow's Archiv*, five articles, vols. xviii.-xx., 1860–61; in the Netherlands, Israëls, in *Nederl. Tijdschr. voor Geneeskunde*, vol. i., 1857; in Britain, J. Y. Simpson, *Edin. Med. and Surg. Jour.*, three articles, vols. lxvi. and lxvii., 1846–47. Treatises on modern leprosy in particular localities: Danielssen and Boeck (Norway), *Traité de la Spédalskhed*, with atlas of twenty-four colored plates, Paris, 1848; A. F. Anderson, *Leprosy as met with in the Straits Settlements*, colored photographs with explanatory notes, London, 1872; H. Vandyke Carter (Bombay), *On Leprosy and Elephantiasis*, with colored plates, London, 1874; Hillis, *Leprosy in British Guiana*, an account of West Indian leprosy, with twenty-two colored plates, London, 1882. See also the dermatological works of Hebra, Erasmus Wilson, Bazin, and Hutchinson. An important early work is that of P. G. Hensler, *Vom abendländischen Aussatze im Mittelalter*, Hamburg, 1790. (C. C.)

LEPTIS, now LEBDA, the leading city of the ancient *Tripolis*, Northern Africa, extensive ruins of which exist on the coast, about 50 miles east of Tripoli. Leptis Magna, as it is usually called to distinguish it from Leptis Parva (now Lemta) in Byzacium, was a Phœnician colony, probably superimposed on an old Libyan settlement. The old town, of which the massive quays and docks are still extant, is similar to Carthage in position and plan, occupying a tongue of land to the west of the harbor. The new town, whose simple appellation Neapolis almost threatened the disuse of the name Leptis, is much more extensive; but the ruins belong to the later period of the Roman empire. Septimius Severus was a native of the place; and he not only bestowed upon it the *jus Italicum*, but enriched it with many costly buildings, the most remarkable being the palatium dedicated *fortunæ suæ* (Procopius). Ammianus mentions that Leptis was laid waste by the Austurians (a Libyan tribe) in 370; and, though Justinian enclosed a part of the city with new walls and made it the military seat of the province of Tripolis, it never recovered its prosperity, and from the time of the Arab conquest it disappears from history. The local inscriptions are Greek, Latin, and Punic. See *Travels of Ali Bey* (by Badia y Lablich); Barth, *Wanderungen*, etc.; and *Corpus Inscr. Lat.*, viii.

LÉRIDA, one of the forty-nine provinces of Spain, is bounded on the N. by France (and the "republic" of Andorra), on the E. by Gerona and Barcelona, on the S. by Tarragona, and on the W. by Saragossa and Huesca, and has an area of 4772 square miles, with a population (in 1877) of 285,297. It is almost entirely mountainous, and partakes of the features common to the whole southern slope of the Pyrenees. The principal river is the Segre, a tributary of the Ebro. The province has five cities, Lérida, Balaguer (Bergusia), Cervera, Seo de Urgel, and Solsona, but only the first-mentioned of these has a population exceeding 5000; the next largest (Balaguer) in 1877 had only 4742. The inhabitants are chiefly employed in pastoral occupations.

LÉRIDA, the capital of the above province, and is point of numbers and prosperity the second city in Catalonia, is situated on the right bank of the Segre, crossed there by a handsome stone bridge. The distances by rail from Saragossa and Barcelona respectively are 114 and 113 miles. The old cathedral, on the top of an eminence overlooking the town, was begun in 1203 and consecrated in 1278; it is a Gothic building of merit in some respects, but is rapidly going to decay, having never been used for religious purposes since 1707. The actual cathedral is a Græco-Roman structure dating only from 1749. The town has no other feature of interest. There are manufactures of glass, leather, paper, and of woollen and cotton goods, and a considerable trade in the timber brought down from the Pyrenees by the Segre. Population in 1877, 20,369.

Lérida is the Ilerda of the Romans, and was the capital of the people whom they called Ilerdenses (Pliny) or Ilergetes (Ptolemy). By situation the key of Catalonia and Aragon, it was from a very early period an important military station. In the Punic wars it sided with the Carthaginians and suffered much from the Roman arms. In its immediate neighborhood Hanno was defeated by Scipio in 216 B. C., and it afterwards became famous as the scene of Cæsar's arduous struggle with Pompey's generals Afranius and Petreius in the first year of the civil war (49 B. C.). It was already a municipium in the time of Augustus, and enjoyed great prosperity under later emperors. Under the Goths it became an episcopal see, and at least one ecclesiastical council is recorded to have met there (in 546). Under the Saracens Lareda became one of the principal cities of the province of Saragossa; it became tributary to the Franks in 793, but was reconquered in 797. In 1149 it fell into the hands of Don Ramon Berenguer IV., last count of Barcelona. In modern times it has come through numerous sieges, having been taken by the French in November, 1707, during the war of succession, and again in 1810. In 1300 Jaime II. of Aragon founded a university at Lérida, which achieved some repute in its day, but is now extinct. Pope Calixtus III. at one time taught within its walls, and Vicente Ferrer was one of its alumni.

LERMONTOFF, Mikhail Yurevitch (1814–1841), often styled the poet of the Caucasus, was born in Moscow, but belonged to a respectable family of the Tula government, and was brought up in the village of Tarkhanui (in the Penzensk government), which now preserves his dust. By his grandmother—on whom the whole care of his childhood was devolved by his mother's early death and his father's military service—no cost nor pains was spared to give him the best education she could think of. The intellectual atmosphere which he breathed in his youth differed little from that in which Pushkin had grown up, though the domination of French had begun to give way before the fancy for English, and Lamartine shared his popularity with Byron. From the academic gymnasium in Moscow Lermontoff passed in 1830 to the university, but there his career came to an untimely close through the part he took in some acts of insubordination to an obnoxious teacher. From 1830 to 1834 he attended the school of cadets at St. Petersburg, and in due course he became an officer in the guards. To his own and the nation's anger at the loss of Pushkin (1837) the young soldier gave vent in a passionate poem addressed to the czar, and the very voice which proclaimed that, if Russia took no vengeance on the assassin of her poet, no second poet would be given her was itself an intimation that a poet had come already. The czar, however, seems to have found more impertinence than inspiration in the address, for Lermontoff was forthwith sent off to the Caucasus as an officer of dragoons. He had been in the Caucasus with his grandmother as a boy of ten, and he found himself at home by yet deeper sympathies than those of childish recollection. The stern and rocky virtues of the mountaineers against whom he had to fight, no less than the scenery of the rocks and mountains themselves, proved akin to his heart; the emperor had exiled him to his native land. He was in St. Petersburg in 1838 and 1839, and in the latter year wrote the novel *A Hero of Our Time*, which is said to have been the occasion of the duel in which he lost his life in July, 1841. In this contest he had purposely selected the edge of a precipice, so that if either combatant was wounded so as to fall his fate should be sealed.

Lermontoff published only one small collection of poems in 1840. Three volumes, much mutilated by the censorship, were issued in 1842 by Glasunoff; and there have been full editions of his works in 1860 and 1863. To Bodenstedt's German translation of his poems (*Michail Lermontoff's poetischer Nachlass*, Berlin, 1842, 2 vols.), which indeed was the first satisfactory collection, he is indebted for a wide reputation outside of Russia. His novel has found several translators (August Boltz, Berlin, 1852, etc.). Among his best-known pieces are "Ismail-Bey," "Hadji Abrek," "Walerik," "The Novice," and, remarkable as an imitation of the old Russian ballad, "The song of the Czar Ivan Vasilivitch, his young body-guard, and the bold merchant Kalashnikoff."

See Taillandier, "Le Poete du Caucase," in *Revue des Deux Mondes* (February, 1855), reprinted in *Allemagne et Russie*, Paris, 1856; and Duduishkin's "Materials for the biography of Lermontoff," prefixed to the 1863 edition of his works.

LEROUX, Pierre (1798–1871), a French writer on philosophy and politics, commonly recognized as the chief of the (so-called) Humanitarian school, was born at Paris in 1798. He was the son of an artisan. He received his early education at the Lycée Charlemagne, and continued his studies at Rennes. Having obtained an admission to the Polytechnic school, he renounced it in order to support by the labor of his hands his mother and family, who had been left destitute by the death of his father. He first worked as a mason, but soon became a compositor in the printing establishment of his cousin, and afterwards overseer in that of M. Panckoucke. In 1824, P. Dubois, a former schoolfellow, associated him with himself in the foundation of the *Globe* newspaper, in which he became a co-worker with De Broglie, Guizot, Duvergier de Hauranne, Jouffroy, and other distinguished persons. For some time he occupied the position of an advanced Liberal of the ordinary type; but in January, 1831, he gave his adhesion to the Saint-Simonian community, of which he became a prominent member; and under his influence the *Globe* became the organ of its doctrines. In November of the same year, when Enfantin preached the enfranchisement of women and the functions of the *couple-prêtre*, Leroux took the part of Bazard, and, protesting in the name of morality, separated himself from the sect. In 1838, in conjunction with J. Reynaud, who had seceded with him, he founded the *Encyclopédie Nouvelle*, in which he expounded his philosophical and social views. Amongst the articles which he inserted in it were one entitled *De l'Égalité*, and a *Réfutation de l'Éclectisme*, which afterwards appeared as separate works. In 1840 he published his treatise *De l'Humanité*, which contains the fullest exposition of his system, and was regarded as the philosophical manifesto of the Humanitarians. In 1841, disgusted with the *Revue des Deux Mondes* on account of its desertion of the democratic cause, he established, with the aid of M. Viardot and Mme. George Sand, the *Revue Indépendante*. By his philosophic association with the latter eminent writer he obtained the advantage of an eloquent interpreter, capable of charming and impressing the masses. Mme. Sand's *Spiridion*, which was dedicated to him, her *Sept Cordes de la Lyre*, her *Consuelo*, and its continuation *La Comtesse de Rudolstadt*, were written under the Humanitarian inspiration. From the year 1843 M. Leroux devoted himself to the practical applications of his doctrines. He established at Boussac (Creuse) a printing association organized according to his systematic ideas, and founded the *Revue Sociale*, in which, as well as in separate publications, he continued to explain and develop his theoretic views and his suggestions for the renovation of society, professing, amongst other things, to supply "a pacific solution of the problem of the proletariat." After the outbreak of the revolution of 1848 he was elected to the constituent assembly as representative of the department of the Seine, obtaining 90,000 votes, and afterwards, in 1849, to the legislative assembly. He spoke there on the organization of labor, on the colonization of Algeria, and other questions. His discourses from the tribune were sometimes of so abstract and mystical a character, and contained proposals so eccentric and impracticable, that they rather created ridicule than influenced opinion. The *coup d'état* of 1851 made him an exile; he settled with his family in Jersey, where he pursued agricultural experiments. The general amnesty of 1860 permitted his return to France, but he lived at Lausanne till after the definitive amnesty of 1869, when he again fixed his residence at Paris. He died there in April, 1871, during the reign of the Commune. That body deputed two of its members to attend his funeral, as a homage, "not to the partisan of the mystical idea, of which we now feel the evil, but to the politician who, after the days of June, courageously undertook the defence of the vanquished."

The writings of Leroux, though they won a transitory éclat and gave him a position as head of a school, appear to have no permanent significance in the history of thought. His social theories do not rest on any scientific basis; he was rather the propagandist of sentiments and aspirations than the expounder of well-defined and distinctly appreciable ideas. He seems to have had a natural bent towards the mystic and the nebulous. He has, indeed, a system, but it is a singular medley of doctrines borrowed, not only from Saint-Simonian, but from Pythagorean and Buddhistic sources. In philosophy his fundamental principle is that of what he calls the "triad,"—a triplicity which he finds to pervade all things, which in God is "power, intelligence, and love," in man "sensation, sentiment, and knowledge." His religious doctrine is Pantheistic; and, rejecting the belief in a future life as commonly conceived, he substitutes for it a theory of metempsychosis. In social economy his views are very vague; he preserves the family, country, and property, but finds in all three, as they now are, a despotism which must be eliminated. He imagines certain combinations by which this triple tyranny can be abolished, so that the human being may be developed under the influence of those several institutions without being oppressed by them. But his solution seems to require the creation of families without heads, countries without governments, and property without rights of possession. In politics he advocates absolute equality—a democracy pushed to anarchy. A full critcism of his system will be found in L. Reybaud's *Études sur les Réformateurs et Socialistes Modernes*.

The full title of Leroux's principal work is *De l'Humanité, de son principe et de son avenir, où se trouve exposée la vraie définition de la religion, et où l'on explique le sens, la suite, et l'enchaînement du Mosaisme et du Christianisme.* A second edition of this work appeared in 1845. Amongst his other publications, in addition to some already mentioned, are—*Discours sur la situation actuelle de la Société et de l'esprit humain*, 1841, new ed., 2 vols., 1847; *D'une Religion nationale, ou du Culte*, 1846; *Discours sur la fixation des heures de travail*, 1848; *Projet d'une Constitution démocratique et sociale*, 1848; *Du Christianisme et de ses origines démocratiques*, 1848; *Le Carrosse de M. Aguado, ou si ce sont les riches qui payent les pauvres*, 1848; *De la Ploutocratie; ou du gouvernement des riches*, 1848; *Malthus et les Économistes, ou Y aura-t-il toujours des pauvres?* 1848; *Quelques pages de Vérités*, 1859; portions of a philosophical poem, entitled *La Grève de Samarez*, 1863–64; *Job, drame en cinq actes, par le prophète Isaïe, traduit de l'hébreu*, 1865. M. Leroux also produced, with the aid of an anonymous collaborator, a translation of Goethe's *Werther*, which was published in 1843, with a preface by George Sand.

LERWICK. See SHETLAND ISLANDS.

LE SAGE, ALAIN RENÉ (1668–1747), novelist and dramatist, was born at Sarzeau in the peninsula of Rhuys, between the Morbihan and the sea, on the 8th of May, 1668, and died on the 17th of November, 1747, at Boulogne-sur-Mer. Rhuys was a legal district, and Claude Le Sage, the father of the novelist, held the united positions of advocate, notary, and registrar of its royal court. His wife's name was Jeanne Brenugat. Both father and mother died when Le Sage was very young, and his property was wasted or embezzled by his guardians. Little is known of his youth except that he went to school with the Jesuits at Vannes until he was eighteen. Conjecture has it that he continued his studies at Paris, and it is certain that he was called to the bar at the capital in 1692. In August, 1694, he married the daughter of a joiner, Marie Elizabeth Huyard. She was beautiful but had no fortune, and Le Sage had little practice. About this time he met his old schoolfellow the dramatist Danchet, and is said to have been advised by him to betake himself to literature. He began modestly as a translator, and published in 1695 a French version of the *Epistles* of Aristænetus, which was not successful. Shortly afterwards he found a valuable patron and adviser in the Abbé de Lyonne, who bestowed on him an annuity of 600 livres, and recommended him to exchange the classics for Spanish literature, of which he was himself a student and collector. Le Sage began by translating plays chiefly from Rojas and Lope de Vega. *Le Traitre Puni* and *Le Point d'Honneur* from the former, *Don Félix de Mendoce* from the latter, were acted or published in the first two or three years of the 18th century. In 1704 he translated the continuation of Don Quixote by Avellaneda, and soon afterwards adapted a play from Calderon, *Don César Ursin*, which had a divided fate, being successful at court and damned in the city. He was, however, nearly forty before he obtained anything like decided success. But in 1707 his admirable farce of *Crispin Rival de son Maître* was acted with great applause, and *Le Diable Boiteux* was published. This latter went through several editions in the same year, and was frequently reprinted till 1725, when Le Sage altered and improved it considerably, giving it its present form. Notwithstanding the success of *Crispin*, the actors did not like Le Sage, and refused a small piece of his called *Les Étrennes*. He thereupon altered it into *Turcaret*, his theatrical masterpiece, and one of the best comedies in French literature. This appeared in 1709. Some years passed before he again attempted romance writing, and then the first two parts of *Gil Blas* appeared in 1715. Strange to say, it was not so popular as the *Diable Boiteux*. Le Sage worked at it for a long time, and did not bring out the third part till 1724, nor the fourth till 1735. For this last he had been part paid to the extent of a hundred pistoles some years before its appearance. This is the only positive statement we have about his gains. During these twenty years he was, however, continually busy. Notwithstanding the great merit and success of *Turcaret* and *Crispin*, the Théâtre Français did not welcome him, and in the year of the publication of *Gil Blas* he began to write for the Théâtre de la Foire—the comic opera held in booths at festival time. This, though not a very dignified occupation, was followed by many writers of distinction at this time, and by none more assiduously than by Le Sage. According to one computation he produced either alone or with others about one hundred pieces, varying from strings of songs with no regular dialogues, to comediettas only distinguished from regular plays by the introduction of music. He was also industrious in prose fiction. Besides finishing *Gil Blas* he translated the *Orlando Inamorato*, rearranged *Guzman d'Alfarache*, published two more or less original novels, *Le Bachelier de Salamanque* and *Estévanille Gonzales*, and in 1733 produced the *Vie et Aventures de M. de Beauchêne*, which is curiously like certain works of Defoe. Besides all this, Le Sage was also the author of *La Valise Trouvée*, a collection of imaginary letters, and of some minor pieces, of which *Une Journée des Parques* is the most remarkable. This laborious life he continued until 1740, when he was more than seventy years of age. His eldest son had become an actor, and Le Sage had disowned him, but the second was a canon at Boulogne in comfortable circumstances. In the year just mentioned his father and mother went to live with him. At Boulogne Le Sage spent the last seven years of his life, dying, as has been said, on the 17th of November, 1747, at the age of nearly eighty.

Not much is known of Le Sage's life and personality, and the foregoing paragraph contains not only the most important but almost the only facts available for it. The few anecdotes which we have of him represent him as a man of very independent temper, declining to accept the condescending patronage which in the earlier part of the century was still the portion of men of letters. Thus it is said that, on being remonstrated with, as he thought impolitely, for an unavoidable delay in appearing at the duchess of Bouillon's house to read *Turcaret*, he at once put the play in his pocket and retired, refusing absolutely to return. In his old age, when he was very deaf, he is also said to have been decidedly arbitrary in his choice of the persons whom he permitted to have access to his trumpet, but this is not unusual in such cases. It may, however, be said that as in time so in position he occupies a place apart from most of the great writers of the 17th and 18th centuries respectively. He was not the object of royal patronage like the first, nor the pet of *salons* and coteries like the second. Indeed he seems all his life to have been purely domestic in his habits, and purely literary in his interests.

The importance of Le Sage in French and in European literature is not entirely the same, and he has the rare distinction of being more important in the latter than in the former. His literary work may be divided into three parts. The first contains his *Théâtre de la Foire* and his few miscellaneous writings, the second his two remarkable plays *Crispin* and *Turcaret*, the third his prose fictions. In the first two he swims within the general literary current in France; he can be and must be compared with others of his own nation. But in the third he emerges altogether from merely national comparison. It is not with Frenchmen that he is to be measured. He formed no school in France; he followed no French models. His work, admirable as it is from the mere point of view of style and form, is a parenthesis in the general development of the French novel. That product works its way from Madame de la Fayette through Marivaux and Prévost, not through Le Sage. His literary ancestors are Spaniards, his literary contemporaries and successors are Englishmen. The position is almost unique; it is certainly interesting and remarkable in the highest degree.

Of Le Sage's miscellaneous work, including his numerous farce-operettas, there is not much to be said except that they are the very best kind of literary hack work. The pure and original style of the author, his abundant wit, his cool humoristic attitude towards human life, which wanted only greater earnestness and a wider conception of that life to turn it into true humor, are discernible throughout. But this portion of his work is practically forgotten, and no sensible critic who has taken the trouble to examine it will say that for the world at large there is any reason why it should be resuscitated. Of such work every generation produces its own quota, which is sufficient for the day. *Crispin* and *Turcaret* show a stronger and more deeply marked genius, which but for the ill-will of the actors might have gone far in this direction. But Le Sage's peculiar unwillingness to attempt anything absolutely new discovered itself here. Even when he had devoted himself to the Foire theatre, it seems that he was unwilling to attempt when occasion called for it the absolute innovation of a piece with only one actor, a crux which Piron, a lesser but a bolder genius, accepted and carried through. *Crispin* and *Turcaret* are unquestionably Molièresque, though they are perhaps more original in their following of Molière than any other plays that can be named. For this also was part of Le Sage's idiosyncrasy that, while he was apparently unable or unwilling to strike out an entirely novel line for himself, he had no sooner entered upon the beaten path than he left it to follow his own devices. *Crispin Rival de son Maître* is a farce in one act and many scenes, after the earlier manner of motion. Its plot is somewhat extravagant, inasmuch as it lies in the effort of a knavish valet, not as usual to further his master's interests, but to supplant that master. But the charm of the piece consists first in the lively bustling action of the short scenes which take each other up so promptly and smartly that the spectator has not time to cavil at the improbability of the action, and secondly in the abundant wit of the dialogue. *Turcaret* is a far more important piece of work. The only thing which prevents it from holding the very highest place is a certain want of unity in the plot. This unity, however, which was too often attained by Molière through the exaggeration of the ruling-passion theory, as in *Tartuffe* and the *Misanthrope*, is compensated in *Turcaret* by the most masterly profusion of character-drawing in the separate parts. Turcaret, the ruthless, dishonest, and dissolute financier, his vulgar wife as dissolute as himself, the hare-brained marquis, the knavish chevalier, the baroness (a coquette with the finer edge taken off her fine-ladyhood, yet by no means unlovable), are each and all finished portraits of the best comic type, while almost as much may be said of the minor characters. The style and dialogue are also worthy of the highest praise; the wit never degenerates into mere "wit-combats."

It is, however, as a novelist that the world has agreed to remember Le Sage, and the world as usual is right. A great deal of unnecessary labor has been spent on the discussion of his claims to originality. What has been already said will give a sufficient clue through this thorny ground. In mere form Le Sage is not original. He does little more than adopt that of the Spanish picaroon romance of the 16th and 17th centuries. Often, too, he prefers merely to rearrange and adapt existing work, and still oftener to give himself a kind of start by adopting the work of a preceding writer as a basis. But it may be laid down as a positive truth that he never in any work that pretends to originality at all is guilty of anything that can fairly be called plagiarism. Indeed we may go further, and say that he is very fond of asserting or suggesting his indebtedness when he is really dealing with his own funds. Thus the *Diable Boiteux* borrows the title, and for a chapter too the plan and almost the words, of the *Diablo Cojuelo* of Luis Velez de Guevara. But after a few pages Le Sage leaves his predecessor alone. Even the plan of the Spanish original is entirely discarded, and the incidents, the episodes, the style, are as independent as if such a book as the *Diablo Cojuelo* had never existed. The case of *Gil Blas* is still more remarkable. It was at first alleged that Le Sage had borrowed it from the *Marcos de Obregon* of Vincent Espinel, a curiously rash assertion, inasmuch as that work exists and is easily accessible, and as the slightest consultation of it proves that, though it furnished Le Sage with separate incidents and hints for more than one of his books, *Gil Blas* as a whole is not in the least indebted to it. Afterwards Father Isla asserted that *Gil Blas* was a mere translation from an actual Spanish book—an assertion at once incapable of proof and disproof, inasmuch as there is no trace whatever of any such book. A third hypothesis is that there was some manuscript original which Le Sage may have worked up in his usual way, in the same way, for instance, as he professes himself to have worked up the *Bachelor of Salamanca*. This also is in the nature of it incapable of refutation, though the argument from the *Bachelor* is strong against it, for there could be no reason why Le Sage should be more reticent of his obligations in the one case than in the other. Except, however, for historical reasons, the controversy is one which may be safely neglected. There is as little doubt (with the limitations already laid down) of the originality of Le Sage as of that of any great writer in the world. *Gil Blas* then remains his property, and it is admittedly the capital example of its own style. Fielding has been called the prose Homer of human nature, but in the sense in which the expression was used it is doubtful whether his master (as Le Sage certainly was) is not better entitled to the term. For Le Sage has not only the characteristic which Homer and Shakespeare have of absolute truth to human nature as distinguished from truth to this or that national character, but he has what has been called the quality of detachment, which they also have. He never takes sides with his characters as Fielding does. Asmodeus and Don Cleofas, Gil Blas and the Arch bishop and Doctor Sangrado, are produced by him with exactly the same impartiality of attitude. Except that he brought into novel-writing this highest quality of artistic truth, it perhaps cannot be said that he did much to advance prose fiction in itself. He invented, as has been said, no new *genre;* he did not, as Marivaux and Prévost did, help on the novel as distinguished from the romance. In form his books are undistinguishable, not merely from the Spanish romances which are, as have been said, their direct originals, but from the mediæval *romans d'aventures* and the Greek prose romances. But in individual excellence they have few rivals. Nor should it be forgotten, as it sometimes is, that Le Sage was a great master of French style, the greatest unquestionably between the classics of the 17th century and the classics of the 18th. He is perhaps the last great writer before the decadence (for since the time of Paul Louis Courier it has not been denied that the *philosophe* period is in point of style a period of decadence). His style is perfectly easy at the same time that it is often admirably epigrammatic. It has plenty of color, plenty of flexibility, and may be said to be exceptionally well fitted for general literary work.

The dates of the original editions of Le Sage's most important works have already been given. He published during his life a collection of his regular dramatic works, and also one of his pieces for the Foire, but the latter is far from exhaustive; nor is there any edition which can be called so, though the *Œuvres Choisies* of 1782 and 1818 are useful. The *Diable Boiteux* and *Gil Blas* have been reprinted and translated numberless times. Both will be found conveniently printed, together with *Estévanille Gonzales* and *Guzman d'Alfarache*, the best of the minor novels, in four volumes of Garnier's *Bibliothèque Amusante* (Paris, 1865). *Turcaret* and *Crispin* are to be found in all collected editions of the French drama. There is a useful edition of them, with ample specimens of Le Sage's work for the Foire, in two volumes (Paris, 1821). (G. SA.)

LESBOS was the name applied by the Greeks to the island now called Metilin—the ancient name of the chief city on the island, Mytilene, having been in the Middle Ages applied to the whole island. It lies along the coast of Mysia, north of the entrance to the Gulf of Smyrna. Strabo estimates its circumference as 1100 stadia, about 138 miles, and Scylax reckons it seventh in size of the islands in the Mediterranean Sea. The narrowest part of the channel which divides it from the Mysian coast, between the promontory of Argennum and the town of Assos, is about 8 miles wide. The island is of irregular shape; it has three prominent points, Argennum on the north-east, Sigrium (now Sigri) on the west, and Malea (now Maria) on the south-east, and a deep gulf, the Euripus Pyrrhæus, now the port of Calloni, runs far into its western side between Sigrium and Malea. The surface is mountainous, but the soil is in spite of this exceedingly fertile; the wine, oil, and grain of Lesbos were well known in ancient times. The climate is perhaps more delightful than that of any other part of the Ægean; the breezes and the sea temper the heat of summer, and the winter is not severe. Earthquakes were often experienced in the island; the latest, that of 1861, is still remembered as one of the severest known in a country of earthquakes.

The oldest inhabitants are said to have been Pelasgians; and two generations before the Trojan war came Ionians under Macareus. These two races may be said to represent respectively the first period of primitive barbarism, and the second period, when navigation brought to the island the commerce and intercourse of more advanced races; it deserves notice that the name Macareus, the Phœnician Melkarth, is taken by Curtius as a sign of the presence of Phœnician traders. But the island begins to be important in history from the time of the Æolian immigration, which is said to have commenced one hundred and thirty years after the Trojan war; from this time it continued long to be one of the chief homes of Hellenic civilization. Homer refers to its wealth and its populous cities; its chief fame lies in its connection with the earliest development of Greek poetry and literature. Lesches the cyclic poet, Terpander, Arion, Hellanicus, Pittacus, Alcæus, and Sappho were all natives of Lesbos. Probably no district of Greece can boast of so many names, most of them associated with some marked advance in literature, as Lesbos can enumerate between 700 and 500 B. C.

The chief city of Lesbos was Mytilene or Mitylene, the latter spelling being general in literature while the former is the official spelling used on coins. It was originally built on an island close to the western coast of Lesbos; afterwards when the limits of the island were too narrow it was joined to Lesbos by a causeway, and the city spread out along the coast. On each side of this isthmus was a harbor; not far from the city was a place called Maloeis, but it does not appear that this name was, as some have said, given to the northern harbor. The city has always been known for its delightful and healthy climate. With the advantage of its strong situation and good harbor it soon became one of the most powerful Greek cities of Asia Minor. It was the only Æolian city that possessed a strong navy. Its colonies were spread along Asia Minor and Thrace, and in the 6th century it maintained a long though finally unsuccessful contest with Athens for the possession of Sigeum. About its internal government little is known. After the kingly period there was a time when oligarchical and democratical factions contended with one another. The noble family of the Penthelidæ, descended from Penthilus, son of Orestes, played a great part in these contentions. Its Pelopid descent may be compared with various legends that connect Pelops with the island of Lesbos. The city fell under the Persian power after the defeat of Crœsus. A tyrant Coes ruled it soon after, but was expelled when the island joined the Ionic revolt in 500 B. C. It was freed from the Persian yoke after the battles of Platæa and Mycale, and was a member of the Delian confederacy. It revolted from Athens 429 B. C., and was reduced after a long siege. The story of the cruel revenge which the Athenian assembly at first resolved on, of the second meeting and the more merciful resolution, and of the arrival of the second despatch vessel barely in time to prevent the massacre of the whole male population, has been told by Thucydides. The territory of Mytilene was, however, divided among Athenian κληροῦχοι. The harbor was the scene of a great battle between Callicratidas and Conon in the latter part of the Peloponnesian war; but it is impossible here to trace all the vicissitudes of its history, which are coincident with the history of Greece in the East. It continued to be a rich and prosperous city throughout ancient history, and its name came during the Byzantine period to be applied to the whole island. It was long a stronghold of the Venetians during the Middle Ages, but has belonged to the Turkish empire since 1460.

The other chief towns besides Mytilene were Methymna, Antissa, Eresus, and Pyrrha; hence the island is sometimes called a Pentapolis. There was also a town called Arisba, which was destroyed by an earthquake before the time of Herodotus; Conze finds its site inland at Palaiokastro, north-east of the port of Calloni. Pyrrha lay on the south-east coast of this port, at a place also called Palaiokastro. Antissa, near Sigrium, was destroyed by the Romans in 168 B. C., as having sided with Perseus in the Macedonian war. Eresus, now Eresí, was also near Sigrium. Of these five cities, Mitylene was the chief; Pyrrha, Eresus, and Antissa were under its influence, and seem almost always to have followed its lead. But Methymna on the north coast, though it had not such a fine situation as Mytilene, was a very strong place; it was therefore able to maintain a constant quarrel with the more powerful city, and was always ready to side with its enemies. Mólivo, still the second city of the island, occupies the site of the old Methymna. The name Methymna or

Mathymna is derived from the wine for which it was famous (Virg., *Georg.*, ii. 90).

See Conze, *Reise auf der Insel Lesbos*; Plehn, *Lesbiaca*; Boutan, *Archives d. Missions Scient. et Liter.*, v. (according to Conze not very trustworthy); Zanders, *Beitr. z. Kunde d. Insel Lesbos*; Newton, *Travels*; and for the geography Cramer, *Descr. of Asia Minor*, and Forbiger, *Alt. Geogr.* The best maps are the English admiralty charts, and those in Conze's work.

LESGHIANS, or **Lesghis** (from the Persian *Leksi*, called Leki by the Grusinians or Georgians, Armenians, and Ossetians), a number of tribes in the Caucasus forming along with the Tchetchenians (about 165,000) the East Caucasus group, and spreading southward over the borders of Daghestan, the country which they have occupied from time immemorial, into the Transcaucasian circles Kuba, Shemakha, Nukha, and Sakataly. They are mentioned as Λῆχαι by Strabo and Plutarch along with the Γῆλαι (perhaps the modern Galgai, a Tchetchenian tribe), and their name occurs with great frequency in the old chronicles of the Georgians, whose territory was exposed to their raids for centuries, until through the fall of Shamyl they were brought under subjection to Russia. Moses of Chorene mentions a battle in the reign of the Armenian King Baba (370–377 A. D.), in which Shagir, king of the Lekians, was slain. Among the Lesghians the chief place, both on account of numbers and importance, is due to the Avars (155,194) and the closely related Andians (35,511), to whom may be attached the Dido (9074) and a number of small tribes, confined to a few villages or even to one, and speaking different though intimately connected languages. The Avars, extending from the Sulak and the Kumyk steppe right through Daghestan to the Alasan in the Sakataly circle, were once the dominant people as their language is still the dominant language of all this district. Their neighbors the Kasimukhians (35,139), who call themselves Lakians, have a language of their own, and are well known as traders not only through all Transcaucasia but also in European Russia; beside them a small fragment of another race occupies the village Artchi (592 inhabitants) in a separate mountain valley. Towards the Caspian Sea the Lakians are bordered by the Darginians (88,045) and the Tabassaranians (16,350), who in the matter of dialect are strongly marked off from each other. To the north and south of the basin of the Samur (which consequently bears the native name Kulan-uaz or "middle river") lives another of the leading tribes of Daghestan, the Kurinians or Lesghians *par excellence*, who by themselves alone occupy the circles of Kuri and Samur, as well as the greatest part of Kuba, and parts of Shemakha, Nukha, etc. Their language (investigated like other Caucasian tongues by Baron Uslar) is there spoken by 130,873 individuals; and closely related to it apparently are the languages of the neighboring Agulians (5357), Rutulians (11,803), Zakhurians (4561). According to the specimens collected by Von Seidlitz in 1880 during a visit to their country, which lies round the snowy peak of the Shakh Dagh in the Kuba circle, the Djekians, Haputlians, and Krysians speak what seem to be dialects of Kurinian; but he cannot connect with any other tongue the language spoken by the peculiar-looking inhabitants of the neighboring village of Khinalugh (2196). The Udinians (9668) are another Lesghian tribe, which, though at present it only occupies a few villages in the Nukha circle, was formerly widely distributed over the plain of the Kura, and may possibly be the wretched remnant of the Albanians, mentioned by Strabo and others as a people of similar importance with the Grusinians and Armenians.

All these Lesghians are more or less tall, good-looking and powerful, sometimes fair, sometimes dark, bold, enduring, and intelligent—in one word, excellent material for the work of civilization as soon as their country is opened up by roads and the railway just projected from Vladikavkas by Petrovsk to Baku. Smith-work and cutlery are skilfully wrought among the Lesghians in general; the women weave excellent shawls (which vary in style according to locality); and the felt cloaks of Andi are known throughout the Caucasus.

See Von Seidlitz, "Ethnographie des Kaukasus," in Petermann's *Mittheilungen*, 1880.

LESLEY, John (1527–1596), bishop of Ross, Scottish historian and statesman, was born in 1527. His father was Gavin Lesley, parson of Kingussie. He was educated at the university of Aberdeen, where he took the degree of M. A. In 1538 he obtained a dispensation permitting him to hold a benefice, notwithstanding his being a natural son, and in June, 1546, he was made an acolyte in the cathedral church of Aberdeen, of which he was afterwards appointed a canon and prebendary. He also studied at Poitiers, at Toulouse, and at Paris, where he was made doctor of laws. In 1558 he was appointed official of Aberdeen, and in 1559 he was inducted into the parsonage and prebend of Oyne. At the Reformation Lesley became a champion of the Romish faith, and appeared on that side at the disputation held in Edinburgh in 1561, when Knox was one of his antagonists. He was one of the commissioners sent the same year to bring over the young Queen Mary to take the government of Scotland. He returned in her train, and was appointed a privy councillor, and in 1564 one of the senators of the college of justice. Shortly afterwards he was made abbot of Lindores, and in 1565 bishop of Ross. He was one of the sixteen commissioners appointed to revise the laws of Scotland, and the volume of the Acts of Parliament known as the Black Acts was, chiefly owing to his care, printed in 1566.

The bishop was one of the most steadfast friends of Queen Mary.[1] After the failure of the royal cause, and whilst Mary was a captive in England, Lesley continued to exert himself on her behalf. He was one of the commissioners at the conference at York in 1568. He appeared as her ambassador at the court of Elizabeth to complain of the injustice done to her, and when he found he was not listened to he laid plans for the escape of the queen. He also projected a marriage for her with the duke of Norfolk, which ended in the execution of that nobleman. For this he was put under the charge of the bishop of Ely, and afterwards imprisoned in the Tower of London. During his confinement he collected materials for his history of Scotland, with which his name is now chiefly known. In 1571 he presented the latter portion of this work, written in his own vernacular tongue, to Queen Mary to amuse her in her captivity. He also wrote for her use his *Piæ Consolationes*, and the queen devoted some of the hours of her captivity to translating a portion of it into French verse.

In 1573 he was liberated from prison, but was banished from England. For two years he attempted unsuccessfully to obtain the assistance of Continental princes in favor of Queen Mary. While at Rome in 1578 he published his history *De Origine, Moribus, et Rebus Gestis Scotorum*, the Latinity of which is held only second to that of Buchanan. In 1579 he went to France, and was made suffragan and vicar-general of the archbishopric of Rouen by the Cardinal de Bourbon. Whilst visiting his diocese, however, he was thrown into prison, and had to pay 3000 pistoles to prevent his being given up to Elizabeth. During the remainder of the reign of Henry III. he lived unmolested, but on the accession of the Protestant Henry IV. he again fell into trouble. In 1590 he was thrown into prison, and had to purchase his freedom at the same expense as before. In 1593 he was made bishop of Coutances in Normandy, and had license to hold the bishopric of Ross till he should obtain peaceable possession of the former see. Being tired of life, he retired at last to a monastery at Gurtenburg near Brussels, where he died in 1596.

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[1] An interesting account of his care of her during her illness at Jedburgh is given in *Proc. Roy. Soc. Ant. Scot.*, vol. xv. p. 210.

The works of Lesley are as follows:—*A defence of the Honour of Marie Quene of Scotland, by Eusebius Dicæophile*, 8vo, London, 1569; *A treatise concerning the Defence of the Honour of Marie Queene of Scotland, made by Morgan Philippes, bachelar of divinitie*, 8vo, Liége, 1570–71; *Piæ afflicti animi consolationes, ad Mariam Scot. Reg.*, 8vo, Paris, 1574; *Pro libertate impetranda Oratio, ad Elizabetham*, 8vo, Paris, 1574; *De origine, moribus, et rebus gestis Scotorum, libri decem*, 4to, Rome, 1578 and 1675; *De illustriam fœminarum in republica administranda authoritate libellus*, 4to, Rheims, 1580; *De titulo et jure Mariæ Scot. Reg., quo regni Angliæ successionem sibi juste vindicat*, 4to, Rheims, 1580; *A treatise touching the right of Marie Queene of Scotland, and of King James her graces sonne to the succession of the croune of England*, 8vo, 1584; *Congratulatio Alberto Archiduci Austriæ de ejus adventu ad regimen provinciarum inferioris Germaniæ*, 8vo, Brussels, 1596; *The History of Scotland from 1436 to 1561*, edited for the Bannatyne Club by Thomas Thomson from a MS. in the possession of the earl of Leven and Melville, 4to, Edinburgh, 1830. Several of Lesley's works, of which the originals are very rare, will be found reprinted in Anderson's *Collections relating to the History of Queen Mary;* and in Jebb, *De vitu Mariæ Reg. Scotorum.*

LESLIE, Alexander. See Leven, Earl of.

LESLIE, or Lesley, Charles (1650–1722), a prominent nonjuror, famous as the author of *A Short and Easy Method with the Deists*, was born in 1650 in Ireland, where his father, Dr. John Leslie, was bishop of Raphoe and subsequently of Clogher. His early education was received at Inniskilling, Fermanagh, and in 1664 he was admitted a fellow commoner in Trinity College, Dublin, where he continued until he commenced master of arts. On his father's death in 1671, removing to England, he entered himself as a student of law at the Temple, but soon afterwards turned his attention to theology, and took orders in 1680. Seven years later he became chancellor of the cathedral of Connor and a justice of the peace, and began a long career of public controversy by responding in public disputation at Monaghan to the challenge of the Roman Catholic bishop of Clogher. Although an eager and uncompromising opponent of Roman Catholicism, Leslie was a firm supporter of the Stuart dynasty, and, having declined at the Revolution to take the oath to William and Mary, he was on this account deprived of his benefice. In 1689 the growing troubles in Ireland induced him to withdraw to England, where he employed himself for the next twenty years in writing various controversial pamphlets in favor of the nonjuring cause, and in numerous polemics against the Quakers, Jews, Socinians, and Papists, and especially in that against the Deists with which his name is now most commonly associated. A warrant having been issued against him in 1710 for his pamphlet *The Good Old Cause, or Lying in Truth*, he in that year resolved to quit England and to accept an offer made by the Pretender (with whom he had previously been in frequent correspondence) that he should reside with him at Barle-duc. After the failure of the Stuart cause in 1715, Leslie accompanied his patron into Italy, where he remained until 1721, in which year, having found his sojourn amongst Roman Catholics extremely unpleasant, he sought and obtained permission to return to his native country. He died at Glaslough, Monaghan, on April 13, 1722.

The *Theological Works* of Leslie were collected and published by himself in 2 vols. folio in 1721; a later edition, slightly enlarged, appeared at Oxford in 1832 (7 vols. 8vo). They handle the controverted points of which they treat with considerable force of argument and vigor of style; he had the somewhat rare distinction of making several converts by his reasonings, and probably persons might still be found who are prepared to concur in Dr. Johnson's dictum that "Leslie was a reasoner, and a reasoner who was not to be reasoned against." But the questions in dispute are no longer discussed on the basis which seems to have been pretty unanimously accepted by the orthodox theologians of that age. This is sufficiently seen when the promise given in the title of his best-known work is contrasted with the actual performance. The book professes to be *A Short and Easy Method with the Deists, wherein the certainty of the Christian Religion is Demonstrated by Infallible Proof from Four Rules, which are incompatible to any imposture that ever yet has been, or that can possibly be* (1697). The four rules which, according to Leslie, have only to be rigorously applied in order to establish not the probability merely but the absolute certainty of the truth of Christianity are simply these:—(1) that the matter of fact be such as that men's outward senses, their eyes and ears, may be judges of it; (2) that it be done publicly, in the face of the world; (3) that not only public monuments be kept up in memory of it, but some outward actions be performed; (4) that such monuments and such actions or observances be instituted and do commence from the time that the matter of fact was done. Other publications of Leslie are *The Snake in the Grass* (1696), against the Quakers; *A Short Method with the Jews* (1689); *The Socinian Controversy Discussed* (1697); *The True Notion of the Catholic Church* (1703); and *The Case Stated between the Church of Rome and the Church of England* (1713).

LESLIE, Charles Robert (1794–1859), one of the most popular of English genre-painters, was born in London on the 19th of October, 1794. His parents were American, and when he was five years of age he returned with them to their native country. They settled in Philadelphia, where their son was educated and afterwards apprenticed to a bookseller. He was, however, mainly interested in painting and the drama, and when George Frederick Cooke visited the city he executed a portrait of the actor, from recollection of him on the stage, which was considered a work of such promise that a fund was raised to enable the young artist to study in Europe. He left for London in 1811, bearing introductions which procured for him the friendship of West, Beechey, Allston, Coleridge, and Washington Irving, and was admitted as a student of the Royal Academy, where he carried off two silver medals. At first, influenced by West and Fuseli, he essayed "high art," and his earliest important subject depicted Saul and the Witch of Endor; but he soon discovered his true aptitude and became a painter of cabinet-pictures, dealing, not like those of Wilkie, with the contemporary life that surrounded him, but with scenes from the great masters of fiction, from Shakespeare and Cervantes, Addison and Molière, Swift, Sterne, Fielding, and Smollett. Of individual paintings we may specify Sir Roger de Coverley going to Church, 1819; May-day in the Time of Queen Elizabeth, 1821; Sancho Panza and the Duchess, 1824; Uncle Toby and the Widow Wadman, 1831; *La Malade Imaginaire*, act iii. sc. 6, 1843; and the Duke's Chaplain Enraged leaving the Table, from *Don Quixote*, 1849. Many of his more important subjects exist in varying replicas. He possessed a sympathetic imagination, which enabled him to enter freely into the spirit of the author whom he illustrated, a delicate perception for female beauty, an unfailing eye for character and its outward manifestation in face and figure, and a genial and sunny sense of humor, guided by an instinctive refinement which prevented it from overstepping the bounds of good taste. In 1821 Leslie was elected A. R. A., and five years later full academician. In 1833 he left for America to become teacher of drawing in the military academy at West Point, but the post proved an irksome one, and in some six months he returned to England, where he practised his profession with unfailing assiduity till his death on the 5th of May, 1859.

In addition to his skill as an artist, Leslie was a ready and pleasant writer. His *Life* of his friend Constable, the landscape painter, appeared in 1845, and his *Handbook for Young Painters*, a volume embodying the substance of his lectures as professor of painting to the Royal Academy, in 1845. In 1860 Tom Taylor edited his *Autobiography and Letters*, which contain interesting reminiscences of his distinguished friends and contemporaries.

LESLIE, Sir John (1766–1832), geometrician and physicist, was born of humble parentage at Largo, Fifeshire, on April 16, 1766, received his early education there and at Leven, and in his thirteenth year, encouraged by friends who had even then remarked his aptitude for mathematical and physical science, entered the university of St. Andrews. On the completion of his arts course, he nominally studied divinity at Edinburgh until 1787; in 1788–89 he spent rather more than a year as private tutor in a Virginian family, and from 1790 till the close of 1792 he held a similar appointment in Staffordshire, employing his spare time in experimental research and in preparing a translation of Buffon's *Natural History of Birds*, which was published in nine 8vo vols. in 1793, and brought him some money. For the next twelve years (passed chiefly in London or at Largo, with an occasional visit to the Continent) he continued his physical studies, which resulted in numerous papers contributed by him to Nicholson's *Philosophical Journal*, and in the publication (1804) of the *Experimental Inquiry into the Nature and Propagation of Heat*, a work which gained for its author the Rumford Medal of the Royal Society of London. In 1805 he was elected to succeed Playfair in the chair of mathematics at Edinburgh, not, however, without violent though unsuccessful opposition on the part of a narrow-minded clerical party who accused him of heresy in something he had said as to the "unsophisticated notions of mankind" about the relation of cause and effect. During his tenure of this chair he published two volumes of a *Course of Mathematics*—the first entitled *Elements of Geometry, Geometrical Analysis, and Plane Trigonometry*, in 1809, and the second, *Geometrical Analysis, and Geometry of Curve Lines*, in 1821; the third volume, on "Descriptive Geometry" and the "Theory of Solids" was never completed. With reference to his invention (in 1810) of a process of artificial congelation, he published in 1813 *A Short Account of Experiments and Instruments depending on the relations of Air to Heat and Moisture*; and in close connection with the subject of this treatise he also wrote a paper on the æthrioscope, which appeared in 1818 in the *Transactions of the Royal Society of Edinburgh*. In 1819, on the death of Playfair, he was promoted to the more congenial chair of natural philosophy, which he continued to hold until his death, and in 1823 he published, chiefly for the use of his class, the first volume of his never-completed *Elements of Natural Philosophy*. Leslie's main contributions to physics were made by the help of the "differential thermometer," an instrument whose invention was contested with him by Count Rumford. By adapting to this instrument various ingenious devices he was enabled to employ it in a great variety of investigations, connected especially with photometry, hygroscopy, and the temperature of space. In 1820 he had been elected a corresponding member of the Royal Institute of France, the only distinction of the kind which he valued, and early in 1832 he was, on the recommendation of Lord Chancellor Brougham, created a knight of the Guelphic order. He died at Coates, a small property which he had acquired near Largo, on November 3 of the same year.

LESLIE, THOMAS EDWARD CLIFFE (1827–1882), one of the ablest and most original English economists of the present century, was born in the county of Wexford in (as is believed) the year 1827. He was the second son of the Rev. Edward Leslie, prebendary of Dromore, and rector of Annahilt, in the county of Down. His family was of Scotch descent, but had been connected with Ireland since the reign of Charles I. Amongst his ancestors were that accomplished and energetic prelate, John Leslie, bishop first of Raphoe and afterwards of Clogher, who, when holding the former see, offered so stubborn a resistance to the Cromwellian forces, and the bishop's son Charles, the well-known nonjuror. Cliffe Leslie received his elementary education from his father, who resided in England, though holding church preferment as well as possessing some landed property in Ireland; by him he was taught Latin, Greek, and Hebrew, at an unusually early age; he was afterwards for a short time under the care of a clergyman at Clapham, and was then sent to King William's College, in the Isle of Man, where he remained until, in 1842, being then only fifteen years of age, he entered Trinity College, Dublin. He was a distinguished student there, obtaining, besides other honors, a classical scholarship in 1845, and a senior moderatorship (gold medal) in mental and moral philosophy at his degree examination in 1846. He became a law student at Lincoln's Inn, was for two years a pupil in a conveyancer's chambers in London, and was called to the English bar. But his attention was soon turned from the pursuit of legal practice, for which he seems never to have had much inclination, by his appointment, in 1853, to the professorship of jurisprudence and political economy in Queen's College, Belfast. The duties of this chair requiring only short visits to Ireland in certain terms of each year, he continued to reside and prosecute his studies in London, and became a frequent writer on economic and social questions in the principal reviews and other periodicals. In 1870 he collected a number of his essays, adding several new ones, into a volume entitled *Land Systems and Industrial Economy of Ireland, England, and Continental Countries*. J. S. Mill gave a full account of the contents of this work in a paper in the *Fortnightly Review*, in which he pronounced Leslie to be "one of the best living writers on applied political economy." Mill had sought his acquaintance on reading his first article in *Macmillan's Magazine*; he admired his talents and took pleasure in his society, and treated him with a respect and kindness which Leslie always gratefully acknowledged.

In the frequent visits which Leslie made to the Continent, especially to Belgium and some of the less-known districts of France and Germany, he occupied himself much in economic and social observation, studying the effects of the institutions and system of life which prevailed in each region, on the material and moral condition of its inhabitants. In this way he gained an extensive and accurate acquaintance with Continental rural economy, of which he made excellent use in studying parallel phenomena at home. The accounts he gave of the results of his observations were among his happiest efforts; "no one," said Mill, "was able to write narratives of foreign visits at once so instructive and so interesting." In these excursions he made the acquaintance of several distinguished persons, amongst others of M. Léonce de Lavergne and Émile de Laveleye. To the memory of the former of these he afterwards paid a graceful tribute in a biographical sketch (*Fortnightly Review*, February, 1881); and to the close of his life there existed between him and M. de Laveleye relations of mutual esteem and cordial intimacy.

Two essays of Leslie's appeared in volumes published under the auspices of the Cobden Club, one on the "Land System of France" (2d ed., 1870), containing an earnest defence of *la petite culture* and still more of *la petite propriété*; the other on "Financial Reform" (1871), in which he exhibited in detail the impediments to production and commerce arising from indirect taxation. Many other articles were contributed by him to reviews between 1875 and 1879, including several discussions of the history of prices and the movements of wages in Europe, and a sketch of life in Auvergne in his best manner; the most important of them, however, related to the philosophical method of political economy, notably a memorable one which appeared in the Dublin University periodical, *Hermathena*. In 1879 the provost and senior fellows of Trinity College published for him a volume in which a number of these articles were collected under the title of *Essays in Political and Moral Philosophy*. These and some later essays, which ought one day to be united with them, together with the earlier volume on *Land Systems*, form the essential contribution of Leslie to our economic literature. He had long contemplated, and had in part written, a work on English economic and legal history, which would have been his *magnum opus*—a more substantial fruit of his genius and his labors than anything he has left to us. But the MS. of this treatise, after much pains had already been spent on it, was unaccountably lost at Nancy in 1872; and, though he hoped to be able speedily to reproduce the missing portion and finish the work, it is feared that but a small part of it, if any, has been left in a state fit for publication. What the nature of it would have been may be gathered from an essay on the "History and Future of Profit" in the *Fortnightly Review* for November, 1881, which is believed to have been in substance an extract from it.

That he was able to do so much may well be a subject of wonder when it is known that his labors had long been impeded by a painful and depressing malady, from which he suffered severely at intervals, whilst he never felt secure from its recurring attacks. To this disease he in the end succumbed at Belfast, whither he had gone to discharge his professional duties, on the 27th of January, 1882, in the fifty-fifth year of his age.

Leslie's work may be distributed under two heads, that of applied political economy, and that of discussion on the philosophical method of the science. The *Land Systems* belonged principally to the former division. The author perceived the great and growing importance for the social welfare of both Ireland and England of what is called "the land question," and treated it in this volume at once with breadth of view and with a rich variety of illustrative detail. His general purpose was to show that the territorial systems of both countries were so encumbered with elements of feudal origin as to be altogether unfitted to serve the purposes of a modern industrial society. The policy he recommended is summed up in the following list of requirements, "a simple jurisprudence relating to land, a law of equal intestate succession, a prohibition of entail, a legal security for tenants' improvements, an open registration of title and transfer, and a considerable number of peasant properties." The volume is full of practical good sense and exhibits a thorough knowledge of home and foreign agricultural economy; and in the handling of the subject is everywhere shown the special power which its author possessed of making what he wrote interesting as well as instructive. The way in which sagacious observation and shrewd comment are constantly intermingled in the discussion not seldom reminds us of Adam Smith, whose manner was more congenial to Leslie than the abstract and arid style of Ricardo.

But what, more than anything else, marks him as an original thinker, and gives him a place apart among contemporary economists, is his exposition and defence of the historical method in political economy. Both at home and abroad there has for some time existed a profound and growing dissatisfaction with the method and many of the doctrines of the hitherto dominant school, which, it is alleged, under a "fictitious completeness, symmetry, and exactness" disguises a real hollowness and discordance with fact. It is urged that the attempt to deduce the economic phenomena of a society from the so-called universal principle of "the desire of wealth" is illusory, and that they cannot be fruitfully studied apart from the general social conditions and historic developments of which they are the outcome. Of this movement of thought Leslie was the principal representative, if not the originator, in England. There is no doubt, for he has himself placed it on record, that the first influence which impelled him in the direction of the historical method was that of Sir Henry Maine, by whose personal teachings of jurisprudence, as well as by the example of his writings, he was led "to look at the present economic structure and state of society as the result of a long evolution." The study of those German economists who represent similar tendencies doubtless confirmed him in the new line of thought on which he had entered, though he does not seem to have been further indebted to any of them except, perhaps, in some small degree to Roscher. And the writings of Comte, whose "prodigious genius," as exhibited in the *Philosophie Positive*, he admired and proclaimed, though he did not accept his system as a whole, must have powerfully co-operated to form in him the habit of regarding economic science as only a single branch of sociology, which should always be kept in close relation to the others. The earliest writing in which Leslie's revolt against the so-called "orthodox school" distinctly appears is his *Essay on Wages*, which was first published in 1868, and was reproduced as an appendix to the volume on *Land Tenures*. In this, after exposing the inanity of the theory of the wage-fund, and showing the utter want of agreement between its results and the observed phenomena, he concludes by declaring that "political economy must be content to take rank as an inductive instead of a purely deductive science," and that, by this change of character, "it will gain in utility, interest, and real truth far more than a full compensation for the forfeiture of a fictitious title to mathematical exactness and certainty." But it is in the essays collected in the volume of 1879 that his attitude in relation to the question of method is most decisively marked. In one of these, on "the political economy of Adam Smith," he exhibits in a very interesting way the co-existence in the *Wealth of Nations* of historical-inductive investigation in the manner of Montesquieu with *a priori* speculation founded on the theologico-metaphysical bases, and points out the error of ignoring the former element, which is the really characteristic feature of Smith's social philosophy, and places him in strong contrast with his *soi-disant* followers of the school of Ricardo. The essay, however, which contains the most brilliant polemic against the "orthodox" school, as well as the most luminous account and the most powerful vindication of the new direction, was that of which we have above spoken as having first appeared in *Hermathena*. It may be recommended as supplying the best extant presentation of one of the two contending views of economic method. On this essay mainly rests the claim of Leslie to be regarded as the founder and first head of the English historical school of political economy. How far his opinions on the philosophical constitution of the science are destined to prevail must for the present remain doubtful. Those who share his views on that subject regard the work he did, notwithstanding its unsystematic character, as in reality the most important done by any recent English economist. But even the warmest partisans of the older school are ready to acknowledge that he has done excellent service by insisting on a kind of inquiry, heretofore too much neglected, which is of the highest interest and value, in whatever relation it may be supposed to stand to the establishment of economic truth. The members of both groups alike recognize his great learning, his patient and conscientious habits of investigation, and the large social spirit in which he treated the problems of his science. (J. K. I.)

LESSING, GOTTHOLD EPHRAIM (1729–1781), was born at Kamenz, in Upper Lusatia, Saxony, on the 22d of January, 1729. He was descended from Clemens Lessing, a Saxon clergyman, whose name is found attached to an ecclesiastical document of 1580. Lessing's father, Johann Gottfried, born in 1693, was the son of Theophilus Lessing, the burgomaster of Kamenz, who died at the age of eighty-nine, when Lessing was between six and seven years old. At the time of Lessing's birth his father was one of the clergymen of Kamenz, where, a few years afterwards, he became pastor primarius, or head pastor. He was a man of high character, rather irascible, but earnest in the fulfilment of his pastoral duties, and universally beloved for his kindness to the poor. Throughout life he continued the studies in theology and church history which he had successfully begun at the university of Wittenberg, and he made some reputation as an original writer and as a translator of Tillotson. Of the Frau Pastorin we do not know much except that she was a faithful and affectionate wife and mother. They had twelve children, of whom Lessing was the second who survived infancy. He seems to have been an exceedingly happy child, healthy and playful, and already remarkable for his fondness for reading. After attending the Latin school of Kamenz, he was sent in 1741 to the great school of St. Afra at Meissen, where he was maintained free of charge. Here he made such rapid progress in classical and mathematical study that, towards the end of his career as a pupil, he was described by the rector as "a steed that needed double fodder." Work which was oppressive to others, added the rector, was to Lessing "as light as a feather." He had the reputation of being one of the most sarcastic, but at the same time one of the most loyal and generous, boys in the school. In 1746 he left St. Afra's and went to the university of Leipsic, nominally for the purpose of studying theology. To theology, however, he did not give the slightest attention. Under Professors Christ and Ernesti he continued his classical studies, and he also attended the philosophical disputations presided over by his friend Kästner, a young professor of mathematics. For some time Lessing was shy and retired amid his new surroundings, but being of an eminently social disposition he soon became tired of this kind of life, and began to form friends among his fellow-students, and strove to acquire the manners of a free and polished man of the world. His principal friend was Weisse, who afterwards attained a respectable position as a man of letters. He also became intimate with Mylius, who was considerably older than himself, and had made a certain mark as a literary and scientific writer. There was at this time in Leipsic an excellent actress, Frau Neuber, who had gathered around her a number of respectable players, and Lessing, in company with Weisse, was one of the most regular attenders at her theatre. At St. Afra's he had begun a comedy, *Der Junge Gelehrte*, and this he now completed. Frau Neuber immediately accepted it, and it was received with much favor by the public of Leipsic.

Alarmed by reports of what was supposed to be his dissolute life, the elder Lessing summoned him to Kamenz, where he remained for some months. He soon succeeded in overcoming the fears of his parents, who allowed him to return to Leipsic on condition that he would devote himself to the study of medicine. Some medical lectures he did attend; but his ambition was to become a great dramatist, and as long as Frau Neuber's company kept together he occupied himself almost exclusively with the theatre, being frequently present at rehearsal during the day as well as at the performance in the evening.

In 1748 the company broke up, and Lessing, finding nothing to interest him in Leipsic, went to Wittenberg, and afterwards, towards the end of the year, to Berlin, where his friend Mylius had established himself as a journalist and man of science. In Berlin Lessing now spent three years, maintaining himself chiefly by literary work. He translated two volumes of Rollin's history, wrote some of the best of his early plays, and, in association with Mylius, started a periodical (which soon came to an end) for the discussion of matters connected with the drama. Early in 1751 he accepted the office of literary critic to the *Voss Gazette*, and in this position he reviewed some of the most important German and French books of the day, manifesting already to some extent the learning, judgment, and wit which were to make him the greatest critic of modern times. His father had been bitterly opposed to his scheme of life, and in 1751 urged him to complete his studies at the university of Wittenberg. Feeling the need of further thought and research, Lessing at last consented, and at the close of the year left Berlin. It is worthy of note that he had been brought into slight contact with Voltaire, for whom he had translated some documents relating to the Hirsch trial. Voltaire's secretary having lent him a volume of the *Siècle de Louis XIV.*, which had not yet been published, he took it with him to Wittenberg. This came to the ears of Voltaire, who assumed that Lessing intended to print either a pirated edition or an unauthorized translation. The affair led to an angry correspondence, and was a subject of much talk in Berlin.

Lessing remained about a year in Wittenberg, where he passed most of his time in the university library, every volume in which, he afterwards declared, had passed through his hands. Having taken the degree of master of arts, he returned to Berlin, determined to make literature his profession; and the next three years were among the busiest of his life. Besides translating for the booksellers, he issued several numbers of the *Theatralische Bibliothek*, a periodical essentially the same as that which he had begun with Mylius. He also resumed his labors as critic to the *Voss Gazette*. For many years the most influential writer in Germany had been Gottsched, the Leipsic professor, who continually proclaimed the necessity of rigid adherence, in the drama and in poetry, to French rules. In his articles for the *Voss Gazette*, Lessing made it his principal object to ridicule the pretensions of Gottsched and his school, and in a short time there was no writer of whom they were so much afraid. In 1754 he produced a deep impression by *Ein Vade Mecum für den Herrn Sam. Gotth. Lange*, in which he exposed with bitter satire Lange's errors in his popular translation of Horace. During these three years Lessing took a definite position in contemporary literature by issuing, in six small volumes, those of his writings which he considered worthy of preservation. They included his lyrics and epigrams, some of the latter being in German, others in Latin. Most of his lyrics were written in Leipsic, and had already appeared, during his first residence in Berlin, in a volume of *Kleinigkeiten*, published without his name. Although they do not, like Goethe's lyrics, touch deep sources of natural feeling, they have the merit of being bright, gay, and musical, and some of them are still sung by German students. The epigrams, many of which were produced in Wittenberg, are in the style of Martial, and give evidence, like Lessing's critical writings, of a keen and biting humor. Among his collected writings there was also a remarkable series of *Letters*, in which, for the first time in German literature, some of the results of extensive learning were presented in a free and vivid style. Even more important, perhaps, were the papers entitled *Rettungen*, in which he undertook to vindicate the character of various writers who had been misunderstood by preceding generations. One of the best of these *Rettungen* is on Horace, whom he defends against the critics who charge him with sensuality and cowardice. In another, almost equally good, he shows that Cardan, instead of being an atheist, did full justice to the evidences for Christianity, as they were understood in his time, while he did rather less than justice to other religions. This essay contains a powerful argument in favor of Mohammedanism, developed from the point of view of an intelligent believer in the Prophet. In addition to these varied contents, Lessing published in the six volumes of his *Schriften* his early plays and *Miss Sara Sampson*. Of the former the chief are *Der Junge Gelehrte*, already mentioned, *Der Freidenker*, *Die Juden*, and *Der Misogyn*. Although superior to any other German comedies produced at the same time, they cannot be said to reveal a high dramatic faculty. In the arrangement of his plots and the balancing of his characters, Lessing follows closely the methods of contemporary French comedy, and in the dialogue there is often a too obvious straining after effect. *Miss Sara Sampson*, written in 1755, marks a wholly different stage of his development. It has many faults both in conception and in execution, but it exercised a powerful influence by indicating to the dramatists of Germany that materials for tragedy are to be found in the experiences of ordinary men and women as well as in those of "the great." Lessing attributed much importance to this principle, which had been suggested to him chiefly by the study of Richardson, whose Clarissa is almost exactly reproduced in the heroine of *Miss Sara Sampson*.

This tragedy, when represented in Frankfort-on-the Oder, was received with so much applause that he resolved to devote himself to the drama; and in fulfilment of his design he suddenly quitted Berlin in October, 1755, and went to Leipsic, where a good theatre had been lately established. During his second residence in Berlin he had made his name widely known, and he had secured several friends, whose affection he retained during the rest of his life. The chief of these was Moses Mendelssohn, in association with whom, in 1755, he wrote an admirable treatise, *Pope ein Metaphysiker*, tracing sharply the lines which separate the poet from the philosopher. The Berlin Academy of Sciences had offered a prize for the best essay on Pope's doctrine that "Whatever is, is right," as compared with the optimism of Leibnitz. The treatise of the two friends was written to show that there cannot be a true comparison between a poetic and a philosophic conception; and they threw much light on the aims both of Leibnitz and of Pope. Other Berlin friends of Lessing were Nicolai, the bookseller, and Ramler, the author of many well-known odes. He had also made the acquaintance of Gleim, the Halberstadt poet, and Ewald Christian von Kleist, a Prussian officer, whose fine poem, *Der Frühling*, had won for him Lessing's warm esteem.

In Leipsic, Lessing was asked by Winkler, a wealthy young merchant, to accompany him in a foreign tour, which was to last three years. As he offered liberal terms, Lessing consented; and early in the summer of 1756 they started for England. They did not, however, get beyond Amsterdam, for after the outbreak of the Seven Years' War they heard that Winkler's house was occupied by the Prussian commandant; and he deemed it necessary to hasten back. After some time Winkler was offended by Lessing's intimacy with certain Prussian officers, and suddenly announced to him that he must consider their engagement at an end. Lessing demanded compensation, and in the end the courts decided in his favor, but not until the case had dragged on for about six years. In the meantime it detained him in Leipsic, and, as there was little opportunity for earning money by literature in a city occupied by foreign troops, he went through a period of extreme hardship. During these anxious months he began the study of mediæval poetry, in which some interest had been awakened by the Swiss school of critics; he also translated several English writings, and worked occasionally for the *Bibliothek*, a periodical edited by Nicolai. Fortunately he had an opportunity of developing his friendship with Kleist, who happened to be stationed in Leipsic. Kleist, a man of truly heroic temper, with the simplicity of a child, was powerfully attracted by Lessing's frank and noble nature, and Lessing loved him with an ardor which was excited by no other friend, not even by Mendelssohn. Kleist's regiment being ordered to new quarters early in 1758, Lessing decided not to remain behind him, and, saying farewell to his friend (who was mortally wounded in the following year at the battle of Kunersdorf), he returned once more to Berlin.

His third residence in Berlin was made memorable by the *Literaturbriefe*, a series of critical essays (written in the form of letters to a wounded officer) on the principal works that had appeared since the beginning of the Seven Years' War. The scheme was suggested by Nicolai, by whom the *Letters* were published. Those written by Lessing manifested far higher intellectual power than anything he had yet accomplished. The critical principles set forth in the *Literaturbriefe* are now universally recognized, but they were then new, and even at the present day they seem to derive fresh vitality from the force, precision, and animation with which he expresses them. He insisted especially on the necessity of truth to nature in the imaginative presentation of the facts of life, and in one letter he boldly proclaimed the superiority of Shakespeare to Corneille, Racine, and Voltaire. At the same time he marked the immutable conditions to which even genius must submit in order to move enduring sympathies. While in Berlin at this time, he edited with Ramler a selection from the writings of Logau, a vigorous epigrammatist of the 17th century, and introduced to the German public *The War Songs of a Grenadier*, by Gleim. He admired the vigor of these songs, but in several private letters protested against the vehemence of the author's patriotism—patriotism being a virtue which, he thought, he "could do very well without." In 1759 he published *Philotas*, a prose tragedy; and in the same year appeared a complete collection of his fables, with an essay on the essential idea of the fable. The latter is one of his best essays in criticism, defining with perfect lucidity what is meant by "the action" in works of imagination, and distinguishing the action of the fable on the one hand from that of the epic and the drama on the other. His theory prevented him from lending poetic interest to his own fables, but they surpass the works of all other German fabulists in the depth and variety of the moral truths which they are intended to enforce.

In 1760, weary of incessant writing, and feeling that change of scene and work was necessary for his health, Lessing went to Breslau to apply for the post of secretary to General Tauentzien, to whom Kleist had introduced him in Leipsic. Tauentzien was not only a general in the Prussian army, but governor of Breslau, and director of the mint. He willingly granted the vacant office to Lessing, who retained it for more than four years. He thus found himself in circumstances wholly different from those to which he had been hitherto accustomed. He associated chiefly with Prussian officers, went much into society, and became passionately fond of the gaming table, where he played for such high stakes that even General Tauentzien expostulated with him. While, however, he seemed to be wasting his energies, he never lost sight of his true goal. He gradually collected a library of about 6000 volumes (which he was ultimately obliged to sell); and after the conclusion of the Seven Years' War in 1763 he resumed more enthusiastically than ever the studies which had been partly interrupted. In investigating the early history of Christianity, he obtained a profound knowledge of the fathers; and a remarkable letter to Mendelssohn shows that he had penetrated more deeply than any contemporary thinker into the significance of the philosophy of Spinoza. In 1764 he was prostrated by a severe illness, during which he reviewed, in a rather sorrowful spirit, his past life, and formed many serious resolutions for the future. Before this time he had worked hard at *Laocoon*, and in fresh spring mornings he had sketched in a garden the plan of *Minna von Barnhelm*. His parents were now in exceedingly straitened circumstances, and often appealed to him for aid. He responded generously to their demands, but they greatly overrated his power to help them, as they assumed that he intended to remain permanently in General Tauentzien's service. In reality, he had always regarded the engagement as a temporary one, and in 1765 he resigned his office, and left Breslau.

It seemed not improbable that he might find a suitable appointment in Dresden, but he was again compelled, much against his will, to become a resident of Berlin, whither he went after a brief visit to Kamenz and Leipsic. His friends exerted themselves to obtain for him the office of keeper of the royal library, but Frederick had not forgotten Lessing's quarrel with Voltaire, and declined to consider his claims, although, about the time when Lessing went to Breslau, he had confirmed his election as a foreign member of the Berlin Academy of Sciences. During the two years which Lessing now spent in the Prussian capital he was restless and unhappy, yet it was during this period that he published two of his greatest works—*Laocoon* in 1766, and *Minna von Barnhelm* in 1767. *Laocoon* ranks as a classic not only in German but in European literature, and its style alone, which is as near perfection as anything Lessing ever wrote, would almost entitle it to this position. His central aim is to define by analysis the limitations of poetry and the plastic arts. Many of his conclusions have been corrected and extended by later criticism; but he indicated more decisively than any of his predecessors the fruitful principle that each art is subject to definite conditions, and that it can accomplish great results only by limiting itself to its special function. The most valuable parts of the work are those which relate to poetry, of which he had a much more intimate knowledge than of sculpture and painting. His exposition of the methods of Homer and Sophocles is especially suggestive, and he may be said to have marked an epoch in the appreciation of these writers, and of Greek literature generally. He invariably starts from the consideration of doctrines set forth by other scholars (chiefly Winkelmann, Caylus, and Spence); but he is never satisfied until he arrives at positive principles, and he leads us towards them gradually by the paths he himself has trodden, glancing at many side issues by the way. He was unable in later years to complete his scheme, but even in its fragmentary form, as Goethe testifies in *Wahrheit und Dichtung*, *Laocoon* was welcomed with gratitude by the most active minds of the age. The power of *Minna von Barnhelm* was also immediately recognized. This is, on the whole, the best of Lessing's purely dramatic writings. The hero, Tellheim, is an admirable study of a manly and sensitive soldier, with somewhat exaggerated ideas of conventional honor; and Minna, the heroine, is one of the brightest and most attractive figures in the dramatic literature of Germany. The subordinate characters are conceived with the same force and vividness; and the plot, which reflects precisely the struggles and aspirations of the period that immediately followed the Seven Years' War, is simply and naturally unfolded. This beautiful play is valued by the Germans, not only as a work of art, but as one of the earliest and most striking manifestations of the growing spirit of German nationality.

In 1767 Lessing settled in Hamburg, where he had been invited to take part in the institution of a national theatre. The scheme promised well, and, as he associated himself with Bode, a literary man whom he respected, in starting a printing establishment, he hoped that he might at last look forward to a peaceful and prosperous career. The theatre, however, being mismanaged was soon closed, while the printing establishment failed, and left behind it a heavy burden of debt. Many of Lessing's letters from Hamburg breathe almost a spirit of despair, and towards the end of his residence there he determined to quit Germany, believing that in Italy he might find congenial labor that would suffice for his wants. Even in Hamburg he made splendid contributions to enduring literature, the chief being his *Hamburgische Dramaturgie*. It consists of criticism of some of the plays represented in the Hamburg theatre; but in these criticisms he offers a complete theory of the laws of dramatic art. In the main his theory is that of Aristotle, but it is maintained on independent grounds and applied in new ways. By this powerful work he delivered German dramatists for ever from the yoke of the classic tragedy of France, and directed them to the Greek dramatists and to Shakespeare as the poets who have opened most truly the fountains of tragic feeling. Another result of his labors in Hamburg was the *Antiquarische Briefe*, a series of masterly letters in answer to Klotz, a pedantic writer who, after flattering Lessing, had attacked him, and sought to establish a kind of intellectual despotism by means of critical journals which he directly or indirectly controlled. In connection with this controversy, Lessing wrote his brilliant little treatise *Wie die Alten den Tod gebildet*, contrasting the mediæval representation of death as a skeleton with the Greek conception of death as the twin-brother of sleep.

Instead of going to Italy as he intended, Lessing accepted, in 1770, the office of librarian at Wolfenbüttel, a post which was offered to him by the hereditary prince of Brunswick. In this position he passed his remaining years. For a time he was not unhappy, but by and by he was rendered miserable by his inability to pay the debts which he had contracted in Hamburg. He missed, too, the society of his friends, and his health, which had hitherto been excellent, gradually gave way. In 1775 he travelled for nine months in Italy with Prince Leopold of Brunswick; and in the following year he married Eva König, the widow of a Hamburg merchant with whom he had been on terms of intimate friendship. She was in every way worthy of Lessing, and their correspondence during his lonely years in Wolfenbüttel forms one of the most attractive elements of his biography. Their happiness in each other was perfect, but it lasted only for a brief period; in 1778 she died in childbed. After her death Lessing found one of his chief sources of consolation in the love of his four step-children, to whom he was tenderly attached.

Meanwhile he had extended his fame by several important writings. Soon after settling in Wolfenbüttel he found in the library an ancient manuscript, which proved to be a treatise of Berengarius of Tours on transubstantiation in reply to Lanfranc. Lessing was thus induced to write an essay on Berengarius, vindicating his character as a serious and consistent thinker. The essay was much admired by the leading theologians of Germany, and it is, on the whole, the ablest and most interesting of his *Rettungen*. In 1771 he published his *Zerstreute Anmerkungen über das Epigramm, und einige der vornehmsten Epigrammatisten*—a work which Herder described as "itself an epigram." Lessing's theory of the origin of the epigram is somewhat fanciful, but no other critic has offered so many pregnant hints as to the laws of epigrammatic verse, or defended with so much force and ingenuity the character of Martial. In 1772 lovers of the drama were delighted by the appearance of *Emilia Galotti*, a tragedy which he had begun many years before in Leipsic. The subject was suggested by the Roman legend of Virginia, but the scene is laid in an Italian court, and the whole play is conceived in accordance with the modern spirit. Its defect is that its tragic conclusion does not seem to be absolutely inevitable, but there is high imaginative power in the character of the prince of Guastalla and in that of Marinelli, his chamberlain, who weaves the intrigue from which Emilia escapes by death. The diction of *Emilia Galotti* is at once refined and vigorous, and there are scenes in which some of the deepest passions of human nature are sounded with perfect art. Having completed *Emilia Galotti*, Lessing occupied himself for some years almost exclusively with the treasures of the Wolfenbüttel library. The results of his researches (some of them of high value) he embodied in a series of volumes, *Zur Geschichte und Literatur*, the first being issued in 1773, the last in the year of his death.

The concluding period of Lessing's life was devoted chiefly to theological controversy. Reimarus, professor of Oriental languages in Hamburg, who commanded general respect as a scholar and thinker, wrote a book entitled *Apologie oder Schutzschrift für die vernünftigen Verehrer Gottes*. The standpoint of Reimarus was that of the English deists, and he investigated, without hesitation, the evidence for the miracles recorded in the Bible. The manuscript of this work, after the author's death in 1767, was entrusted by his daughter, Elise Reimarus, to Lessing, who published extracts from it in his *Zur Geschichte und Literatur*, in 1774–78. These extracts, the authorship of which was not publicly avowed, were known as the "Wolfenbüttel Fragments." They created profound excitement among orthodox theologians, and evoked many replies, in which Lessing was bitterly condemned for having issued writings of so dangerous a tendency. Lessing delighted at all times in the stir of combat, and prepared to offer a full and vigorous defence. His most formidable assailant was Pastor Goeze, of Hamburg, a sincere and earnest theologian, but utterly unscrupulous in his choice of weapons against an opponent. To him, therefore, Lessing addressed his most elaborate answers, —*Eine Parabel*, *Axiomata*, eleven letters with the title *Anti-Goeze*, and two pamphlets in reply to an inquiry by Goeze as to what Lessing meant by Christianity. These papers are not only full of thought and learning; they are written with a grace, vivacity, and energy that make them hardly less interesting to-day than they were to Lessing's contemporaries. He does not undertake to defend the conclusions of Reimarus; his immediate object is to claim the right of free criticism in regard even to the highest subjects of human thought. The argument on which he chiefly relies is that the Bible cannot be considered necessary to a belief in Christianity, since Christianity was a living and conquering power before the New Testament in its present form was recognized by the church. The true evidence for what is essential in Christianity, he contends, is its adaptation to the wants of human nature; hence the religious spirit is undisturbed by the speculations and researches of the boldest thinkers. The effect of this controversy was to secure wider freedom for writers on theology, and to suggest new problems regarding the growth of Christianity, the formation of the canon, and the essence of religion. On one subject, the origin of the gospels, Lessing poured a flood of fresh light in a treatise, published after his death, presenting "A New Hypothesis concerning the Evangelists, regarded as merely human writers." The Brunswick Government having, in deference to the consistory, confiscated the "Fragments" and ordered Lessing to discontinue the controversy, he resolved, as he wrote to Elise Reimarus, to "try whether they would let him preach undisturbed from his old pulpit, the stage." In *Nathan der Weise*, written in the winter of 1778–79, he gave poetic form to the ideas which he had already developed in prose. Its governing conception is that noble character may be associated with the most diverse creeds, and that there can, therefore be no good reason why the holders of one set of religious principles should not tolerate those who maintain wholly different doctrines. This element of *Nathan der Weise* receives so much attention from its critics that many of them overlook the high artistic qualities of the work. As a play it has serious imperfections, but as a dramatic poem it is one of the finest creations of the 18th century. The characters possess true vitality, and several passages (including, of course, the famous passage setting forth the parable of the three rings) have both the depth and the spontaneity which are the unmistakable notes of genius. In 1780 appeared *Die Erziehung des Menschengeschlechts*, the first half of which he had published in 1777 with one of the "Fragments." This work, composed of a hundred brief paragraphs, was the last, and is, perhaps, the most suggestive, of Lessing's writings. The doctrine on which its argument is based is that no dogmatic creed can be regarded as final, but that every historical religion has played a great part in the development of the spiritual life of mankind. Lessing also maintains that history reveals a definite law of progress, and that occasional retrogression may be necessary for the advance of the world towards its ultimate goal. These ideas afterwards became familiar, but they offered a striking contrast to the principles both of orthodox and of sceptical writers in Lessing's day, and gave a wholly new direction to religious philosophy. Another work of Lessing's last years, *Ernst und Falk* (a series of five dialogues, of which the first three were published in 1777, the last two in 1780), also indicated in a fascinating style many new points of view. Its nominal subject is freemasonry, but its real aim is to plead for a humane and charitable spirit in opposition to a narrow patriotism, an extravagant respect for rank, and exclusive devotion to any particular church.

Lessing's theological opinions exposed him to much petty persecution, and he was in almost constant straits for money. Nothing, however, broke his manly and generous spirit. To the end he was always ready to help those who appealed to him for aid, and he devoted himself with growing ardor to the search for truth. He formed many new plans of work, but in the course of 1780 it became evident to his friends that he would not be able much longer to continue his labors. His health had been undermined by excessive work and anxiety, and after a short illness he died at Brunswick on the 22d of January, 1781.

He was rather above the middle height, and during the greater part of his life maintained an appearance of vigor and elasticity. Luther himself was not of a more fearless and independent character. In an age when men of letters were fond of grouping themselves in sects and coteries, Lessing pursued his own way, unmoved by clamor, and indifferent to popular favor. Yet no man was ever more warmly loved by friends, and he had the satisfaction of knowing that the younger generation of writers looked up to him with confidence and reverence. Jacobi wished for many years to make his acquaintance, but was deterred from addressing him, as he explained to Lessing, by a profound consciousness of the difference between himself and one whom he regarded as "a king among minds." "We lose much, much in him," wrote Goethe after Lessing's death, "more than we think." It may be questioned whether there is any other writer to whom the Germans owe a deeper debt of gratitude. He was succeeded by poets and philosophers who for a time gave Germany the first place in the intellectual life of the world, and it was Lessing, as they themselves acknowledged, who prepared the way for their achievements. Without attaching himself to any particular system of philosophical doctrine, he fought incessantly against error, and in regard to art, poetry, the drama, and religion, suggested ideas which kindled the enthusiasm of aspiring minds, and stimulated their highest energies. While his work was thus effective in its own day, it has lost little of its value for later ages. His great dramas have imaginative qualities which appeal to every generation, and an unfading charm is conferred on his critical and theological writings by the power and classical purity of his style.

The first edition of his collected works appeared, in 30 vols., in 1771–94. A critical edition by Lachmann, in 13 vols., was issued in 1838–40, and this edition was revised with additions, by Maltzahn in 1853–57. In 1868–77 Lessing's works, edited by several competent scholars, were published in 20 vols. by Hempel, and there is an illustrated edition in 8 vols. (Grote, 1875–76). See *Lessing's Leben*, 1793, by Karl G. Lessing (his brother); Danzel, *G. E. Lessing, sein Leben und seine Werke*, 1850 (completed by Guhrauer, 1853–54); Stahr, *G. E. Lessing, sein Leben und seine Werke*, 1859; H. Düntzer, *Lessing's Leben*, 1882; and in English, J. Sime, *Lessing*, 1877, and H. Zimmern, *Gotthold Ephraim Lessing*, 1878.[1] (J. SI.)

L'ESTRANGE, SIR ROGER (1616–1704), an indefatigable pamphleteer on the royalist and court side during the Restoration epoch, but principally remarkable as the first English man of letters of any distinction who made journalism a profession, was born at Hunstanton in Norfolk, December 17, 1616. In 1644, during the civil war, he headed a conspiracy to seize the town of Lynn for the king, under circumstances which led to his being condemned to death as a spy. The sentence, however, was not executed, and after four years' imprisonment in Newgate he escaped to the Continent. He was excluded from the Act of Indemnity, but in 1653 was pardoned by Cromwell upon his personal solicitation, and lived quietly until the Restoration, when after some delay his services and sufferings were acknowledged by his appointment as licenser of the press. This office was administered by him in the spirit which might be expected from a zealous cavalier. He made himself notorious, not merely by the severity of his literary censorship, but by his vigilance in the suppression of clandestine printing. The inconsistency of this course with his actions and professions when himself opposed to the party in power naturally aggravated the unpopularity inevitably attaching to his office. Few men have been more heartily abused than L'Estrange, and it is undoubtedly true that the rights of free speaking and printing, the indispensable conditions of civil and religious liberty, have seldom had a more determined or more dangerous opponent. At the same time there is no ground for questioning his integrity, and he was probably no more intolerant than any similar official of any Government in that day, inspired by an equal strength of conviction, would have been in his place. The representation of him in Grant's *History of the Newspaper Press* as a mere political hireling is entirely contrary to truth. He was a militant loyalist, who used the pen as he had been wont to use the sword, and proved his zeal for his party by the production of a mass of pamphlet literature, above the ordinary standard of the time in ability, and quite on a par with it in virulence and coarseness. These productions still possess an historical value, but their titles are not worth enumerating here. His memory is more honorably preserved by his connection as an author with the journalism which as a licenser he labored to cripple and emasculate. In 1663 he commenced the publication of *The Public Intelligencer and the News*, succeeded in February, 1665, by the *London Gazette*, not to be confounded with the official journal still existing, which appeared for the first time at the close of that year, and was at first printed at Oxford. In 1679 he established *The Observator*, a journal specially designed to vindicate the court from the charge of a secret inclination to popery. This line of political controversy, and it may be hoped some natural humanity and good sense as well, obliged him to discredit the Popish Plot, and he manfully resisted the delusion by which many wiser and better men were carried away. The suspicion he thus incurred was increased by the conversion of his daughter to Romanism, but there seems no reason to question the sincerity of his own attachment to the Church of England. In 1687 he gave a further proof of independence by discontinuing *The Observator* from his unwillingness to advocate James II.'s Edict of Toleration, although he had previously gone all lengths in support of the measures of the court. The Revolution cost him his office as licenser, and the remainder of his life was spent in obscurity. He died in 1704. L'Estrange's place is rather in history than in literature. The importance of the part he played as licenser would be more exactly known if it could be more accurately ascertained how much literature he may have been the means of suppressing. The post he held so long was in itself an unmitigated mischief, but at the same time an evil which men of all parties, with the rare exception of men so far in advance of their time as Milton, then deemed necessary; and no obloquy should attach to L'Estrange for having discharged its functions with zeal and efficiency. As a pamphleteer he is but slightly above mediocrity, and he labors under a special imputation of having contributed to corrupt his native language. The same charge is brought against journalists in all ages, and there are obvious reasons why it should be true to a certain extent. The practice of daily writing for the press is undoubtedly one of the numerous forces which tend to wear down and degrade a language, but it also keeps the diction of the cultivated classes in contact with the speech of the people, and prevents the absolute divorce between them which seems to have existed in ancient times. It is to L'Estrange's credit that among the agitations of a busy political life he should have found time for much purely literary work as a translator of Josephus, Cicero, Seneca, Quevedo, and other standard authors. (R. G.)

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[1] [See also T. W. Rolleston's Life; London and New York, 1889.—AM. ED.]

LESUEUR, JEAN FRANÇOIS (1763–1837), was born near Abbeville in 1763, and studied music under Roze at the college of Amiens. Appointed choirmaster of a church in Paris in 1784, he completed his musical education under Sacchini. In 1786 Lesueur obtained by open competition the musical directorship of Notre-Dame, where he gave successful performances of sacred music with a full orchestra. This place he resigned in 1788; and, after a retirement of five years in a friend's country house, he produced *La Caverne* and two other operas at the theatre Feydeau in Paris. At the foundation of the Paris Conservatoire (1795) Lesueur was appointed one of its inspectors of studies, but was dismissed in 1802, owning to his disagreements with Mehul. On the recommendation of Paisiello, Lesueur succeeded this celebrated composer as *Maestro di cappella* to Napoleon, and produced (1804) his *Ossian* at the Opera. He also composed for the emperor's coronation a mass and a Te Deum. Louis XVIII., who had retained Lesueur in his court, appointed him (1818) professor of composition at the Conservatoire; and at this institution he had, among many other pupils, Hector Berlioz, Ambroise Thomas, Besozzi, and Gounod. He died October 6, 1837. Lesueur composed eight operas and several masses, and other sacred music. All his works are written in a style of rigorous simplicity; and to this may be ascribed their want of popularity at the present time.

LETHE (λήθη, oblivion) is sometimes used as the name of a river in the infernal regions. It seems to have been an idea current in the religion of the mysteries that there were in the lower world two streams, one of memory and one of oblivion. The initiated were taught to distinguish between them, and directions for this purpose written on a gold plate have been found in a tomb at Petilia, buried doubtless with some initiated person. So beside Lebadea, at the oracle of Trophonius, which was counted an entrance to the lower world, the two springs Mnemosyne and Lethe were shown. This thought begins to appear in literature in the end of the 5th century B.C., when Aristophanes (*Frogs*, 186) speaks of the plain of Lethe. Plato (*Rep.* X.) embodies the idea in one of his finest myths of the future life. It is difficult to find any passage in the earlier writers showing acquaintance with this idea. Hesiod makes Lethe one of the children of Eris, along with Toil, Hunger, Pains, etc.; but his meaning probably is that ingratitude and forgetfulness spring from strife. In the epitaph on Anacreon attributed to Simonides, but reckoned by Bergk spurious, the expression Λήθης δόμοι occurs; but even if the epigram be an early one it is not certain that the words have any mythological sense.

LETRONNE, JEAN ANTOINE (1787–1848), French archæologist, was born at Paris on January 2, 1787. His father, a poor engraver, having chosen the profession of an artist for him, sent him to the studio of David, but his own tastes drew him towards literature, and he became a student in the Collége de France, where it is said he used to exercise his already strongly developed faculty of critical divination by correcting for his own amusement old and bad texts of Greek authors, afterwards comparing the results he had thus obtained with the latest and most approved editions. From 1810 to 1812 he travelled in France, Switzerland, and Italy, and on his return to Paris published an *Essai critique sur la topographie de Syracuse* (1812), designed to elucidate Thucydides; two years later appeared his *Recherches géographiques et critiques* on the *De Mensura Orbis Terræ* of Dicuil, along with a restored text. In 1815 he was appointed by Government to complete the translation of Strabo (1805–1819) which had been begun by Laporte-Dutheil, and in March, 1816, he was one of those who were admitted to the Academy of Inscriptions by royal ordinance, having previously contributed a *Mémoire*, "On the Metrical System of the Egyptians," which had been crowned. Further promotion came rapidly; in 1817 he was appointed director of the École des Chartes, in 1819 inspector-general of the university, and in 1831 professor of history in the Collége de France. This chair he exchanged in 1838 for that of archæology, and in 1840 he succeeded Daunou as keeper of the national archives. Meanwhile he had published among other works, *Considérations générales sur l'évaluation des monnaies grecques et romaines et sur la valeur de l'or et de l'argent avant la découverte de l'Amérique* (1817), *Recherches pour servir à l'histoire d'Égypte pendant la domination des Grecs et des Romains* (1823), and *Sur l'origine Greque des zodiaques prétendus égyptiens* (1837); by the last-named he finally exploded a fallacy which had up to that time vitiated the chronology of contemporary Egyptologists. His *Diplomes et chartres de l'époque Mérovingienne sur papyrus et sur velin* were published in 1844. The most important work of Letronne is the *Recueil des inscriptions grecques et latines de l'Égypte*, of which the first volume appeared in 1842, and the second in 1848. He died at Paris on December 14, 1848.

LETTRES DE CACHET are really *lettres closes*, that is, letters sealed in such a way that they cannot be opened without breaking the seal, and which were originally always addressed to individuals, in contradistinction to *lettres patentes*, or letters patent, beginning "know all men by these presents." Lettres closes interfering with the administration of justice or the liberty of the subject were forbidden by numerous edicts in the

14th, 15th, and 16th centuries, and the term lettres de cachet, as synonymous with lettres closes, is first found in the ordinance of Orleans in 1560. The convenience of such a means to consign one's enemies to prison was seen by Richelieu and Mazarin, who followed the Guise Government in using them frequently, despite numerous protestations on the part of the parlements, of which the most notable was when in 1648 an ordinance was registered that no man should be kept in prison three days without interrogation. When once Louis XIV. had begun to rule, he made frequent use of lettres de cachet both for state purposes and to control and disorganize his nobility, and he boldly justified their use in an edict of 1705. But the most marked justification is to be found in the circular letter addressed to the parlements of France in reply to protests against arbitrary imprisonment in 1759, in which the king says that "he reserves arbitrary orders—in other words, lettres de cachet—for occasions wherein they may be necessary for the public good and the interests of families." In this remark he distinguishes between the two purposes for which such letters were granted. He first alleges state reasons why he should have power to arrest arbitrarily —a power no one would deny to the executive on occasions of emergency, if used under proper restrictions. Secondly, he says that they are issued in the interest of families, and here he touches the great source of their injustice and unpopularity. It was the custom for the king to sign a number of blank lettres de cachet which his ministers gave away to whoever they pleased. Thus they often fell into hands of people who used them to gratify private hate; fathers obtained them and inserted the names of their sons, wives inserted the names of their husbands, opera dancers those of lovers who had spurned them. The evil grew to such a height that Turgot and Lamoignon de Malesherbes refused to enter the ministry of Louis XVI. unless they might see the contents of the orders they countersigned, and see the causes for which men were to be imprisoned. It is needless to say that when the cahiers of the primary assemblies were prepared, to instruct the deputies to the states-general in the wishes of their constituents, abolition of the lettres de cachet was demanded in almost all the cahiers of the noblesse and tiers état. The subject was mentioned in the early debates of the Constituent Assembly, but lettres de cachet were not formally abolished till January 15, 1790, and on March 13 of the same year all imprisoned under them were ordered to be set at liberty. The great authority for the history and injustice of lettres de cachet is Mirabeau's *Enquiries concerning Lettres de Cachet and State Prisons*, written in the dungeon at Vincennes into which his father had thrown him by a lettre de cachet. It is one of the ablest and most eloquent of his works, had an immense circulation, and was translated into English with a dedication to the duke of Norfolk in 1788. See also Mercier's *Tableaux de Paris* (ed. 1783), vol. vii. chap. 588, and numerous stories in Linguet's *Bastille*, and especially in the *Bastille dévoilée* (1790).

LETTS. See Lithuanians.

LEUCADIA. See Santa Maura.

LEUCIPPUS, the founder of Atomism in Greek philosophy, flourished about the middle or latter half of the 5th century B. C. Almost nothing is known of his life. His birthplace is variously given as Elea, Abdera, or Miletus. It is disputed whether he left any writings. Empedocles of Agrigentum and Anaxagoras of Clazomenæ were his contemporaries, while Zeno the Eleatic is said to have been his teacher. As pupil and associate he had Democritus of Abdera, beside whose greater fame his own work has been thrown into the background. Thus Epicurus would not look upon him as a philosopher at all; Lucretius ignored him; and he is barely mentioned by Lange, the modern historian of materialism. But the references of Aristotle, as well as of later authorities, leave no doubt that the leading principles of the Atomic theory are due to him. He eluded the Eleatic criticism of plurality and motion by postulating the reality of that which is not, the empty or space. Empty space and atoms are, he held, the ultimate constituents of all things. The former is infinite in magnitude; the latter are infinite in number, indivisible, and with only quantitative differences amongst one another. Nor is there any such thing as qualitative change; but all growth and decay are merely the compounding and separation of atoms. The atoms are always in activity or motion, and all things happen of necessity. Worlds, infinite in number, are produced by the atoms, variously shaped and of different weights, falling in empty space and giving rise to an eddying motion by their mutual impact. In this way worlds are being for ever produced and again destroyed. In the notices of Leucippus handed down to us there are additional traces of a cosmology, differing slightly from that of Democritus, and of a psychology which identified the soul with spherical atoms, and explained sensation and thought by a change brought about in it mechanically through the entrance of external images. The further development of the Atomic philosophy was the work of Democritus.

See Diog. Laert., *De Vitis*, lib. ix. c. 6; Ritter and Preller, *Hist. Phil.*, pp. 111 *sq.*; Zoller, *Phil. d. Griechen*, 4th ed., i. 760 *sq.*

LEUK, or Loèche la Ville, a village of Switzerland, at the head of a district in the canton of Valais, 15 miles by rail east of Sion, on the right bank of the Rhone. The population has increased from 1220 in 1870 to 1411 in 1880. About 5 miles to the north, in the valley of the Dala, at a height of 4642 feet above the sea, and overshadowed by the immense cliffs of the Gemmi, lie the Baths of Leuk, Leukenbad, or Loèche-les-Bains, a place of only 650 permanent inhabitants, but largely frequented during its brief summer season by French, Swiss, and Italian visitors, attracted by the hot mineral springs. These springs are twenty-two in number, and vary considerably in chemical composition and temperature. The hottest and strongest is the Lorenz spring, the water of which, registering 124° Fahr., has to be allowed to cool over night before it is used. The patients remain for hours up to their necks in the bath, talking, reading, and otherwise amusing themselves in the most sociable style. Most of the hotels are open only from June to September. The little village has several times been destroyed by avalanches (1518, 1719, 1758), and a strong embankment has been erected on the eastern side to protect it from similar catastrophes.

LEUTSCHAU (Hungarian, *Löcse*; Latin, *Leutsovia;* Slovakian, *Levocza*), capital of the Cis-Tisian county of Szepes, Hungary, and until 1876 a royal free town, lies in an elevated position surrounded by mountains, and near the railway from Kassa (Kaschau) to Oderberg, about 120 miles north-east from Budapest, in 49° 1′ N. lat., 20° 35′ E. long. Leutschau is the seat of the county administration, and of a royal court of law, and has many fine old buildings, of which the most interesting is the church of St. James, a Gothic structure of the 13th century, with richly carved altar, several monuments, and a celebrated organ erected in 1623, and long reputed the largest in Hungary. The educational establishments comprise a royal upper gymnasium (founded 1520), a state upper real school (1868), a collegiate institute for girls, and a Minorite convent. The soil of the surrounding country is generally stony and sandy, and the climate from October to April severe, but the inhabitants nevertheless succeed in raising barley, wheat, oats, flax, and a large quantity of garden produce, especially beans and pease, which are considered the best in Hungary. Other sources of occupation are mining, foresting, horse, sheep, and cattle breeding, bee-keeping, and the preparation of wax, honey, and mead, for which last the town has long been noted. The number of beehives in 1881 was seven hundred. In December, 1881, the population was 6900, mostly Germans and Slovaks by nationality, and Roman Catholics and Lutherans by creed.

Founded by Saxon colonists in 1245, Leutschau had by the early part of the 16th century attained a position of great relative importance. In 1599 a conflagration laid the greater part of the town in ashes, and during the 17th century it suffered repeatedly at the hands of the Transylvanian princes and leaders. In 1849, at the time of the revolutionary war, nearly half the houses were destroyed by fire.

LEVEN, Alexander Leslie, Earl of, one of the most distinguished soldiers of his time, was born about the close of the 16th century. He was descended from a younger son of the ancient Scottish family of Balquhain. His father was George Leslie of Balgonie, commander of the castle of Blair, and his mother was Anne, daughter of Stewart of Ballechin. At his first outset in life he acted as a volunteer in Lord Vere's regiment in Holland, fighting with the Dutch against the encroachments of Spain, where he rose to the rank of captain. He then entered the service of Gustavus Adolphus of Sweden, and became field-marshal. In 1628, when the town of Stralsund was besieged by Wallenstein, and reduced almost to the last extremity, the king of Sweden sent Leslie to take the command of the garrison, and he acted with such resolution that he obliged the count to raise the siege. For this service medals were struck in his honor. In 1630 he drove the imperialists out of the island of Rügen, and continued to serve with great distinction in the Swedish armies till the troubles in Scotland brought him home. In 1639 he was invited by the Covenanters to take the command of their army. One of his first exploits was to take the castle of Edinburgh by surprise, without the loss of a man. He commanded the Scottish army at Dunse Law in May of that year, and in 1640 he invaded England, and defeated a party of the king's troops at Newburn, which gave him possession of Newcastle and other towns. At the treaty with the king at Ripon, Leslie was one of the commissioners of the parliament, and Charles was so well pleased with his behavior that he created him Lord Balgonie and Earl of Leven, by patent dated 1641.

After suppressing an insurrection in Ireland in 1642, he was in 1643 appointed to the command of the Scottish army sent to assist the parliamentary party against King Charles, but after the execution of that prince he warmly espoused the cause of his son, and served as a volunteer against Cromwell at the unfortunate battle of Dunbar in 1650. Next year, however, a gathering at Alyth of Angus royalists, of whom Leslie was one, was surprised and captured by the troops of General Monk, who was then besieging Dundee. The earl with some others was sent to London and confined in the Tower, where he remained incarcerated for some time, till by the intercession of the queen of Sweden he obtained his liberty. After visiting the queen, and thanking her in person for this service, he retired to his seat at Balgonie, in Fifeshire, and died there at an advanced age in 1661. He is said to have been of a diminutive size, and deformed in person, but prudent, vigilant, and expert in war. He acquired considerable landed property, particularly Inchmartin in the Carse of Gowrie, which he called Inchleslie. His granddaughter married George, earl of Melville; their descendant, the present representative of the title (1882), is twelfth earl of Leven and ninth earl of Melville.

LEVER, Charles (1806–1872), novelist, was born at Dublin on the 31st of August, 1806 (not 1809 as usually stated), and died at Trieste on the 1st of June, 1872. The accounts of the earlier part of his life are, considering the time at which he lived, singularly meagre, confused, and conflicting. His father was an architect, and he entered Trinity College, Dublin, in 1822, taking his degree in 1827. Many of the adventures of college life recorded in *Charles O'Malley* are believed to have actually happened. Later, Lever studied at Göttingen, and obtained a degree there. At some time or other before 1832 (for in this unsatisfactory way most of the facts of this part of his life are recorded) he is said to have visited America, and to have sojourned with the Indians, adopting their dress and mode of life, and going through adventures afterwards utilized in *Con Cregan* and *Arthur O'Leary*. But it is impossible to be certain as to this period; it is only towards the cholera outbreak of 1832 that something like a firm ground offers itself to the biographer. Lever had taken up the profession of medicine, and he was appointed, first to a district of which the headquarters was Kilrush in Galway, where *Harry Lorrequer* was begun, local stories being largely embodied in it, and then to a district in Ulster, around Coleraine and Newtown Limavady, where material was gathered for *Charles O'Malley* and the *Knight of Gwynne*. He married Miss Kate Baker, but even here the mist of uncertainty which envelops him exists, and it is not clear what the real date of the marriage was. After his cholera work was done he proceeded to Brussels. It has been usual to represent him as physician to the embassy, and even Thackeray (who knew him well) has given currency to the description by a quotation in the *Book of Snobs*. But it is certain that Lever was never formally appointed physician to the embassy, though he had letters of introduction to the secretary of the English legation there, and unquestionably practised. *Harry Lorrequer* was completed at Brussels, and it began to be published in 1837. It was followed by *Charles O'Malley* and *Jack Hinton*. All these stories, but especially the first two, were made up to a great extent of experiences through which Lever had gone, or stories which he had heard in Ireland, and of the reminiscences and oddities of English residents at Brussels, where there were then many retired English officers who had gone through the Peninsular and other campaigns of the great war. It is said in particular that Major Monsoon was almost a photograph of a well-known living character at the time, and much the same thing has been asserted of other personages. This piecing together of scraps accounts for the incoherency and absence of plot in the earlier books—defects which were increased by the author's habit of composing them in fragments, and revising them for the press with the utmost carelessness. The abundance and variety of his materials, however, his skill as a *raconteur*, and the fresh and almost boisterous good humor which blew through all his work, made him very popular, and he found a congenial illustrator in H. K. Browne. After a time proposals were made to him to undertake the editorship of the *Dublin University Magazine*, which he accepted, and held the post from 1842 to 1845. During this time his income was considerable, amounting, according to his biographer, to fully three thousand a year. He lived not in Dublin but a little way out of it, and exercised boundless hospitality to visitors. Besides this, he was an inveterate card player, and not on the whole a lucky one, and he was very fond of horses, which he kept in large numbers for himself and all his family. He was indefatigable in novel-writing, *Tom Burke*, *The O'Donoghue*, *The Knight of Gwynne*, etc., following those already named. But the work of editing was irksome to him, and for the reasons just named residence in Ireland made it comparatively unprofitable. He therefore resigned his editorship in the year 1845, and went abroad, where he was always more at home than in England or even in Ireland. At first he lived at Carlsruhe, where G. P. R. James was also residing; then he pitched his tent in a castle of Tyrol, which is said to be pretty accurately described in *A Day's Ride*. Afterwards he wandered about, finally settling at Florence. This neighborhood became specially agreeable to him, uniting as it did abundant society with the possibility of enjoying it without great expense. In November, 1858, he received from Lord Derby one of the rare pieces of patronage which have fallen in modern days to the share of Englishmen of letters, by being appointed consul at Spezzia. During this period of wandering or settled life on the Continent, he changed his style of novel-writing. His method was, as has been hinted already, always one rather of observation and reproduction than of deliberate creation, and as he had formerly drawn on the humors of Irish life, or the oddities of Wellington's veterans, so now he dealt with those of travelling Britons abroad, and with similar subjects. *The Daltons*, *The Dodd Family Abroad*, *Davenport Dunn*, etc., belong to this time and family for the most part, though some of them rather fall under the earlier class in style and date of composition. *One of Them*, *Barrington*, *The Fortunes of Glencore*, etc., led up to the most singular of all Lever's books, *A Day's Ride, a Life's Romance.* This book, which was published in *All the Year Round*, was said at the time—with what truth it is not easy to say—to have positively lowered the sale of that publication, yet it contains some of Lever's best work, and displays an originality not common with him. The mixture of burlesque and sentiment was, it may be supposed, either uncongenial or incomprehensible to the ordinary reader.

As he grew older, Lever, whose politics had been a rather indefinite Toryism, became more of a party man, and showed this in the papers published in *Blackwood's Magazine*, under the name of "Cornelius O'Dowd," papers of a miscellaneous kind, but often political. He is said to have thought of engaging, or to have been invited to engage, in regular journalism, but wisely declined. In 1867 he was transferred from Spezzia to Trieste, a change pecuniarily advantageous, but involving the loss of the society which he passionately loved. The last years of Lever's life were somewhat clouded. His health had never been good, and he had not lived carefully. His wife, to whom he was much attached, died before him. But he was still active with his pen, and the novels of his last period, if less lively than his earlier ones, are far better written as well as far more regular and careful in construction. Such are *Sir Brooke Fosbrooke*, *That Boy of Norcott's*, *Sir Jasper Carew*, *The Bramleighs of Bishop's Folly*, and his last book, *Lord Kilgobbin.* He died, as has been said, in the summer of 1872. Novels not yet mentioned are *Roland Cashel*, *Luttrell of Arran*, *Tony Butler*, *Maurice Tiernay*, *the Martins of Cro' Martin*, *St. Patrick's Eve*, *etc.*

Lever deserves an honorable place among the secondary novelists of the 19th century, but it is not very probable that any single novel of his will have a long lease of popularity. He is one of the authors who do not take the trouble to learn the mechanism of their art until the heyday of their imaginative force is past. The defects of his earlier works have been already indicated. They are written with almost inconceivable carelessness, the same incidents occurring over and over again, and the chronology being altogether bewildering. This is especially the case with *Charles O'Malley*, which, however, owing to the liveliness of its adventures and the personage of Mickey Free the Irish servant, is still perhaps the most popular of all. With young and uncritical readers this popularity is likely to be maintained until some supplanter in the same kind arises, or until the state of manners and society becomes too obsolete for anything more than historical interest. Then Lever, like all writers whose formal excellence is not sufficient to save them, will be forgotten; for his later work, though almost always amusing and sometimes more, has little abiding interest. The sole authority for Lever's biography is the *Life* by Dr. W. J. Fitzgerald (London, 1879). (G. SA.)

LEVERRIER, URBAIN JEAN JOSEPH (1811–1877), one of the greatest astronomers of modern times, was born at St. Lô in Normandy, March 11, 1811. His father, who held a small post under Government, made great efforts to send him to Paris, where a brilliant examination gained him, in 1831, admittance to the École Polytechnique. The distinction of his career there was rewarded with a free choice amongst the departments of the public service open to pupils of the school. He selected the administration of tobaccos, addressing himself especially to chemical researches under the guidance of Gay-Lussac, and gave striking proof of ability in two papers on the combinations of phosphorus with hydrogen and oxygen, published in *Annales de Chimie et de Physique* (1835 and 1837). His astronomical vocation, like that of Kepler, came from without. The place of teacher of that science at the École Polytechnique falling vacant in 1837, it was offered to and accepted by Leverrier, who, "docile to circumstance," instantly abandoned chemistry, and directed the whole of his powers to celestial mechanics. The first fruits of his arduous labors were contained in two memoirs presented to the Academy, September 16 and October 14, 1839. Pursuing the investigations of Laplace, he demonstrated with greater rigor the stability of the solar system, and calculated the limits within which the eccentricities and inclinations of the planetary orbits vary. This remarkable début excited much attention, and, on the recommendation of Arago, he took in hand the theory of Mercury, producing, in 1843, tables of that planet far superior in accuracy to those hitherto available. The perturbations of the comets discovered, the one by Faye in November, 1843, the other by De Vico a year later, were minutely investigated by Leverrier, with the result of disproving the supposed identity of the first with Lexell's lost comet of 1770, and of the other with Tycho's of 1585. On the other hand, he made it appear all but certain that Vico's comet was the same with one seen by Lahire in 1678. He was once more, by the summons of Arago, recalled to planetary studies, and this time it was to Uranus that his attention was directed. Step by step, with sagacious and patient accuracy, he advanced to the great discovery which has immortalized his name. Carefully sifting all the known causes of disturbance, he showed that one hitherto unknown must be added to their number, and on the 23d of September, 1846, the planet Neptune was discerned by Galle at Berlin, within one degree of the spot indicated by Leverrier. See ASTRONOMY, p. 711.

This memorable achievement was greeted with an outburst of public enthusiasm, and requited with a shower of public distinctions. Academies vied with each other in enrolling Leverrier among their members; the Royal Society awarded him the Copley medal; the king of Denmark sent him the order of the Dannebrog; he was named officer in the Legion of Honor, and preceptor to the Comte de Paris; a chair of astronomy was created for his benefit at the Faculty of Sciences; he was appointed adjunct astronomer to the Bureau of Longitudes. Returned to the Legislative Assembly in 1849 by his native department of Manche, he voted with the anti-republican party, but devoted his principal attention to subjects connected with science and education. After the *coup d'état* he became a senator and inspector-general of superior instruction, sat upon the commission for the reform of the École Polytechnique (1854), and, on January 30, 1854, succeeded Arago as director of the Paris observatory. His official work in the latter capacity would alone have strained the energies of an ordinary man. The institution had fallen into a state of lamentable inefficiency. Leverrier placed it on a totally new footing, freed it from the control of the Bureau of Longitudes, and raised it to its due rank among the observatories of Europe. He did not, however, escape the common lot of reformers. His uncompromising measures and unconciliatory manner of enforcing them raised a storm only appeased by his removal, February 5, 1870. Three years later, on the death of his successor Delaunay, he was reinstated by M. Thiers, but with authority restricted by the supervision of a council. In the midst of these disquietudes, he executed with unflinching resolution a task the gigantic proportions of which cannot be contemplated without amazement. This was nothing less than the complete revision of the planetary theories, together with a laborious comparison of results with the most authentic observations, and the construction of tables representing the movements thus corrected. It required all his indomitable perseverance to carry through to the end a purpose which failing health continually menaced with frustration. He had, however, the happiness of living long enough to perfect this work. Three weeks after he had affixed his signature to the printed sheets of the theory of Neptune he died at Paris, in his sixty-seventh year, September 23, 1877. By his marriage with Mademoiselle Choquet, who survived him a little more than a month, he left a son and daughter.

The discovery with which the memory of this great man is popularly identified was only an incident in his career. The elaboration of the scheme of the heavens traced out by Laplace in the *Mécanique Céleste* was its larger aim, for the accomplishment of which forty years of unremitting industry barely sufficed. The work once done, however, may almost be said to have been done for all time, from the extraordinary care with which errors were guarded against, and imperfections in the data allowed for. The organization of the meteorological service in France is entirely due to Leverrier, and the present system of international weather-warnings is the realization of a design which he warmly promoted. He founded the Association Scientifique, and was active in introducing a practical scientific element into public education. His inference of the existence, between Mercury and the sun, of an appreciable quantity of circulating matter (*Comptes Rendus*, 1859, ii. p. 379), though unquestionably sound, has not yet been satisfactorily verified by observation. He was twice, in 1868 and 1876, the recipient of the gold medal of the Royal Astronomical Society, London, and the university of Cambridge conferred upon him, in 1875, the honorary degree of LL.D. All his planetary tables have been adopted by the *Nautical Almanac*, as well as by the *Connaissance des Temps*.

The *Annales de l'Observatoire de Paris*, the publication of which was set on foot by Leverrier, contain, in vols. i.–vi. (*Mémoires*), 1855–61, and x.–xiv., 1874–77, his theories and tables of the several planets. In vol. i. will be found, besides his masterly report on the observatory, a general theory of secular inequalities, in which the development of the disturbing function is carried to a point hitherto unattempted. The memoirs and papers communicated by him to the Academy have been summarized in *Comptes Rendus*, 1839–76, and the more important published in full either separately, or in the *Conn. des Temps* and the *Journal des Mathématiques*. That entitled *Développemens sur différents points de la Théorie des perturbations*, 1841, has been translated in part xviii. of Taylor's *Scientific Memoirs*. For his scientific work see Professor Adams's address, *Monthly Notices*, vol. xxxvi. p. 232, and M. Tisserand's review in *Ann. de l'Obs.*, tom. xv., 1880; for a notice of his life, M. Bertrand's "Éloge Historique," *Mém. de l'Ac. des Sciences*, tom. xli., 2me série. (A. M. C.)

LEVIS, formerly POINTE LEVI or POINT LEVIS, the chief town of a county of the same name in Canada, on the other side of the St. Lawrence from Quebec, with which it communicates by a ferry. In the beginning of the present century Pointe Levi was a cluster of white houses, with a church and a number of large mills; it has now become an important station on the Grand Trunk Railway, and in the extent of its river trade is surpassed by only a few places in the Dominion. In 1881 the population was 7597.

LEVITES (לְוִיִּם), or sons of Levi (בְּנֵי לֵוִי), are defined according to the usual methods of Hebrew genealogical history as the descendants of Levi, the third son of Jacob by Leah (Gen. xxix. 34).[1] But in Hebrew genealogies we are not necessarily entitled to look upon the eponymus of a tribe as more than an ideal personality, and, without entering into the large question how far the patriarchal history may be held to furnish exceptions to this rule, it may be observed that the only narrative in which, on a literal interpretation, Levi appears as a person (Gen. xxxiv.) bears internal evidence of the intention of the author to delineate under the form of personification events in the history of the tribes of Levi and Simeon which must have taken place after the sojourn of Israel in Egypt.[2] The same events are alluded to in Gen. xlix. 5–7, where Simeon and Levi are plainly spoken of as communities with a communal assembly (קָהָל). They were allied tribes or brothers; their onslaught on the Shechemites was condemned by the rest of Israel; it took place before the Hebrews had passed from pastoral to settled life (ver. 5, "instruments of violence are their shepherds' staves"); and its results were disastrous to the actors, when their cause was disavowed by their brethren. The Bnê Hamor regained possession of Shechem, as we know from Judges ix., and both the assailing tribes were scattered through Israel, and failed to secure an independent territorial position. The details of this curious portion of the earliest Hebrew history must remain obscure; the narrative in Gen. xxxiv. does not really place them in so clear a light as the briefer reference in Gen. xlix.; for the former chapter has been recast and largely added to by a late writer, who looks upon the action of the brethren in the light of the priestly legislation, and judges it much more favorably than is done in Gen. xlix. In post-canonical Judaism the favorable view of the zeal of Levi and Simeon becomes still more dominant (Judith ix. 2. *sq.*; *B. Jubil.*, chap. xxx.; and especially Theodotus, *ap.* Polyhistor, in Müller's *Fragmenta*, iii. 217 *sq.*), and the curse of Jacob on the ferocity of his sons is quite forgotten.[3] In the oldest history, however, the treachery of Levi and Simeon towards a community which had received the right of *connubium* with Israel is represented as a crime, which imperilled the position of the Hebrews and was fatal to the future of the tribes directly involved.

But while the Levites were scattered throughout Israel their name does not disappear from the roll of the tribes. In the Blessing of Moses (Deut. xxxiii.), where Simeon is passed over, Levi still appears, not as a territorial tribe, but as the collective name for the priesthood. The priesthood meant is that of the northern kingdom under the dynasty of Jehu, to which the chapter in question belongs; and in fact we know that the priests of the important northern sanctuary of Dan traced their origin to a Levite (Jud. xvii. 9), Jonathan the son of Gershom, the son of Moses (Jud. xviii. 30).[4] That the Judæan priesthood were also known as Levites in the later times of the kingdom appears from the book of Deuteronomy, especially from x. 8 *sq.*, xviii. 1 *sq.*; and we learn from Ezek. xliv. 10 *sq.* that the Judæan Levites were not confined to the service of the temple, but included the priests of the local high places abolished by Josiah. Alike in Judah and in the north the priestly prerogative of Levi was traced back to the days of Moses (Deut. x. 8, xxxiii. 8); but in later times at least the Judæan priesthood did not acknowledge the Levitical status of their northern colleagues (1 Kings xii. 31). It must, however, be observed that the prophets Amos and Hosea never speak of the northern priesthood as illegitimate, and Hosea iv. certainly implies the opposite. Presumably it was only after the fall of Samaria, and the introduction of large foreign elements into the population of the north, that the southern priests began to disavow the ministers of the sanctuaries of Samaria, most of whom can no longer have been representatives of the old priesthood as it existed before the northern captivity (2 Kings xvii. 28, comp. Amos vii. 17, Jud. xviii. 30, 2 Kings xxiii. 20, in contrast with verses 8 *sq.*).

In the most developed form of the hierarchical system the ministers of the sanctuary are divided into two grades. All are regarded as Levites by descent, but the mass of the Levites are mere subordinate ministers not entitled to approach the altar or perform any strictly priestly function, and the true priesthood is confined to the descendants of Aaron. In the documents which reveal to us the actual state of the priesthood in the northern and southern kingdoms before the exile, there is no trace of this distinction. Every Levite is a priest, or at least is qualified to become such (Deut. x. 8, xviii. 7). The subordinate and menial offices of the tabernacle are not assigned to members of a holy guild; in Jerusalem at least they were mainly discharged by members of the royal body-guard (the Carians and footmen, 2 Kings xi. 4, *Heb.*), or by bond slaves, the ancestors of the later Nethinim,—in either case by men who might even be uncircumcised foreigners (Ezek. xliv. 7 *sq.*). A Levitical priest was a legitimate priest; when the author of 1 Kings xii. 31 wishes to represent Jeroboam's priests as illegal he contents himself with saying that they were not taken from the sons of Levi. The first historical trace of a modification of this state of things is found in connection with the suppression of the local high places by Josiah, when their priests were brought to Jerusalem and received their support from the temple offerings, but were not permitted to minister at the altar (2 Kings xxiii. 9). The priests of the temple, the sons of Zadok, were not prepared to concede to their provincial brethren all the privileges which Deut. xviii. had proposed in compensation for the loss of their local ministry. Ezekiel, after the fall of the temple, in planning a scheme of ritual for the new temple, raises this practical exclusion from the altar to the rank of a principle. In the new temple the Levites who had ministered before the local altars shall be punished by exclusion from proper priestly work, and shall fill the subordinate offices of the sanctuary in place of the foreigners who had hitherto occupied them, but shall not be permitted to pollute Jehovah's house in future by their presence (Ezek. xliv. 7 *sq.*). After the exile this principle was actually carried out; priests and Levites are distinguished in the list of the Jews who returned under the decree of Cyrus (Ezra ii.; Neh. vii.); but the former, that is, the descendants of the pre-exilic priests of the royal temple, greatly outnumber the Levites or descendants of the priests of the high places. At this time other classes of temple servants, the singers, the porters, the Nethinim or slaves of the sanctuary, and the children of Solomon's slaves, whose hereditary service would, on Eastern principles, give them a pre-eminence over other slaves of the sanctuary, are also still distinguished from the Levites; but these distinctions lost their significance when the word Levite itself came to mean a subordinate minister. In the time of Nehemiah, Levites and singers, Levites and porters, are very much run into one (Neh. xi., xii., xiii.), and ultimately the absorption of the other classes of subordinate ministers into the hereditary guild of Levites is formally expressed in the shape of genealogies, deriving the singers, and even families whose heathenish and foreign names show them to have originally belonged to the Nethinim, from the ancient stock of Levi.[1]

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[1] In Gen. xxix. 34 the name of Levi is connected with נִלְוָה, "attach oneself to." The form, however, is that of a gentile noun, and it is most probably a *nisbeh* from Leah, as suggested by Wellhausen. See also Stade in *Z. f. A. T.liche Wissenschaft*, i. 115.

[2] Jacob in verse 30 is not a personal but a collective idea, for he says, "I am a few men," and the capture and total destruction of a considerable city is in the nature of things the work of two tribes rather than of two individuals.

[3] According to Wellhausen's analysis (*Jahrb. f. D. Theol.*, xxi. 435 *sq.*), the old narrative consisted of Gen. xxxiv. 3, 7*, 11, 12, 19, 25*, 26*, 30, 31, the asterisk denoting that only parts of the verses marked by it are ancient. The latest and most satisfactory discussion is that of Kuenen (*Theol. Tijdsch.*, xiv. 257 *sq.*), in which the opposite view of Dillmann (*Genesis, ad l.*) is fully refuted.

[4] It is generally agreed that Moses (מֹשֶׁה) is the true reading. The later Jews corrected the name to Manasseh by inserting the letter נ, but did not venture to do so except above the line (מנשה), so that the reading of the archetype can still be restored.

The new hierarchical system found its legal basis in the Pentateuch, or rather in the so-called priestly legislation, first publicly accepted as an integral part of the Torah under Ezra and Nehemiah. Here the exclusion of the Levites from all share in the proper priesthood of the sons of Aaron is precisely formulated (Num. iii. *sq.*): their service is regulated from the point of view that they are essentially the servants and hereditary serfs of the priests (iii. 9), while, on the other hand, they are recognized as possessing a higher grade of holiness than the mass of the people, and are endowed with the tithes, of which in turn they pay a tithe to the priests (Num. xviii. 21 *sq.*). These regulations as to tithes were enforced by Nehemiah; but the subordinate position of the Levites was hardly consistent with their permanent enjoyment of revenues of such importance, and we learn from the Talmud that they were finally transferred to the priests.[2] Another provision of the law, viz., the assignation to the Levites of certain cities with a definite measure of inalienable pasture ground (Num. xxxv.; Lev. xxv. 34), was apparently never put in force after the exile.

As the priestly legislation carried its ordinances back into the time of Moses (see PENTATEUCH), so the later developments of the Levitical service as they existed in the time of the Chronicler about the close of the 4th century B.C. are referred by that author to David (1 Chron. xv., xvi., xxiii.) or to Hezekiah (2 Chron. xxix.) and Josiah (2 Chron. xxxv.). The chief point is the development of the musical service of the temple, which has no place in the Pentateuch, but afterwards came to be of the first importance, as we see from the Psalter, and attracted the special attention of Greek observers (Theophrastus, *ap.* Porph., *De Abstin.*, ii. 26).

While it is not difficult to trace the history of the Levites from the time of the Blessing of Moses and Deuteronomy downwards, the links connecting the priestly tribe with the earlier fortunes of the tribe of Levi are hardly to be determined with any certainty.

According to the traditional view the scheme of the Levitical legislation, with its double hierarchy of priests and Levites, is of Mosaic ordinance. But there are many proofs that in the Pentateuch, as we possess it, divergent ordinances, dating from very different ages, are all carried back by means of a legal convention to the time of the wilderness journey. And, if the complete hierarchical theory as it existed after the exile was really the work of Moses, it is inexplicable that all trace of it was so completely lost in the time of the monarchy, that Ezekiel speaks of the degradation of the non-Zadokite Levites as a new thing and as a punishment for their share in the sin of the high places, and that no clear evidence of the existence of a distinction between priests and Levites has been found in any Hebrew writing demonstrably earlier than the exile.[3] It is indeed argued that the narrative of the rebellion of Korah, and the list of Levitical cities in Josh. xxi., imply that the precepts of the post-exile law were practically recognized by Moses and Joshua; but it is certain that the distribution spoken of in Josh. xxi. did not take place at the time of the conquest, because many of the cities named were either not occupied by the Hebrews till long afterwards, or, if conquered, were not held by Levites. The Levitical cities of Joshua are indeed largely identical with ancient holy cities (Hebron, Shechem, Mahanaim, etc.); but in ancient Israel a holy city was one which possessed a noted sanctuary (often of Canaanite origin), not one the inhabitants of which belonged to the holy tribe. These sanctuaries had of course their local priesthoods, which in the time of the monarchy were all called Levitical; and it is only in this sense, not in that of the priestly legislation, that a town like Shechem can ever have been Levitical. So again the narrative of Korah proves on critical examination to be of composite origin; the parts of it which represent Korah as a common Levite in rebellion against the priesthood of Aaron belong to a late date, and the original form of the history knows nothing of the later hierarchical system.[4]

We are thus compelled to give up the idea of carrying back the distinction of Levites and Aaronites in the later sense to the time of Moses, and are excluded from using the priestly parts of the Pentateuch and Joshua as a source for the earliest history of the tribe. It still, however, remains certain that under the monarchy the priestly consecration of Levi was referred to the time of Moses, who was himself a member of the tribe, and in Deut. x. 8 the functions of Levi are specially connected with the Mosaic sanctuary of the ark. Now we know from 1 Sam. ii. 27 *sq.* that the priests of the ark in the period of the Judges claimed descent from the family of Moses; and the case of Micah's Levite shows that a descendant of Moses was regarded as a peculiarly fit priest. The whole evidence conspires to show that from the time of Moses downward his kin had a certain hereditary prerogative in connection with the worship of Jehovah. In the earliest times the ritual of Jehovah's sanctuary had not attained such a development as to occupy a whole tribe; but if, as appears probable, the mass of the tribe of Levi was almost annihilated in the first age after Moses, the name of Levite might very well continue to be known only in connection with those of the tribe who traced kin with Moses or remained by the sanctuary. The multiplication of Hebrew holy places was effected partly by syncretism with the Canaanites, partly in other ways that had nothing to do with the Mosaic sanctuary, and so a variety of priestly guilds arose which certainly cannot have been all of Levitical descent. But, as the nation was consolidated and a uniform system of sacred law, referred to Moses as its originator, came to be administered all over the land, in the hands of the ministers of the greater sanctuaries, the various guilds must have been drawn together and have aimed at forming such a united body as we find described in Deut. xxxiii.; and this unity would find a natural expression in the extension of the name of Levites to all priesthoods recognized by the state. If this was the course of things we can hardly suppose that the term came into large use till the Israelites were consolidated under the monarchy, and in fact the integrity of the text in 1 Sam. vi. 15, 2 Sam. xv. 24, as well as 1 Kings viii. 4, is open to question. Up to the time of David and Jeroboam, as appears from the cases of Samuel, Zadok, Eleazar (1 Sam. vii. 1), and the sons of David (2 Sam. viii. 18), as well as from 1 Kings xii. 31, the priesthood was not essentially hereditary; but, like all occupations that required traditional knowledge, it must have tended to become more and more so, so that all priests would appear as Levites by adoption if not by descent. Wellhausen (*Gesch.*, i. 139) has argued from Deut. xxxiii. 9 that the northern priesthood was not an hereditary guild, but involved the surrender of all family connection; the words, however, are more naturally understood as praise of the judicial impartiality which refused to be influenced by family ties. Our data are too scanty to clear up the details of this interesting piece of history; but it can hardly be doubted that the development of a consolidated and hereditary priestly corporation in all the sanctuaries was closely bound up with the unification of the state and the absorption of tribal organization in the monarchy. The reaction of tribal feeling against the central government, of which there are many traces in the history of Ephraim, has perhaps its counterpart in the opposition to the unified priesthood which is alluded to in Deut. xxxiii. 11.

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[1] See the details, and the proof that the later Levites included men whose actual ancestry belonged to other tribes, in Ewald's *Geschichte*, iii. 380 Wellhausen, *Geschichte*, i 152, 229; Graf in Merx's *Archiv*, i. 231.

[2] See Mishna, *Maaser Sheni*, chap. v. end, and the *Jerusalem Gemara* (iii. 259 of Schwab's translation); *Yebamoth*, f. 86a; Carpzov, *App. ad Godw.*, p. 624; and Hottinger, *De Dec.*, vi. 8, ix. 17.

[3] The recent defence of the traditional view by S. I. Curtiss (*The Levitical Priests*, 1877) still seeks such evidence in 1 Kings viii. 4. But there are many evidences that the text of this part of Kings has undergone considerable editing at a pretty late date. The LXX. translators did not read the clause which speaks of "priests and Levites," and the Chronicler read "the Levite priests,"—the phrase characteristic of the Deuteronomic identification of priestly and Levitical ministry.

[4] See the latest researches of Kuenen, *Theol. Tijdsch.*, xii. 139 *sq.*, where other recent discussions of the chapter are cited and examined.

There have been many attempts on the part of recent writers from the time of Vatke downwards to deny that Levi was one of the original tribes of Israel, but they all break down before the testimony of Gen. xlix. See especially Kuenen's refutation of the theory of Land, *Theol. Tijdsch.*, 1872, p. 628 *sq.*; and for the latest aspects of the whole subject Graf in Merx's *Archiv*, vol. i. (1869), "Zur Geschichte des Stammes Levi;" Wellhausen, *Gesch.*, i. p. 123 *sq.*; Stade, *Gesch. d. V. Israels*, p. 152 *sq.* (W. R. S.)

LEVITICUS. See PENTATEUCH.

LEW-CHEW ISLANDS. The Lew-chew, Loochoo, Liu Kiu, or Riu Kiu Islands[1] include, in the wider application of the name, the whole series extending in a north-east and south-west direction from the southern end of Kiushiu in Japan proper to the north-east of Formosa. Within the northern group lies the intersection of 130° E. long. and 30° N. lat.; and in the southern group that of 125° E. long. and 25° N. lat. The islands, however, to the north of 29° are not unfrequently considered, by Europeans as well as Japanese, to belong in part to Japan proper, and in part to constitute the separate group of the Linschotens, Shichito, or Cecille Archipelago.

The following, according to Doederlein, are the recognized subdivisions and areas of the whole archipelago:—(1) *The Northern Islands* (attached to Satsuma or Kiushiu Osumi, 398 square miles): Tanega (189 square miles), Make, Yakuno (172 square miles), Take, Yuo or Iwoga, Kuro, Kose or Kowose, and Kuchino-Erabu or Nagarobe; (2) *Shichi-to* (43 square miles): Kuchino, Gaza or Yebi, Naka-no (the largest, 13 square miles), Hira or Fira, Suwase, Akuseki, Takara, and Yoko; (3) *Hokubu-Shoto* (515 square miles): Oshima (302 square miles), Kageruma or Katona 40 square miles), Yoro, Uke or Uru, Kitai, Tokono or Kakirouma (92 square miles), Naka Erabu, and Yoron or Yori; (4) *Chubu-Shoto* (592 square miles): Tori or Iwo, Eheya or Tebeya, Isona, Iye, Awakuni or Agunyeh, Tonashi, Kume, Kerama or Amakirima, and Okinawa (520 square miles); (5) *Nambu-Shoto* or the Meiakoshima Group (315 square miles): Miyako or Ty-pin-san (57 square miles), Misuna and Tarama, Ishigaki or Pat-chung-san (104 square miles), Taketoma or Robertson Island, Ohama or Kubah, Kuro or Baugh, Iriomoto Nishiomoto or Koo-Kien-San, Aragusuku or Chung-chi, Hateruma or Hasyokan, Yonakuni or Kumi.

The area of the Lew-chews proper is thus 1423 square miles, that of the whole chain 1864 square miles. The largest islands are Okinawa (often called Great Lew-chew) and Oshima, the former being also the political centre of the whole archipelago. The Lew-chews consist in the main of crystalline rocks—gneiss, hornblende, and granite—upheaved at a very remote date, and only partially covered by severely weathered sedimentary strata seldom left in their original horizontal position. Coralline limestone is found in great abundance even on the tops of the hills, and the coasts are often fringed by coral reefs. In Okinawa a soft argillaceous rock occupies a large part of the surface. Though the existence of Sulphur Island with its smoking crater towards the north-west shows that volcanic activity is still going on at no great distance, the main islands at least seem to bear no trace of recent subterranean disturbance. Their surface is very irregular: Okinawa consists for the most part of a succession of rounded swelling hills, 300 to 500 feet in height, broken towards the centre by more precipitous crags, and Oshima may be best described as a cluster of steep mountains reaching in Yowangatake a height of about 2100 feet. Of the many streams a few attain considerable dimensions, and serve to carry the timber from the highlands; and all round the coasts are excellent harbors. The mildness and humidity of climate, which is the natural consequence of the geographical position of the archipelago, is further enhanced by the neighborhood of the Kuro-Siwo or Pacific gulf-stream. Snow never falls on the tops even of the highest hills; but at the same time even in summer the heat is seldom extreme. Three days seldom pass without rain; sudden downpours are not unfrequent, and wet weather often lasts for several days on end. The boundary between the Palæoarctic and Oriental regions passes to the north of Oshima, which is the northern limit of many southern forms at once of vegetable and animal life both on land and sea. Sago trees and other *Cycadaceæ*, banyans, and pine trees (resembling the cedar of Lebanon) are abundant, and the natives, who succeed well both as farmers and as gardeners, grow wheat, rice, bananas, tarro (*Colocasia*), sweet potatoes, maize, millet, sugar-cane, eggplants, etc. There is a small but excellent breed of cattle (usually black); and ponies, pigs, goats, and poultry are kept.

Part of the population of the northern Lew-chews is evidently Japanese, but the aboriginal and preponderating element is of quite another type, in some points similar to the Ainos. The striking features, according to Doederlein, are a comparatively narrow face ending in a pointed chin, large European-looking eyes, thin lips, thin and rather convex nose, strongly developed beard, and a luxuriant growth of hair over breast, arms, and legs. The women are (or were, for the practice is forbidden by the Japanese) accustomed to tattoo the back of the hands with a special pattern in a dark blue color. Though closely allied to Japanese, the native language is a genuinely independent form, containing obsolete words only found in the ancient monuments of Japanese literature, and showing the greatest resemblance to the Satsuma dialect. The use of Japanese and Chinese by the learned has prevented it being used for literary purposes; and the version of the Bible prepared by the missionary Dr. Bettelheim (sent out in 1845) is really in Japanese. There was neither printing press nor bookshop in the islands as late as 1876 (see G. W. Aston in *Church Miss. Intell.*, 1879). The lowest class of the population have neither civil rights nor personal freedom; next in order come the peasants, who rent the land from the Government; and above all are the literati or governing class. Rank is indicated by various symbols, particularly by the kind of metal of which the hair-pins are made, and by the color of the robes and head-dress. Confucianism and Buddhism seem to have had considerable influence on the upper classes at least in Okinawa; in Oshima there is neither temple nor priest, and the people say they pray to no god. The sole objects of worship (if worship it be) are the manes of one's immediate ancestors. To the dead great respect is shown in both islands,—the wealthier people building on the hillsides large and handsome tombs, which from a distance look like dwelling-houses. The body is buried in a coffin in a sitting posture, and after seven years the bones are collected and placed in an urn.

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[1] See a curious history of the name in Li Ting Yuen's Journal.

The population of Okinawa was estimated by the American expedition at from 150,000 to 200,000. Doederlein was informed by the officials that Amami Oshima contained 50,000 souls, but thinks 30,000 a more probable conjecture. Besides Napa or Napa-Kiang the capital, and Shui the royal residence, there are some thirty-six towns in Okinawa, with about 6000 inhabitants each; in the other island Nase the chief town (comprising Itsubemura and Kanekumura) has not more than 2000, and only five or six of the other villages exceed 500.

Though Captain Broughton visited Napa in 1797, it was not till the Alceste and Lyra expedition in 1816–17 that detailed information about the Lew-chews was obtained. The people at that time showed a curious mixture of courtesy and shyness. Her British Majesty's ship "Sphinx" visited Okinawa in 1852; and the American expedition under Commodore Perry (1852–54) added very largely to our knowledge of the island, and concluded a treaty of friendship with its Government, securing for the United States the right of using Tamui near Napa as a coaling depôt.

Theen-sun, "Grandson of Heaven," is the mythical founder of the Lew-chew monarchy. Towards the close of the 12th century, his descendants were driven from the throne by a usurper Le-yung; but the old national party soon found a victorious leader in Sun-thien-ong son of Tametomo, a member of the famous Yoritomo family, who, having been expelled from Japan, had come to Lew-chew and married the youngest sister of Ansoo, governor of Oho-prto. The introduction of the arts of reading and writing is assigned to Sun-thien-ong's reign. Chinese invasions of Lew-chew may be traced back to the 6th century, but they did not result in annexation; and it was Hung-woo, the founder of the Ming dynasty, who first in 1395 obtained from the Lew-chew ruler recognition of Chinese supremacy. The earliest notice of intercourse with Japan belongs to the year 1441, when a voluntary gift of copper money (at that time extremely scarce in Japan) was made by the Lew-chewans to the tenno Go-Hanazone; but for a long time afterwards the relations of the two powers continued to be of the friendliest description. In the beginning of the 17th century the Lew-chew minister Yana, anxious to gain favor with the Chinese Government, persuaded his king to break off all connection with Japan, and when the prince of Satsuma sent to remonstrate against this course of conduct his envoys were maltreated. For this insult the prince exacted signal vengeance. With the permission of his liege lord he invaded the islands with 8000 men, took the capital by storm, and captured the king and carried him off to Kagoshima. A few years later the unfortunate Seang-leng was restored to his throne, but only on condition that he and his successors should receive reinvestiture on the accession of each new shogun, and that each new king of Lew-chew should send an embassy to Yedo. The Lew-chewans nevertheless continued to pay tribute to China, and Chinese commissioners were despatched to attend the installation of their kings. Particular interest in the islands was displayed by the emperor Kang-hi, whose memory is still cherished by the natives as that of a great benefactor; he built them a temple in honor of Confucius, founded a Chinese school, and, when they were in great distress through hurricanes, plague, and famine, contributed liberally for their relief. Su-pao-Koang, from whose report was derived the first information about the islands which found its way to Europe, was Kang-hi's commissioner in the year 1719. When in 1859 the house of Seang became extinct in the direct line, Shotai, a descendant of Satto, governor of Urasoyé, was called to the throne. On the establishment of the imperial authority of the mikado he received the title of sovereign prince of Lew-chew; but at the same time his territory was declared first a *han* or feudal dependency and afterwards a *ken* or province of the Japanese monarchy. In 1873, according to a custom with which the lords of Satsuma had not interfered, the people of Lew-chew sent to pay their biennial tribute to China. This was forbidden by the mikado; and it was in vain that they urged—"For five hundred years China has protected us; we regard China as our father, and Japan as our mother." The Japanese Government insisted on its exclusive rights, and undertook to settle the difficulty with China. Its claims were formally recognized by the treaty of Peking in 1874, and the islands are treated as an integral part of the empire.

See Gaubil's extracts from Su-pao-Koang in *Lettres édifiantes*, vol. xxiii.; Klaproth in *Mémoires rel. à l'Asie*, vol. ii.; Hervey de Saint Denys's translation of Ma-twan-lin's *Encyclopædia*; Basil Hall, *Voy. of Dis. to the West Coast of Corea and the Great Loochoo Island*, London, 1818; John M'Leod, *Voy. of H. M. S. "Alceste,"* London, 1819; George Smith (bishop of Victoria), *Lew-chew and the Lew-chewans*, London, 1853; Halloran, *Wae Yang Jin—Eight Months' Journal, etc.*, London, 1856; Commodore Perry's *Narrative*, New York, 1856 (a most important work); E. W. Sator, "Notes on Loo-choo," in *The Phœnix* (a monthly magazine for India, etc.), vol. iii., London, 1872–73; J. J. Hoffmann in *Bijdragen tot de T. L. en V. Kunde van Ned. Ind.*; L. Serrurier, "De Lioe-Kioe Archipel," in *Tijdschr. v. het Aardrijksk. Gen. te Amsterdam*, 1880 (containing extracts from the Japanese sketch of the geography of Japan, published in 1873 by the minister of war); Wells Williams's epitome of "Shi Liu-Kiu-Ki,—Journal of an Envoy to Lew-chew by Li Ting Yuen, 1803," in *Proc. of Roy. As. Soc. North China Branch*, 1871; Henry Brunton, "Visit to Okinawa," in *Japan Mail*, January 22, 1876; Tournafond, "Les isles Loutschou," in *L'Exploration*, 1880; A. v. Klöden in Petermann's *Mittheil.*, 1880; Doederlein, "Die Liu-Kiu-Insel Amami Oshima," in *Mittheil. d. deut. Ges. f. Natur- und Völkerk. Ostasiens*, Yokohama, 1881.

LEWES, a market-town and parliamentary borough, and the county town of Sussex, England, is situated on the river Ouse, at the junction of a number of railway lines, 50 miles south of London, and 7 north of Newhaven, which is its port. It occupies the slope of one of the chalk hills, and consists principally of one main street with smaller and narrower ones at right angles. St. Michael's church, restored in 1878, is without architectural merit, but possesses some old brasses and monuments; St. Anne's church is a very ancient structure in the Early English style; St. Thomas at-Cliffe, in the Perpendicular style, was erected in the 15th century; St. John's, Southover, is of mixed architecture, but preserves some specimens of Early Norman. There are only slight remains of the old castle, occupying a picturesque situation on the height, and supposed to have been founded by Alfred and rebuilt by William de Warren. In the grounds of the old Cluniac priory of St. Pancras, founded in 1078, the leaden coffins of William de Warren and Gundrada were dug up during an excavation in 1845. There is a free grammar school dating from 1512, and among the other public buildings are the county-hall, the prison, and the Fitzroy memorial library. The industries include the manufacture of agricultural implements, brewing, tanning, and iron and brass founding. The population of the urban sanitary district in 1871 was 6010, and in 1881 it was 6017, the population of the parliamentary borough (area 1087 acres) in the same years being 10,753 and 11,199. Lewes was incorporated by royal charter in 1881.

From various discoveries that have been made of Roman coins, and the traces that still remain of old mounds and tumuli, the town is believed to be of very ancient origin. It was a royal demesne of the South Saxon kings. Mints were established at it by Athelstan, which were in operation till the reign of Harold. At the battle of Lewes, May 13, 1264, Simon de Montfort defeated Henry III. From the time of Edward I. until 1868 the town returned two members to parliament, but now it returns only one.

See, besides the histories of Sussex, Horsfield, *History of Lewes*, 2 vols., 1824–27, and several interesting papers in the Sussex *Archæological Collection*.

LEWES, George Henry (1817–1878), a prolific and versatile writer, born in London in 1817, was a grandson of Charles Lee Lewes, a comedian who had a considerable reputation in his day. He was educated in London, Jersey, and Brittany, and began active life by attempting business and afterwards medicine. Later he appears to have had serious thoughts of making the stage his profession. He finally fixed his choice on a literary career. His early writings belong mainly to the lighter departments of letters. He contributed a large number of critical studies to the leading quarterly and other reviews. These discuss a wide variety of subject, and, though often characterized by hasty impulse and imperfect study, betray a singularly acute critical judgment, which has been enlightened by philosophic study. Of these critical writings the most valuable are those on the drama, which were afterwards republished under the title *Actors and Acting* (1875). With this may be taken the volume on *The Spanish*

Drama (1846). The combination of wide scholarship, philosophic culture, and practical acquaintance with the theatre gives these essays a high place among the best efforts in English dramatic criticism. In 1845–1846 he published *The Biographical History of Philosophy*, an attempt to depict the life of philosophers as an ever-renewed fruitless labor to attain the unattainable. In 1847–1848 he made two attempts in the field of fiction —*Ranthrope*, and *Rose, Blanche, and Violet*—which, though displaying considerable skill both in plot, construction, and in characterization, have taken no permanent place in literature. The same is to be said of an ingenious attempt to rehabilitate Robespierre (1849). The culmination of the author's work in prose literature is the *Life of Goethe* (1855), probably the best known of his writings. Lewes's many-sidedness of mind, and his combination of scientific with literary tastes, eminently fitted him to appreciate the large nature and the wide-ranging activity of the German poet. The high position this work has taken in Germany itself, notwithstanding the boldness of its criticism and the unpopularity of some of its views (*e. g.*, on the relation of the second to the first part of *Faust*), is a sufficient testimony to its general excellence. From about 1853 Lewes's writings show that he was occupying himself with scientific and more particularly biological work. He may be said to have always manifested a distinctly scientific bent in his writings, and his closer devotion to science was but the following out of early impulses. Considering the author's want of the usual course of technical training, these studies are a remarkable testimony to the penetration of his intellect. The most important of these essays are collected in the volumes *Seaside Studies* (1858), *Physiology of Common Life* (1859), *Studies in Animal Life* (1862), and *Aristotle, a Chapter from the History of Science* (1864). They are much more than popular expositions of accepted scientific truths. They contain able criticisms of authorized ideas, and embody the results of individual research and individual reflection. He struck out a number of impressive suggestions, some of which have since been accepted by physiologists at home and abroad. Of these the most valuable is that now known as the doctrine of the functional indifference of the nerves—that what are known as the specific energies of the optic, auditory, and other nerves are simply differences in their mode of action due to the differences of the peripheral structures or sense-organs with which they are connected. This idea has since been independently arrived at by Wundt (*Physiologische Psychologie*, 2d ed., p. 321). In 1865, on the starting of the *Fortnightly Review*, Lewes became its editor, but he retained the post for less than two years. This date marks the transition from more strictly scientific to philosophic work. He had from early youth cherished a strong liking for philosophic studies; one of his earliest essays was an appreciative account of Hegel's *Æsthetics*. Coming under the influence of positivism as unfolded both in Comte's own works and in J. S. Mill's *System of Logic*, he abandoned all faith in the possibility of metaphysic, and recorded this abandonment in the above-mentioned *History of Philosophy*. Yet he did not at any time give an unqualified adhesion to Comte's teaching, and with wider reading and reflection his mind moved away further from the positivist's standpoint. In the preface to the third edition of his *History of Philosophy* he avowed a change in this direction, and this movement is still more plainly discernible in subsequent editions of the work. The final outcome of this intellectual progress is given to us in *The Problems of Life and Mind*, which may be regarded as the crowning work of his life. His sudden death in 1878 cut short the work, yet it is complete enough to allow us to judge of the author's matured conceptions on biological, psychological, and metaphysical problems.

The first two volumes on *The Foundations of a Creed* lay down what he regarded as the true principles of philosophizing. He here seeks to effect a *rapprochement* between metaphysic and science. He is still so far a positivist as to pronounce all inquiry into the ultimate nature of things fruitless. What matter, form, spirit are in themselves is a futile question that belongs to the sterile region of "metempirics." But philosophical questions may be so stated as to be susceptible of a precise solution by scientific method. Thus, since the relation of subject to object falls within our experience, it is a proper matter for philosophic investigation. It may be questioned whether Lewes is right in thus identifying the methods of science and philosophy. Philosophy is not a mere extension of scientific knowledge; it is an investigation of the nature and validity of the knowing process itself. In any case Lewes cannot be said to have done much to aid in the settlement of properly philosophical questions. His whole treatment of the question of the relation of subject to object is vitiated by a confusion between the scientific truth that mind and body coexist in the living organism and the philosophic truth that all knowledge of objects implies a knowing subject. In other words, to use Mr. Shadworth Hodgson's phrase, he mixes up the question of the *genesis* of mental forms with the question of their *nature* (see *Philosophy of Reflexion*, vol ii. pp. 40–58). Thus he reaches the "monistic" doctrine that mind and matter are two aspects of the same existence by attending simply to the parallelism between psychical and physical processes given as a fact (or a probable fact) of our experience, and by leaving out of account their relation as subject and object in the cognitive act. His identification of the two as phases of one existence is open to criticism, not only from the point of view of philosophy, but from that of science. In his treatment of such ideas as "sensibility," "sentience," and the like, he does not always show whether he is speaking of physical or psychical phenomena. Among the other properly philosophic questions discussed in these two volumes the nature of the causal relation is perhaps the one which is handled with most freshness and suggestiveness. The third volume, *The Physical Basis of Mind*, further develops the writer's views on organic activities as a whole. He insists strongly on the radical distinction between organic and inorganic processes, and on the impossibility of ever explaining the former by purely mechanical principles. With respect to the nervous system, he holds that all its parts have one and the same elementary property, namely, sensibility. Thus sensibility belongs as much to the lower centres of the spinal cord as to the brain, contributing in this more elementary form elements to the "subconscious" region of mental life. The higher functions of the nervous system, which make up our conscious mental life, are merely more complex modifications of this fundamental property of nerve substance. Closely related to this doctrine is the view that the nervous organism acts as a whole, that particular mental operations cannot be referred to definitely circumscribed regions of the brain, and that the hypothesis of nervous activity passing in the centre by an isolated pathway from one nerve-cell to another is altogether illusory. By insisting on the complete coincidence between the regions of nerve-action and sentience, and by holding that these are but different aspects of one thing, he is able to attack the doctrine of animal and human automatism, which affirms that feeling or consciousness is merely an incidental concomitant of nerve-action, and in no way essential to the chain of physical events. Lewes's views in psychology, partly opened up in the earlier volumes of the *Problems*, are more fully worked out in the last two volumes (3d series). He discusses the method of psychology with much insight. He claims against Comte and his followers a place for introspection in psychological research. In addition to this subjective method there must be an objective, which consists partly in a reference to nervous conditions, and partly in the employment of sociological and historical data. Biological knowledge, or a consideration of the organic conditions, would only help us to explain mental *functions*, as feeling and thinking; it would not assist us to understand differences of mental *faculty* as manifested in different races and stages of human development. The organic conditions of these differences will probably for ever escape detection. Hence they can be explained only as the products of the social environment. This idea of dealing with mental phenomena in their relation to social and historical conditions is probably Lewes's most important contribution to psychology. Among other points which he emphasizes is the complexity of mental phenomena. Every mental state is regarded as compounded of three factors in different proportions—namely, a process of sensible affection of logical grouping, and of motor impulse. But Lewes's work in psychology consists less in any definite discoveries than in the inculcation of a sound and just method. His biological training prepared him to view mind as a complex unity, in which the various functions interact one on the other, and of which the highest processes are identical with and evolved out of the lower. Thus the operations of thought, or "the logic of signs," are merely a more complicated form of the elementary operations of sensation and instinct, or "the logic of feeling." The whole of the last volume of the *Problems* may be said to be an illustration of this position. It is a valuable repository of psychological facts, many of them drawn from the more obscure regions of mental life and from abnormal experience, and is throughout suggestive and stimulating. To suggest, and to stimulate the mind, rather than to supply it with any complete system of knowledge, may be said to be Lewes's service in philosophy. The exceptional rapidity and versatility of his intelligence seem to account at once for the freshness in his way of envisaging the subject-matter of philosophy and psychology, and for the want of satisfactory elaboration and of systematic coordination. (J. S.)

LEWIS AND HARRIS form together an island of the Outer Hebrides, nearly separated into two parts by the inlets of Loch Reasort and Seaforth,—the northern part, Lewis or the Lews, being in Ross-shire, and the southern part, Harris, in Inverness. The island is situated about 30 miles from the mainland, between 57° 40′ and 58° 32′ N. lat., and 6° and 7° W. long. Its length is 60 miles, the average breadth 15, and the extreme breadth 30. The area is 770 square miles, of which 575 are comprised in Lewis. The greater part of the surface is composed of gneiss rocks, which in Ben More attain a height of 1750 feet, but there is also a large breadth of peat and swamp, with remains of an ancient forest. The coast is much indented by bays. The climate is very moist and unsuitable for tillage. Agriculture is in a backward condition, but much has been done in draining, reclamation, and planting of trees by the late proprietor of Lewis, Sir James Matheson. Barley and potatoes are the principal crops, and a large number of black cattle are reared. Kelp making is also carried on, but one of the chief supports of the inhabitants is fishing, Stornoway being the largest station for the herring fishing in Scotland, and employing over 1000 boats with nearly 4000 men and boys. The town was made a burgh of barony by James VI. It has a commodious harbor with a patent slip suitable for vessels of 1000 tons. On a height overlooking the bay is the beautiful residence of the proprietor of the island. The most remarkable archæological remains in Lewis are the druidical stones of the temple of Callernish. There are also a large number of old obelisks, and at Mealista in Uig the remains of an old monastery. Six miles from Stornoway there is a huge cave covered with stalactites. See HEBRIDES.

LEWIS, SIR GEORGE CORNEWALL, BART. (1806–1863), statesman and man of letters, was born in London on 21st April, 1806. His father, Thomas F. Lewis of Harpton Court, Radnorshire, after holding subordinate office in various administrations become a poor-law commissioner. He was made a baronet in 1846. Lewis was educated at Eton, and at Christ Church, Oxford, where in 1828 he took a first-class in classics and a second-class in mathematics. He then entered the Middle Temple, and was called to the bar in 1831. In the year before he had, with John Romilly and John Stuart Mill, attended the celebrated lectures on jurisprudence delivered by John Austin at London University. In 1832 he undertook his first public work as one of the commissioners to inquire into the condition of the poor Irish residents in the United Kingdom.[1] Again, in 1834, Lord Althorp included him in the commission to inquire into the state of church property and church affairs generally in Ireland. To this fact we owe his work on *Local Disturbances in Ireland, and the Irish Church Question* (London, 1836), in which he condemned the existing connection between church and state, proposed a state provision for the Catholic clergy, and maintained the necessity of an efficient workhouse organization. During this period of apprenticeship to politics Lewis's mind was much occupied with the phenomena of language. Before leaving college he had published some observations on Whately's doctrine of the predicables, and soon afterwards he assisted Thirlwall and Hare in starting the *Philological Museum*. Its successor, the *Classical Museum*, he also supported by occasional contributions. In 1835 he published an *Essay on the Origin and Formation of the Romance Languages* (re-edited in 1862), which, though anticipated by Schlegel, may be taken as the first effective criticism in England of Raynouard's theory of a uniform romance tongue, represented by the poetry of the troubadours. He also set an excellent example to county gentlemen by compiling a glossary of provincial words used in Herefordshire and the adjoining counties. But the most important work of this earlier period was one to which his logical and philological tastes both contributed. The *Remarks on the Use and Abuse of some Political Terms* (London, 1832) may have been suggested by Bentham's *Book of Parliamentary Fallacies*, but it shows all that power of clear sober original thinking which marks his larger and later political works. And yet this original mind did more than most scholars in the humbler walk of useful translation. He translated Boeckh's *Public Economy of Athens* and Müller's *History of Greek Literature*, and he assisted Tufnell in the translation of Müller's *Dorians*. Some time afterwards he edited a text of the *Fables* of Babrius. While his friend Hayward conducted the *Law Magazine*, he wrote in it frequently on such subjects as secondary punishments and the penitentiary system. In 1836, at the request of Lord Glenelg, he accompanied John Austin to Malta, where they spent nearly two years reporting on the condition of the island and framing a new code of laws. One leading object of both commissioners was to associate the Maltese in the responsible government of the dependency. On his return to England Lewis succeeded his father as one of the principal poor-law commissioners. But his literary activity did not cease. In 1841 appeared the *Essay on the Government of Dependencies*, a systematic statement and discussion of the various relations in which colonies may stand towards the mother country. In 1844 Lewis married Lady Maria Theresa Lister sister of Lord Clarendon, and a lady of literary tastes. Much of their married life was spent in Kent House, Knightsbridge. They had no children. In 1847 Lewis resigned his office. He was then returned for the county of Hereford, and Lord John Russell appointed him secretary to the Board of Control, but a few months afterwards he became under secretary to the Home Office. In this capacity he introduced two important bills, one for the abolition of turnpike trusts and the management of highways by a mixed county board, the other for the purpose of defining and regulating the law of parochial assessment. On the latter subject his evidence before the select committee (Lords) of 1850 is the clearest statement of general results which we have. In that year he succeeded Hayter as financial secretary to the Treasury. About this time, also, appeared his *Essay on the Influence of Authority in Matters of Opinion*. Lewis seems to have thought that authority was too much divided to be of much use in theological matters, while in the world of science he found sufficient authority for declaring that homœopathy, mesmerism, and phrenology were all impostures. On the dissolution of parliament which followed the resignation of Lord John Russell's ministry in 1852, Lewis was defeated for Herefordshire and then for Peterborough. Excluded from parliament, he accepted the editorship of the *Edinburgh Review*, which the death of Empson had left vacant. Lord Halifax offered him, in 1853, the governorship of Bombay, but he remained editor until 1855. During this period he did some public work on the Oxford commission, and on the commission to inquire into the government of London. But its chief fruits were the *Treatise on the Methods of Observation and Reasoning in Politics*, and the *Enquiry into the*

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[1] See the *Abstract of Final Report of Commissioners of Irish Poor Enquiry*, etc., by G. C. Lewis and N. Senior, 1837

Credibility of the Early Roman History,[1] in which he vigorously attacks the theory of epic lays and other theories on which Niebuhr's reconstruction of that history had proceeded. In 1855 Lewis succeeded his father in the baronetcy. He was at once elected member for the Radnor boroughs, and Lord Palmerston made him chancellor of the exchequer. The position was difficult, for he had a war loan to contract and heavy additional taxation to impose. But his industry, method, and clear vision carried him safely through. His financial statement of 13th February, 1857, and his speech on 12th February, 1858, on the bill for the better government of India were most successful efforts. After the change of ministry in 1859, Sir George became home secretary under Lord Palmerston, and in 1861, much against his wish, he succeeded Sidney Herbert (Lord Herbert of Lea) at the War Office. The closing years of his life were marked by increasing intellectual vigor. In 1859 he published an able *Essay on Foreign Jurisdiction and the Extradition of Criminals*, a subject to which the attempt on Napoleon's life, the discussions on the Conspiracy Bill, and the trial of Bernard, had drawn general attention. He advocated the extension of extradition treaties, and condemned the principal idea of *Weltrechtsordnung* which Mohl of Heidelberg had proposed. His two latest works were the *Survey of the Astronomy of the Ancients*, in which, without professing any knowledge of Oriental languages, he applies a sceptical analysis to the ambitious Egyptology of Bunsen; and the *Dialogue on the Best Form of Government*, in which under the name of Crito, the author points out to the supporters of the various systems that there is no one abstract government which is the best possible for all times and places. An essay on the *Characteristics of Federal, National, Provincial, and Municipal Government* does not seem to have been published. Sir George died in April, 1863. A marble bust by Weekes stands in Westminster Abbey. He has two other monuments—the reprint from the *Edinburgh Review* of his long series of papers on the *Administrations of Great Britain* (1864), and his *Letters to various Friends* (1870), edited by his brother, who succeeded him in the baronetcy.

Lewis was a man of mild and affectionate disposition, much beloved by a large circle of friends, among whom were Sir E. Head, the Grotes, the Austins, Lord Stanhope, J. S. Mill, Dean Milman, the Duff Gordons. In public life he was distinguished, says Lord Aberdeen, "for candor, moderation, love of truth." He had a passion for the systematic acquirement of knowledge, and a keen and sound critical faculty. Nothing is more remarkable than the practical good sense of his speculative writings. Sometimes he betrayed a slight intellectual impatience; but this was merely the passing irritation of a healthy and modest judgment.

LEWIS, Matthew Gregory (1775–1818), often referred to as "Monk" Lewis, was born in London on July 9, 1775. He was educated for a diplomatic career at Westminster School and at Christ Church, Oxford, spending most of his vacations abroad in the study of modern languages; and in 1794 he proceeded to the Hague as attaché to the British embassy. His stay there lasted only a few months, but was marked by the composition, in ten weeks, of *Ambrosio, or the Monk*, which was published in the summer of the following year. It immediately achieved extensive celebrity; but some passages it contained were of such a nature that about a year after its appearance an injunction to restrain its sale was moved for and a rule *nisi* obtained. Lewis published a second edition from which he had expunged, as he thought, all the objectionable passages, but the work still remains of such a character as almost to justify the severe language in which the author of *English Bards and Scotch Reviewers* addresses—

> "Wonder-working Lewis, Monk or Bard,
> Who fain would'st make Parnassus a churchyard;
> Even Satan's self with thee might dread to dwell,
> And in thy skull discern a deeper hell."

Whatever its demerits, ethical or æsthetic, may have been, *The Monk* did not interfere with the reception of Lewis into the best English society; he was favorably noticed at court, and almost as soon as he came of age he obtained a seat in the House of Commons as member for Hindon, Wilts. After some years, however, during which he never ventured to address the House, he finally withdrew from a parliamentary career. His tastes lay wholly in the direction of literature, and *The Castle Spectre* (1796, a musical drama of no great literary merit, but which enjoyed a long popularity on the stage), *The Minister* (a translation from Schiller's *Kabale u. Liebe*), *Rolla* (1797, a translation from Kotzebue), with numerous other operatic and tragic pieces, appeared in rapid succession. *The Bravo of Venice*, a romance translated from the German, was published in 1804, and has since been reprinted; next to *The Monk* it is the work connected with the name of Lewis which has been most extensively read. By the death of his father he succeeded to a large fortune, and in 1815 embarked for the West Indies to visit his estates; in the course of this tour, which lasted four months, the *Journal of a West Indian Proprietor*, published posthumously in 1833, was written. A second visit to Jamaica was undertaken in 1817, in order that he might become further acquainted with, and able to ameliorate, the condition of the slave population; but the fatigues to which he exposed himself in the tropical climate brought on a fever which terminated fatally on the homeward voyage, May 14, 1818. *The Life and Correspondence of M. G. Lewis*, in two volumes, was published anonymously in 1839; compiled by friendly hands, it makes it sufficiently plain that, whatever may have been the errors of judgment and taste displayed in the writings of his precocious youth, he was nevertheless a man of more than ordinary discretion, good feeling, and generosity.

LEWIS, Meriwether (1774–1809), American explorer, was born near Charlottesville, Virginia, August 18, 1774. In 1794 he volunteered with the troops called out to suppress the "whisky insurrection," was commissioned as ensign in the regular army in 1795, and as captain in 1800, and was President Jefferson's private secretary from 1801 to 1803. On Jefferson's recommendation he was appointed by Congress to conduct, in connection with Captain William Clarke,[2] an expedition to the headwaters of the Missouri river, and thence across the mountains to the Pacific Ocean—the first extended exploration of the northwestern portion of the United States. The States had as yet acquired no claim to this region, and the exploration was designed by Jefferson in the interests not only of geographical science but of territorial acquisition. Lewis and Clarke, setting out late in 1803 with twenty-eight men, spent the winter at the mouth of the Missouri. Early in the spring the party embarked in several boats, and during the summer made the difficult ascent of the Missouri as far as 47° 21′ N. lat., where the second winter was passed among the Mandan Indians. In 1805 the ascent of the Missouri was continued as far as the tributary which they named Jefferson river, which was followed to its source in the southwestern part of what is now Montana territory. Procuring a guide and horses from the Shoshone Indians, they pushed westward through the mountains, and on October 7 embarked in canoes on a tributary of the Columbia river, the mouth of which they reached on November 15. They had travelled upwards of 4000 miles from their starting point, had encountered various Indian tribes never before seen by whites, had made scientific collections and observations, and were the first explorers to reach the Pacific by crossing the continent north of Mexico. After spending the winter upon the Columbia, they made the return journey across the mountains and down the Missouri, reaching the Mississippi in September, 1806. The reports of the

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[1] Translated into German by Liebrecht, Hanover, 1858.

[2] [A Virginian (1770–1838), and brother of Gen. George R. Clarke. He became a brigadier-general, and in 1813 territorial governor for seven years of Missouri.—Am. Ed.]

Lewis and Clarke expedition attracted great attention at the time, and it has scarcely been exceeded in romantic interest by later explorations in any quarter of the globe. The leaders and men of the exploring party were rewarded with liberal grants of land, and Lewis was made governor of the territory of Missouri. In the unwonted quiet of his new duties his mind, always subject to melancholy, became unbalanced, and, while on his way to Washington, he committed suicide near Nashville, Tennessee, October 11, 1809.

Jefferson wrote a memoir of Lewis published in 1814 in connection with Biddle and Allen's *Narrative of the Lewis and Clarke Expedition.* A new edition by M'Vickar was published at New York in 1843.

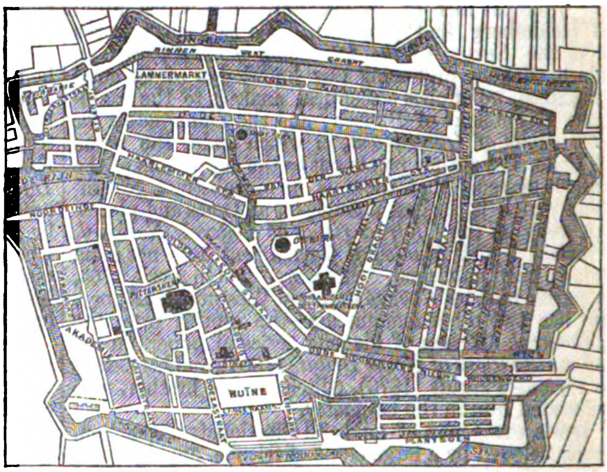
LEWISTON, a city of the United States, in Androscoggin county, Maine, is situated 36 miles north of Portland, on the left bank of the Androscoggin, and is connected by several bridges with Auburn, a city of 9555 inhabitants, and the capital of the county. As the river at this point breaks over a ledge of mica schist and gneiss, and the natural fall of 40 feet has been raised to 50 feet by a strong granite dam, Lewiston commands an abundant supply of water-power. Cotton and woollen goods (shirtings, sheetings, cassimeres, beavers, tweeds, cloakings), twine, boots and shoes, machinery etc., are produced to the annual value of $11,000,000—there being nine considerable manufacturing corporations in the city besides the Franklin Company, which owns the entire water-power. The city hall (1872) is a very fine building; and a public library (over 6000 volumes in 1880) was founded by the corporation in 1861. Bates College, founded by the Free Baptists in 1863–64, and named in honor of Benjamin F. Bates of Boston, possessed in 1880, 11 professors, 161 students, and a library of 5537 volumes.

Lewiston dates from 1770. In 1795 it was incorporated as a town, and in 1861 as a city. The population was 3584 in 1850, 7424 in 1860, 13,600 in 1870, and 19,083 in 1880.

LEXINGTON, capital of Fayette county, Kentucky, is situated near the centre of the State, in the midst of a table-land 1100 feet above the sea, known as the Blue Grass region. It stands on a small sub-tributary of the Kentucky river, 79 miles south of Cincinnati, and 94 miles east by south of Louisville. The population (3584 in 1850, 7424 in 1860, and 13,600 in 1874) in 1880 was 16,656, including about 8000 negroes. Lexington is an important railway junction, has an extensive trade, and manufactures whisky, flour, bagging, ropes, carriages, and machinery. Two railroads, completed in 1882, give access to the mountainous eastern region of the State, from which iron, coal, and timber are obtained in abundance. The surrounding district is characterized at once by beauty and fertility, and the town has been laid out in a spacious and attractive style. It is the seat of the State university (chartered in 1858, originally opened at Harrodsburg in 1859, and removed to Lexington and incorporated with the Transylvania university in 1865), the State agricultural college, and one of the State lunatic asylums (625 patients). Besides the university library, there is a public library of 15,000 volumes.

Lexington was founded by Colonel Robert Patterson in 1775, and received its name in honor of the first contest in the war of American independence, fought in April of that year at Lexington, Middlesex county, Massachusetts.

Lexington in Kentucky must not be confounded with (1) Lexington, the capital of Lafayette county, Missouri, with a population in 1880 of 3996; or (2) Lexington, capital of Rockbridge county, Virginia, a place of 2771 inhabitants, and the seat of the Washington and Lee university (founded in 1749; professors in 1880, 9; students, 300; library, 15,000 volumes), and of the Virginia military institute, founded in 1839, under the patronage of the State, with 12 professors and 300 students.



Plan of Leyden.

LEYDEN, or **Leiden**, a city of the Netherlands, in the province of South Holland, about 20 miles south-west of Amsterdam, and 6 miles inland from the German Ocean. The old Rhine, on which it is situated, enters at the eastern side by two arms which unite near the middle of the town so as to divide the western half into two nearly equal portions. Though the boundaries, which now include about 467 acres, have been six times extended, the general shape is wonderfully regular, nor is regularity wanting in the interior arrangement of the quiet respectable town with its canals and moats, its broad streets, and lifeless squares. The pensive and even melancholy impression which it seems sometimes to produce on the stranger is easily explained. Leyden is *par excellence* an academic city; the bustle of its great markets for cattle and dairy produce is confined to certain spots, and last only for so many hours on so many days, and its industrial activity, considerable though it be, is not sufficient to give that appearance of life and movement which their flourishing local and transit trade makes so generally characteristic of the towns of Holland. The woollen goods (coverlets and broadcloths), the cotton stuffs, the worsted and yarns, the iron and copper wares, and the books and lithographic work which it still produces, are far from maintaining for it the position which it enjoyed when, at the close of the 15th century, its weaving establishments (mainly broadcloth) numbered from three to four hundred, or when, after the expulsion of the Spaniards, Leyden cloth, Leyden baize, and Leyden camlet became familiar terms at home and abroad. Owing to changes of fashion, unwise preservation of old customs and institutions, party spirit, the development of manufactures in other places, these industries had so far declined in the beginning of the 19th century—the total production of all the factories in 1802, for example, did not exceed 1086 pieces of cloth—that the baize manufacture was altogether given up, and the beautiful Say (Worsted) Hall was closed. Although after the revolution of 1813 comparative prosperity was the result of the removal of the French yoke, and more especially of the introduction of steam, the times of a Maurice or a Frederick Henry have never returned, and still less the wonderful days of the 15th century. The university is still a flourishing institution, with fifty professors; but other universities have grown up in the Netherlands, and even professors of European reputation can no longer attract from foreign lands the numbers that visited Leyden in the days of Lipsius, Vossius, Heinsius, Gronovius, Hemsterhuis, Ruhnken, Valckenaer, Scaliger, and Boerhaave. As a class the students are remarkably quiet and orderly. Many are destined to a diplomatic career. The university (*Akademie*) was opened in February, 1575, and originally located in the convent of St. Barbara. In 1581 it was transferred to the convent of the White Nuns, the site of which it still occupies, though the building was destroyed in 1616. Of the institutions connected with the university it is sufficient to mention the library (upwards of 160,000 volumes and 4650 MSS. and 2400 pamphlet portfolios), rich in Oriental and Greek manuscripts and old Dutch travels; the botanic gardens, with splendid collections of East Indian plants; the observatory (1860); the museum of natural history, one of the principal establishments of its kind in Europe; the museum of antiquities, with a specially valuable Egyptian department; the ethnographical museum, of which the nucleus was Von Siebold's Japanese collections; and the national institution for East Indian languages, ethnography, and geography. The Thysian library and the library of the Society of Dutch literature (1766) are both large collections, the former especially rich in legal works and native chronicles; the great school of navigation, and the Remonstrant seminary, transferred from Amsterdam in 1873, deserve special mention, and in general it may be said that there is no city in the Netherlands better supplied than Leyden is with educational and intellectual institutions.

Objects of artistic and antiquarian interest are fewer than might be expected from the position which Leyden holds in the history of painting (Rembrandt, Jan Steen, and Gerard Douw were natives of the town); but such as they are—pieces by Van Finck, Fr. van Mieris, Cornelis Engelbrechtszoon, Lucas of Leyden, and other masters—they have for the most part been collected in the newly founded municipal museum located in the old cloth hall. More interesting is the great collection of portraits of famous professors in the aula of the university. All the gate-houses of the city were still standing about the close of the 17th century; two only, the Zijlpoort and the Morschpoort, have been spared. The old town-hall is a quaint 16th century building, and St. Pancratius church has some striking features. Near the site of the Rijnsburg gate is the statue of Boerhaave by Stracké. The "Burg," on an artificial mound (perhaps of Roman origin) in the centre of the town, is an old circular wall resting on twenty arches; it forms a favorite promenade, and affords a fine point of view. Towards the south side of the town lies an open space, suggestively called the Ruin, which in 1807 was the scene of a terrible disaster, a powder-ship blowing up and destroying eight hundred houses and killing hundreds of men. In 1623 the population of Leyden was much more than 50,000, and in 1640, it is estimated, reached 100,000. Between 1796 and 1811 it sunk to 30,000. In 1850 it was 35,864; in 1870, 38,943 (9632 Roman Catholics, 396 Jews); and in 1882 about 41,000.

Though Lugdunum Batavorum is used by the learned as the Latin name for Leyden, there is no possibility of identifying the town itself with the Lugdunum of the Romans. It first appears in 11th and 12th century documents as Leythen, Leithen, Leithon, and Leithan. The history of Leyden follows the same general lines as the history of the Netherlands. During the period of the counts the city suffered from the quarrels of one count with another (as when Countess Ada was besieged in the castle by Lewis of Loon in 1203), or of the nobles with the citizens; between 1419 and 1485 it was besieged and captured no less than six times by the "Hooks" or the "Cods." From Floris V. it received the confirmation of its privileges (1266) and of its freedom from toll throughout Holland (1290). During the struggle with Spain Leyden covered itself with glory by the persistence with which it held out against the double siege from 31st October, 1573, to 21st March, 1574, and from 25th May to 2d October (see Motley, *Rise of the Dutch Republic*, vol. ii.). With the internal troubles of the 17th century it was closely connected. Coolhas, one of the first professors of its university, gave rise about 1578 to a question of heresy which formed in some sort the prelude to the great contest in which his successors Arminius and Gomarus were protagonists. In 1587 Leicester vainly attempted to bring the city over to his side; in 1618 Maurice was there constrained to alter the government; and in 1672 there were violent disturbances in connection with the elevation of William III. to the stadtholdership. The revolution, excited by the French, took place in 1798; and in 1813 the Rhenish peasants, in revolt against the conscription, marched into the city. In 1836 there was a great inundation caused by the Haarlem Lake. The bicentenary of the university was celebrated with great ceremony in 1874.

See Mieris, *Beschrijving der Stad Leyden*, 1772–84.

LEYDEN, John (1775–1811), was born on the 8th of September, 1775, at Denholm on the Teviot, not far from Hawick. Like most Scottish villages, Denholm is commonplace and uninteresting, but Leyden's upbringing was in a wilder part of the country, at the foot of Ruberslaw, whither his father had gone as shepherd to a relation of the family. Though he did not attend school till he was nine years old, long before that he had learnt at home to read, and had devoured all the books he could lay his hands on in the border farm houses and cottages. Naturally his parents thought that a boy so fond of letters was meant for something else than shepherding; and, as the only scholarly office clearly within their horizon was that of a parish minister, they concluded that his gifts pointed in that direction, and with much stinting of their own little comforts sent him to Edinburgh university in 1790. There the uncouth lad, dressed in rough homespun, with a voice that smacked strongly of the Jed and the Teviot, played his part manfully enough in the class-work, but still better in the "societies" where Brougham, Jeffrey, Sydney Smith, Horner, and other clever young fellows were then chopping logic and cracking jokes. Leyden was a diligent but somewhat miscellaneous student, reading everything apparently, except theology, for which he seems to have had no taste. Accordingly, though he completed his divinity course, and took license from the presbytery of St. Andrews, and preached occasionally, it soon became clear that the pulpit was not his vocation, and that the border shepherds were not to find a second Thomas Boston in John Leyden.

In 1794 Leyden had formed the acquaintance of Dr. Robert Anderson, editor of *The British Poets*, and of *The Literary Magazine*, a cultivated but not otherwise remarkable individual, who, however, filled a rather important niche in the Edinburgh of that time. Contributions to his magazine were probably what brought them first together, but more important results followed from their intimacy than either the verses on "Ruberslaw," or "The Descent of Odin," translated from the Norse. For it was Anderson who introduced him to Dr. Alexander Murray, and Murray, probably, who led him to the study of Eastern languages, to which that great scholar was so passionately devoted. Soon they became warm friends and generous rivals, though Leyden excelled, perhaps, in the rapid acquisition of new tongues, and acquaintance with their literature, while Murray was the more scientific philologist. Through Anderson also he came to know Richard Heber, by whom he was brought under the notice of Walter Scott, when he was collecting materials for his *Minstrelsy of the Scottish Border*. Leyden was admirably fitted for helping in this kind of work. A borderer himself, an enthusiastic lover of old ballads and folk-lore, he spared no pains to enrich the work that promised to bring fame to his beloved hills and glens. Scott tells us how, on one occasion, Leyden walked 40 miles to get the last two verses of a ballad, and returned at midnight, singing it all the way with his loud, harsh voice, to the wonder and consternation of the poet and his household. Neither Scott nor Leyden, however, studied this folk-lore for proper scientific purposes. They cared only for the picturesque and the poetic in it, and were not very successful in their efforts to restore it to life. Of course, the rough old ballads themselves were a welcome addition to our literature, but Leyden's attempt to make Lord Soulis interesting in a modern ballad was something of a failure, and, though he might have made a Scotch Lorelei out of the mermaid of Corrievreckan, his poem wants the delicate touch of the German, and he does not know where to stop. Scott, however, got valuable assistance from him in his task, and learned to esteem highly the blunt integrity of the man, his literary enthusiasm, and his large attainments.

Leyden was evidently drifting away from the church into the life of a scholar, but as yet he had not found his line there, was indeed only wasting himself on miscellaneous learning. He had compiled a work of four hundred pages on the *Discoveries and Settlements of Europeans in Northern and Western Africa*, suggested by Mungo Park's travels. He had edited for Constable *The Complaint of Scotland*, giving a glossary, and a long preliminary dissertation. He had printed various poems, and nearly finished his *Scenes of Infancy*, a poem in four books, based, no doubt, on border scenes and traditions, but meandering "at its own sweet will" over all the world, and a good way beyond it. There are, here and there, some effective enough lines in this poem, but, in the main, it is of the thin, artificial, big-sounding order, and has no unity of design, so that there is no particular reason why it should not go on for ever. He had also made some translations from Eastern poetry, Persian and Arabic, but they have not somehow the aroma of the East. Clearly, here was a man of great and varied powers which, however, were like to run to waste unless he found a definite field to work in. So, at last, friends got him an appointment in India, at first on the medical staff, for which he qualified by a year of intense hard work; but it was hoped something more fitting would turn up by and by. In 1803, therefore, he sailed for Madras, and took his place in the general hospital there. From that he was soon promoted to be naturalist to the commissioners going to survey Mysore. Ere long, however, his knowledge of the languages and dialects of India procured him an appointment as professor of Hindustani, which he soon after resigned for a judgeship, and that again to be a commissioner in the court of requests, which required a familiarity with several Eastern tongues. Friends who had come from the same border country—Lord Minto, Sir John Malcolm, and others—had done what they could to make his path smooth for him, and his linguistic attainments had been recognized by Colebrooke, the greatest Oriental scholar of the day. But in 1811, having joined Lord Minto in the expedition to Java, on landing there he made his way into a library which was said to contain many Eastern MSS., without having the place aired, and was seized with shivering and sickness, first symptoms of the Batavian fever. The climate of India had never agreed with him, and his constitution had already been shaken by several serious illnesses. He was ill fitted, therefore, to endure the assault of this deadly complaint, and after three days of struggle he died on the 28th of August, in the thirty-sixth year of his age. Cut off thus prematurely, he has left comparatively little fruit of all the bright promise of his youth. As a poet he cannot take high rank, but in his knowledge of Eastern languages he would probably have been no mean rival of Henry Colebrooke, had he been spared a little longer to methodize and perfect his attainments. A genuine and generous nature, with a fine enthusiasm for learning, there were few of Britain's sons in India from whom friends at home looked for better work, and few therefore who were more deeply regretted. (W. C. S.*)

LEYDEN, LUCAS VAN. See LUCAS.

LHASA, often written LASSA, for many centuries the chief city of Tibet. Though the place is of great celebrity, the accounts of it are scanty, and information has to be sifted from authorities differing considerably in age. Till recently the latitude even of Lhasa has been stated with variations extending over 1½ degrees, whilst the longitude has naturally been still more uncertain. The Jesuit Grueber, who was at Lhasa in 1661–62, made the latitude 29° 6′. In the maps of Tibet sent from China by the Jesuits, and engraved on five separate sheets in Du Halde, it is about 29° 40′. D'Anville, in his *Carte Générale du Thibet*, chiefly based on these last, but modified to suit other data, reverted nearly to Grueber's figure; Giorgi in his *Alphabetum Tibetanum* states it at about 30° 30′. Klaproth, stretching every datum to cracking point, to suit his fantasies about the course of the great river of Tibet, made it 30° 45′ N. lat. (and 91° 50′ E. long.); our last and highest authority, Pundit Nain Singh, gives (from a mean of twenty observations) 29° 39′ 17″, a result which closely confirms the Jesuit record. The longitude according to the protraction of the same explorer's route is 90° 57′ 13″.[1] The height above the sea, by repeated observation of the boiling point, is stated at 11,700 feet (but the report of Nain Singh, on his second visit, gives 11,910). The city stands near the middle of a tolerably level plain, which is surrounded on all sides by hills, and extends about 13 miles from east to west and about 7 miles from north to south. It lies half a mile to the north of a considerable river called the Kichu Tsanpu, or Tsang-chu, flowing here from east-north-east (called by the Mongols, according to Klaproth, *Galjao-Muren*, or "Turbulent River"), and joining the great Tsanpu (or upper course of the Brahmaputra) some 35 miles to the south-west.

The hills round the city are absolutely barren, and without growth of any kind except an occasional bush of so-called "Tartar furze." There are, however, gardens scattered over the plain round the city, and these are planted with trees of some size (it would seem cedar, willow, and cypress). Four defiles in the encompassing hills, by which the approaches to the city pass, are defended by as many forts. We may quote the description of Huc, which, though a little vague, is vivid, and is the only passage affording anything like a picture of this city, so difficult of access:—

> "The sun was about to set as we completed our descent of the innumerable zigzags of the mountain path. Issuing into a wide valley, we beheld on our right Lhasa, the famous metropolis of the Buddhist world. The multitude of aged trees which encircle the city as with a girdle of foliage, the lofty white houses, terminating in flat roofs surrounded by turrets, the numerous temples with their gilt canopies, the Buddhala [*Potala*], crowned by the palace of the Dalai Lama,—all unite to give Lhasa a majestic and imposing appearance."

The meaning of the name *Lhá-Sa* is "God's ground." Formerly it used to be known to the Mongols as *Barontala*, the "right side" or western region; now, according to Huc, they call it *Monhe Dhot* or *Dehot*, "Eternal Sanctuary."[2] In eastern Turkestan it seems to be best known as *Jo*, a name which probably refers to the great central temple of which we shall speak.

The city is nearly circular in form, and according to Nain Singh less than a mile in diameter. It was walled in the latter part of the 17th century, but the walls were destroyed during the Chinese occupation in 1722. The population has been estimated at 40,000 to 80,000; the last estimate perhaps including the great population of monks and students in the convents near the city.[3]

The chief streets of the city are wide and straight, and in dry weather tolerably clean, but the inferior quarters are unspeakably filthy, and are rife with evil smells and large mangy dogs.[4] Part (much the greater part, according to Nain Singh) of the houses are of clay and sun-dried brick, but those of the richer people of stone and brick. All, however, are frequently whitewashed, the doors and windows being framed in bands of red and yellow. In the suburbs there are houses entirely built of the horns of sheep and oxen set in clay mortar. This construction, according to Huc, is very solid and highly picturesque. The houses generally are large, and of three stories at least. The owner of the house, with his family, occupies the upper story, whilst the two lower floors swarm with tenants. Externally the lower part of Tibetan houses generally presents lofty dead walls pierced by a few air-holes only; above these rise tiers of windows with projecting balconics, and over all flat broad-eaved roofs at varying levels. According to Desideri, in the better houses there are often spacious and well-finished apartments, the principal halls, the verandas, and terraces being often paved with a composition of colored fragments of stone set in a cement of resin, etc., which with much beating and rubbing becomes like a surface of polished porphyry. In every house there is a kind of chapel or shrine, carved and gilt, on which are set images and sacred books, and before them lamps and incense, with the usual offerings of barley, fruits, etc.

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[1] This is corrected to the latest value of Madras longitude, viz., 80° 14′ 51″.

[2] The first word of this phrase is certainly the Mongol *mongke*, "eternal." The second is probably a clerical error for *dchot*, which may represent the *Jo* of the next sentence, which is literally (Tib.) "master, lord," and is applied to very sacred images.

[3] Nain Singh says that a census in 1854 gave "9000 women and 6000 men, exclusive of the military and the priests." But these words are subject to too many doubts for precise interpretation.

[4] The Chinese have a proverb as to the three products of Lhasa being dogs, drabs, and lamas.

Lhasa is not only the nucleus of a cluster of vast monastic establishments, which attract students and aspirants to the (so-called) religious life from all parts of Tibet and Mongolia, and the seat of a quasi papacy, but is also a great place of pilgrimage, so that the streets and public spaces swarm with visitors from every part of the Himalayan plateau, and from all the steppes of Asia between Manchuria and the Balkash Lake, who come to adore the living Buddha, to seek the purgation of their sins and the promise of a happy transmigration, and to carry away with them holy relics, blessed rosaries, and all the miscellaneous trumpery which is set forth to catch the money of idle people in Asia and Europe, whether they are pilgrims or frequenters of mineral waters,[1] whilst as usual a great traffic arises quite apart from the pilgrimage. The city thus swarms with crowds attracted by devotion and the love of gain, and presents an astonishing diversity of language, costume, and physiognomy; though, in regard to the last point, varieties of the broad face and narrow eye greatly predominate. Much of the retail trade of the place is in the hands of the women. Huc's account of the curious practice of the Lhasa women in plastering their faces with a dark-colored unguent is well known, but it does not rest on his authority alone.

During the month of December especially traders arrive from western China by way of Tatsienlu (Tachindo of the Tibetans), bringing every variety of silk-stuffs, carpets, china-ware, and tea; from Siningfu (commonly in Tibet and Turkestan called *Siling*, Ziling, or Zling, a circumstance that has caused sundry misapprehensions) come silk, gold lace, Russian goods, carpets of a superior kind, semi-precious stones, horse furniture, horses, and a very large breed of fat-tailed sheep; from eastern Tibet musk in large quantities, which eventually finds its way to Europe through Nepal; from Bhutan and Sikkim, rice; from the latter also tobacco; besides a variety of Indian and European goods from Nepal and Darjiling, and *charas* (resinous exudation of hemp) and saffron from Ladak and Kashmir. The merchants, who arrive in December, leave Lhasa in March, before the setting in of the rains renders the rivers impassable.

The tea importation from China is a large matter, on which an interesting paper has been written by Mr. E. Baber. The tea is of the coarsest quality, derived from straggling and uncared-for trees, allowed to grow to a height of 10 feet or more, and the coarsest produce of these. This is pressed into bricks or cakes, and carried by porters. The quantity that pays duty at Tatsienlu is about 10,000,000 lb, besides some amount smuggled. No doubt a large part of this comes to Lhasa. Tea is an absolute necessary to the Tibetan; he is miserable without it.

The chief industries of Lhasa are the weaving of a great variety of stuffs from the fine Tibetan wool; the making of earthenware (said to be of very good quality), and of the wooden porringers (varying immensely in elaboration and price) of which every Tibetan carries one about with him; also the making of certain fragrant sticks of pastille much valued in China and elsewhere.

It is curious that Tibet, though using coined money, seems never, strictly speaking, to have had a coinage of its own. Till nearly the end of last century the coinage had for a long time been derived from Nepal. That valley prior to the Gorkha domination (1768) was under three native dynasties (at Bhatgaon, Patan, and Khatmandu), and these struck silver mohurs, as they were called, of the nominal value of half a rupee. The coins were at first not struck specially for Tibetan use, but were so afterwards. These latter bore (obverse) a Nepalese emblem surrounded by eight fleurons containing the eight sacred Buddhist jewels, and (reverse) an eight-petalled flower surrounded by eight fleurons containing the names of the eight jewels in Tibetan characters. Ingots of Chinese silver were sent from Lhasa with a small proportion of gold dust, and an equal weight in mohurs was returned, leaving to the Nepal rajahs, between gold-dust and alloy, a good profit. The quality of these coins (weighing about 81 grains Troy) was low, and at last deteriorated so much that the Tibetans deserted the Nepal mints. The Gorkhas, after becoming masters of Nepal, were anxious to renew the profitable traffic in coin, and in this view sent a deputation to Lhasa, with a quantity of coin to be put in circulation. But the Gorkhas were mistrusted, and their coin refused. A coinage was then issued (it would appear once only) in Tibet for domestic use, modelled on an old Khatmandu pattern, and struck by Nepalese artists (see fig. 1). The Gorkhas, however, in 1788 and following years continued to strike coins of progressively debased quality, which were rude imitations of the old Nepalese mintage (see fig. 2), and to endeavor to force this currency on the Tibetans, eventually making the departure of the latter from old usage a pretext for war and invasion. This brought the intervention of the Chinese, who drove the Gorkhas out of Tibet (1792), and then began to strike silver coins for Lhasa use, bearing Chinese and Tibetan characters (see fig. 3). For practical use these Tibeto-Chinese coins (of which 2½ = 1 rupee, and which are known as *naktang*, *i. e.*, *nagskyang*, "cash") are cut into aliquot parts by the guidance of the figures on them. Large lumps of Chinese silver, stamped with the imperial seal, are also used. But of late years there has been an enormous influx of Anglo-Indian rupees, so that these have become practically the currency of the country even to the frontier of China, and are now counted,

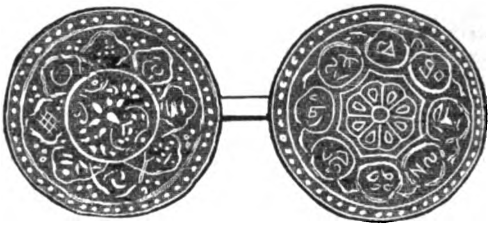

FIG. 1.—Coin struck in Tibet, from specimen in India Library; inscribed "*27th year* (of cycle = 1772 A. D.) *from the princely residence of Galdan.*"

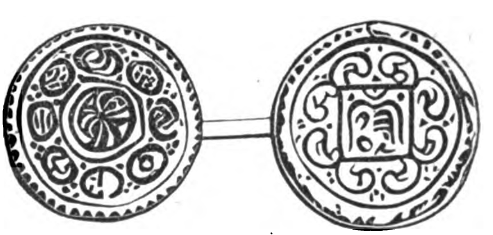

FIG. 2.—Gorkha debased coinage; rubbing from coin in British Museum.

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[1] Among articles sold in the Lhasa bazaars are numerous fossil bones, called by the people "lightning bones," and believed to have healing virtues.

instead of being valued as bullion. They are called *Peiling ch'ranka*, or *chanka* (probably Hind. *tankā*), "English (Firinghi?) coins." Those that bear a crowned head of the queen are called *Lama* heads, the crown being taken for a wandering lama's head-gear. This great influx of rupees indicates a very considerable amount of trade with India. And, in spite of the extraordinary difficulties of the road eastward from Lhasa, quantities of trifling European articles find their way even to Tatsienlu on the Chinese frontier. Mr. Baber found quarter-rupees very popular as buttons, British army buttons very common, corkscrews offered for sale (though no one knew their use), and tin-plates very common, stamped with the heads of Napoleon III., Mr. Gladstone, and other celebrities.

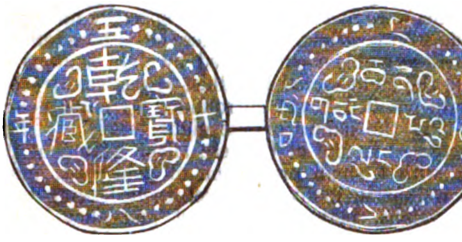

FIG. 3.—Tibeto-Chinese coinage ("*Kienlung*, 58th year," *i. e.*, 1793, A. D.). From specimen in India Library.

The permanent population embraces, besides Tibetans of the country, settled families of Chinese and Kashmiris in considerable numbers, as well as people from Bhotan and Nepal, from Ladak and even from Patna. The Kashmiris and many of the other foreigners are Mohammedans, and much of the trade is in their hands. Desideri, a century and a half ago, speaks also of Armenians and even "Muscovites." The Chinese have a crowded burial-ground at Lhasa, tended carefully after their manner. The Kashmiris, who are called *Khach'hé*, are an important body, and have their mosque, and a provost, at once civil and religious, who is recognized by the government. With their turbans, their fine Caucasian features, and their beards, they strikingly contrast with the mass of other nationalities. The Nepalese (called at Lhasa, according to Huc, *Pebún*) supply all the mechanics and metal-workers. There are among them excellent gold and silversmiths; and they make the elaborate gilded canopies crowning the temples, which form so notable a feature of Lhasa. Huc describes a striking custom among the native population. Every evening, as light begins to fail, they leave off business, and form groups in the streets; all sit down and begin to chant prayer in a low voice. "The combination of religious music arising from these numerous companies produces an aggregate of vast and solemn harmony, which is exceedingly moving."

In the middle of the city is an open space or *place*, in which markets are held; this is densely thronged in the afternoon and evening. On the north side, overlooking this *place*, is a great building which is the residence of the *Gyalbo*, or so-called king of Tibet. It was built at great cost by the dissolute Lama who was set up by the crafty regent Sangje Gyampo, and put to death by the Calmuck prince Latsan or Jenghiz Kahn in 1706–7 (see *infra*); and, as the Lama used to divert himself there with the dances of the ladies of Lhasa, the palace is known as the *Trasi-khang* or "dancing house" (so Desideri; the word *trasi* cannot be identified).

Immediately west of the *place* stands the great temple and convent of Labrang (*bLa-brang*, "Lama-house"), regarded as the *umbilicus* and centre of all Tibet, and from which all the main roads are considered to radiate. This is not merely the great metropolitan convent, sanctuary, and church-centre of Tibet, the St. Peter's or Lateran of Lamaism, but contains the palace of the government and seat of civil administration. It is believed to have been founded by the Tibetan Constantine, Srong-dsan-gampo, in the 7th century, as the shrine of one of those two very sacred Buddha images which were associated with his conversion, and with the foundation of the civilized monarchy in Tibet. From this image, called *Jo* or *Jū*, it is known to the Mongols as the *Jo Erdeni* ("the precious Lord") or *Jo Shakyamuni* (to the Chinese as *Ta-shao-sz'*, "house of the great *Jū*"), and hence as *Ju* or *Jo* simply, a name used in eastern Turkestan (as already noticed) and probably in Mongolia, as a synonym of Lhasa. The temple appears to be known also as *Lhasai-Chhod-khang*, "offering-house of Lhasa," and among Indian and Nepalese visitors as *Mâchendra Nâth*.[1] The Potala as a sacred centre is modern, whilst the Labrang attaches itself to the whole thread of Tibetan history and religion. On one of the walls of this temple is a picture of the famous "Master of the Law," Hwen T'sang, the travelling doctor of Buddhism (see vol. xii. p. 434), whose journeys have in the revolution of the ages become so familiar to European students, as a mine of information on the geography and history of India during a period so clouded as the 7th century. He is represented with three of his disciples. And before the gate of the Labrang stand several monuments of antiquity, especially that famous obelisk spoken of below, which bears the inscribed record of the treaty of peace concluded in 822 between Thi-de-srong-tsan, king of Tibet, and the emperor Mo-tsung of China. Before this obelisk the apostate from Lamaism, Langdharma, brother and successor of the last-named king, was standing in proud contemplation, when a fanatic recluse, who had been stirred by a vision to avenge his persecuted faith, shot him with an arrow in the forehead.

The main building of the Labrang is three stories high. The entrance, facing eastward, forms a portico supported on six great timber columns, richly carved and gilt, whilst the walls are painted with the history of Sakya. Great folding-doors, covered with reliefs in bronze and iron, lead to the ante-hall, and from this a second gate to the *cella* (so to call it) of the temple. On each side of the gate, two and two, stand colossi of the spirit-kings of the four points of heaven. Within is a great basilica, divided into naves and aisles by many pillars, whilst along each wall, north and south, are chapels or sanctuaries, fourteen to a side.

At the west end steps ascend to a quadrangular choir or chancel, on each side of which also are three chapels, and at the extremity a rectangular apse (if it may be called so), and in it is the altar or graded throne, on which stands the great image of Sakya, seen through a lattice of silver gilt,—the higher shelves or offsets of the altar being beset with small figures in precious metals of *deotas* and saints, and the lower ones with lamps burning josticks, platters holding offerings of butter and meal, flowers modelled from butter, etc. In the choir to the right (*i. e.*, looking from the altar) is the elevated and stepped throne of the Grand Lama, laid with splendid cushions, succeeded by the nearly equal throne of the Teshu Lama of Shigatsé, and then by the seats of other ecclesiastical potentates, reborn and elected, in order; on the left of the Buddha throne, opposite the Grand Lama's, and of equal height, there is said now to be a throne for the emperor of China, then, at a lower level, that of the so-called king of Tibet, whilst the ministers of state follow opposite the inferior lamas.

In a space shut in with silver lattice, on the south side of the chancel-steps, are seen fourteen or fifteen great disks of silver, set with precious stones, on which are embossed fundamental Buddhist symbols, such as their system of cosmogony, the circle of transmigration, the births of Sakya, etc.

The great nave or central aisle of the basilica is truly hypæthral, but on the second and third apparent floors it is encompassed with colonnades or verandas, from which the women and the laity look down upon the lamas engaged in chanting the services or in other functions. The sanctuary or chancel itself towers above the rest of the building, and is crowned with a rectangular canopy or pavilion of gilt metal, which rises to a ridge serrated with fantastic figures. This canopy rests on columns which are also gilt, and from its eaves and angles hang bells that tinkle with every breeze, whilst the pillars beneath the eaves are crowned with a great frieze of bas-reliefs embossed in gilt metal.

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[1] So in Nain Singh's narrative. But the word is properly *Matsyendranâth*, which is the name of a saint adored by the Nepalese Buddhists, and identified with Padmapani, the fourth Dhyâni Bodhisatva of their system (see Hodgson in *Journ. Roy. As. Soc.* xviii. 394).

This ancient temple contains a vast accumulation from the ages of gold and silver vessels, lamps, reliquaries, and precious bric-a-brac of every kind, which is annually exposed to view in the spring festivities. The daily offices in the Labrang are attended by crowds of worshippers, and a sacred way which leads round it is constantly traversed by devotees who perform the circuit as a work of merit, always in a particular direction.

Besides the convent-cells, halls of study, and magazines of precious lumber, buildings grouped about the Labrang are occupied, as we have said, by the civil administration, e. g., as treasuries, customs office, courts of justice, etc.; and there are also private apartments for the Grand Lama and other high functionaries. No woman is permitted to pass the night within the precinct.

Another great and famous temple is the *Ramo-chhé* ("large pen or fold"), at the north end of the city. This is also regarded as a foundation of Srong-dsangampo, and is said to contain the body of his Chinese wife, and the second of the primeval palladia, the image that she brought with her to the Snow-land; whence the Mongols and Chinese call it the temple of the little *Jū*. The lamas of this convent, as well as of that next to be mentioned, are noted for their pretensions to and practice of magical arts, one of the degrading characteristics of the lama forms of Buddhism. The orthodox "yellow" sect indeed profess to distinguish between lawful and unlawful magical formulæ, and to give degrees only in the former. The lamas of Ramo-chhé have also the ill repute of cultivating that species of doctrine which is connected, like their magic, with Tantric mysticism, and which professes to destroy sensual passion by the contemplation of its representations. The walls of the convent are defiled with a series of sculptures of gross obscenity.[1]

Another convent within the city is that of *Moru*, also near the north end, remarkable for its external order and cleanliness, and, though famous like the last as a school of orthodox magic, noted also for the printing-house in the convent garden. Lastly we notice the *Garmakhia*, the inmates of which are sorcerers of the ruder kind, who seem really to represent the rude medicine-men of the superstitions which preceded Buddhism in Tibet. As the vulgar will not dispense with their marvels (knife-swallowing, fire-breathing, cutting off their own heads, and the like), every great orthodox monastery in Tibet keeps one of these conjurors, who does not belong to the fraternity of the house, but lives in a particular part of it, bearing the name of *Choi-chong* (*Ch'hos-skyong*) or "protector of religion," and is allowed to marry. These practitioners of the black art possess no literature, but hand down their mysteries from father to son. Their fantastic equipment, their frantic bearing, and their cries and howls seem to identify them with the grossest Shamanist devil-dancers,—strongly remote in externals from the gentle and cultivated persons in the higher ranks of the Lama Church, of whom we read in Turner or Huc. Other monasteries in or near the city are the *Chumuling* at the north-west corner; the *Tankyaling* at the west of the city; the *Kontyaling*, about a mile west of the city, at the foot of a low isolated hill called Chapochi. Three miles south, beyond the river, is the *Chochuling*. These four convents are known as "The Four Ling."

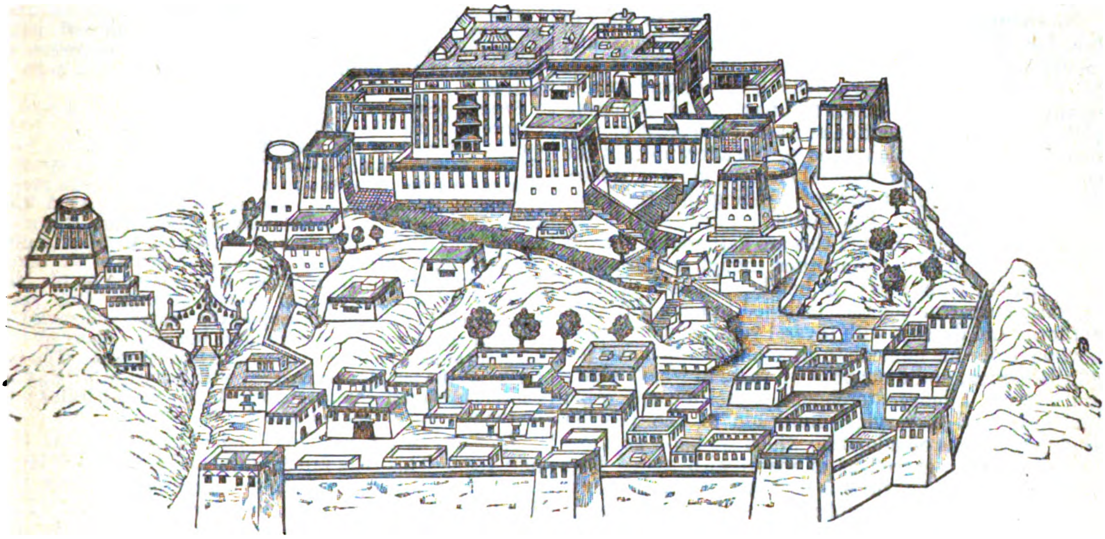

FIG. 4.—Potala, the Palace-Temple of the Grand Lama.

Leaving the city by the side of the Ramoch'hé, we see on our left the famous Potala with its many edifices crowning and seeming to grow out of a rocky hill, which rises like an island from the plain. It forms altogether a majestic mountain of building. At the south base of the rock is a large space inclosed by walls and gates, with great porticoes on the inner side. This swarms with lamas, its nooks with beggars basking in the sun. A series of tolerably easy staircases, broken by intervals of gentle ascent, leads to the summit of the rock. The whole width of this is occupied by the palace. The central part of this group of buildings rises in a vast quadrangular mass, in four stories, to a great height, terminating in a gilt canopy similar, it would seem, to that on the Labrang. Here on the lofty terrace is the Grand Lama's hall of audience, and from this great height he looks down upon the crowds of his votaries far below, thronging the plain, and streaming to kneel before the sacred hill. The monastic buildings attached to the palace temple are said to contain cells for ten thousand monks. Other palatial buildings, towers, chapels, *chodtens* (chaityas), pavilions, gleaming with gold and silver, Buddhas and other idols, cluster round and crown the three peaks of Potala. The palace itself is said to be painted externally with red and white stripes. The walls and ceilings of all the chief apartments and temples are covered with rich silks. We give an engraving of it (fig. 4), extracted from a Chinese view of Lhasa, published by Klaproth in the work quoted at the end. The Potala has every appearance of having been drawn from the reality. Two avenues bordered with trees of considerable size lead from the city to the foot of Potala. "You see there constantly," says Huc, "a great number of foreign pilgrims, passing between their fingers the beads of their long Buddhist rosaries, with lamas of the court splendidly attired, and mounted on richly caparisoned horses. There reigns in the neighborhood of the Potala great and incessant movement; but for the most part everybody is grave and silent; religious thoughts appear to occupy the minds of all." It would seem that between the palace and the city runs a stream which is crossed by a bridge called "The Bridge of Glazed Tiles."

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[1] It was in this convent that P. Desideri studied the religion of the lamas. "From March to July," he says, "I set myself, I will not say to read, but rather to *devour* the chief books of the *Kaa-n-ghiur*, and to take in a complete knowledge of all that pertains to that false religion."

On the north side of the rock a wide and easy road descends winding. By this, which has a parapet along the edge, it is lawful to ride. Not far from the base is a garden-palace in the middle of a lake which is surrounded by trees and shrubberies. This palace, called *Lu-khang*, is described by Desideri as of attractive style, and circular in form, with a *loggia* or portico running all round, and adorned with paintings. Here the dissolute Lama who built it, at the end of the 17th century, used to give himself up to dissipation with the women of Lhasa. Several other villas or gardens of the Tibetan pope are mentioned; in one of them the Panch'hen-Rinpoch'he (or Teshu Lama) is received when he visits Lhasa, and the two living Buddhas drink tea together there. It is in the numerous gardens round the town that those large trees grow of which Huc speaks as giving Lhasa such a green girdle of foliage. There is no natural wood.

No country in the world—not even Spain or Italy in the last century—has so abounded in convents and monks as Tibet. The district of Lhasa alone is said to contain thirty great convents, besides many smaller establishments, and a notice of Lhasa would be incomplete without some mention at least of the great monastic establishments which stand within a few miles of the city, and constitute an essential element in its existence. These are not single masses of building like the great convents of Europe. The temple (*Lha-khang*) is the focus of the whole. Round this are gathered numerous houses detached from one another, though not far apart, and generally three stories in height. In each of these are various apartments, each assigned to a monk of some authority and dignity, with several younger members or novices under his immediate direction. Each house has a little garden, and a quantity of vases in which plants are grown. Library, storehouse, hostel, occupy other buildings, and a varying multitude of the peculiar Buddhist objects of adoration which we know as *dagobas* or *chaityas*, as well as of masts with sacred flags and streamers. The whole is usually enclosed in a lofty and solid wall. These establishments have undoubtedly a vast population, though we can hardly accept specific figures, in which indeed authorities do not agree. Huc says the inmates of each of the three great convents which we are about to name amounted to 15,000; Nain Singh states them at 7700, 5500, and 3300 respectively; the former numbers seem excessive, the latter artificial; but no doubt the real numbers are large. In the Labrang they show a copper kettle holding more than one hundred buckets, which was used to make tea for the lamas who took part in the daily temple service.

The three great convents in the vicinity, all claiming to be foundations of Tsongkhapa, the mediæval reformer and organizer of the modern orthodox Lama Church, are the following:—

1. *Bre-bung* (written *Bras-sPungs*, "the Rice-Heap," so called from the shape of the hill on which it stands), called by Nain Singh *Debang*, is 5 or 6 miles from Lhasa, west of the city, at the entrance to the plain from the side of Shigatzé and Nepal. In the middle of the convent building raises a kind of pavilion, brilliant with color and gilding, which is reserved for the Dalai Lama, when he visits Brebung once a year, and expounds to the inmates. The place is greatly frequented by the Mongol students who come to Lhasa to graduate, and is known in the country as the Mongol convent.

2. *Sera* ("The Golden") is 2 or 3 miles from the city on the acclivity of the hills which border the valley on the north, and close to the road by which pilgrims enter from Mongolia. The hill is planted with holly and cypress, and from a distance the crowd of buildings and temples, rising in amphitheatre against a background of trees, forms a pleasing picture. In the recesses of the hill, high above the convent, are scattered cells of lamas adopting the solitary life. There are three great temples rising in many stories, the walls of which are entirely covered with gilding, whence the convent's name. In the chief of these temples is preserved the famous *Dorjé* of Buddha, *i. e.*, the *Vajra* or Thunderbolt (of Indra properly), or Adamant, the symbol of the strong and indestructible, which the priest grasps and manipulates in various ways during prayer. From this *dorjé*, according to one etymology at least, comes the name of the Himalayan sanatarium *Dorjiling* or Darjeeling. The emblem is a bronze instrument, shaped much like a dumb-bell with pointed ends, and it is said by Koeppen to have been one of the later lama borrowings from Sivaism. The original is carried solemnly in procession to Labrang during the New Year's festival. In Sera P. Desideri found shelter during the capture of the city by the Dzungar Khan in 1717, spoken of below.

The hill adjoining Sera is believed to be rich in silver ore, but it is not allowed to be worked. On the summit is a spring, and a holy place of the Lhasa Mohammedans, who resort thither. Near the convent there is said to be gold, which is worked by the monks. "Should they . . . discover a nugget of large size, it is immediately replaced in the earth, under the impression that the large nuggets . . . germinate in time, producing the small lumps which they are privileged to search for" (Nain Singh).

3. *Galdan.*—This great convent is 10 or 12 miles east of Lhasa, on the other side of the Kichu Tsangpo river. It is the oldest monastery of the "Yellow" sect, having been founded by Tsongkhapa, and having had him for its first superior. Here his body is said to be preserved with miraculous circumstances, and here are other relics of him, such as the impression of his hands and feet in hard butter.

Samayé (*bSam-yas*) is another famous convent intimately connected with Lhasa, but it lies some 36 miles south-east on the left bank of the great Tsangpo. It was founded by Padma Sambhava (*Ur-ghien* of the Tibetans), the apostle who came from Udayâna in the 8th century as the great reviver of Buddhism, and was at the head of the old Red sect. It is visited by the Dalai Lama once a year. It is surrounded by a very high circular stone wall, 1¼ miles in circumference, with gates facing the four points of the compass. On this wall Nain Singh, who was here on his last journey (1874), counted 1030 *chaityas* of brick. One very large temple (*Lha-khang*) occupies the centre, and round it are four smaller but still very large temples. Many of the idols are of pure gold, and the wealth is very great. The interiors of the temples are covered with beautiful writing in enormous Nagari characters, which the vulgar believe to be the writing of Sakya himself.

Lhasa Festivities.—The greatest of these is at the new year. This lasts fifteen days, and is a kind of lama carnival, in which masks and mummings, wherein the Tibetans take especial delight, play a great part. The celebration commences at midnight, with shouts and clangor of bells, gongs, chank-shells, drums, and all the noisy repertory of Tibetan music; whilst friends exchange early visits and administer coarse sweetmeats and buttered tea. On the 2d day the Dalai Lama gives a grand banquet, at which the Chinese and native authorities are present, whilst in the public spaces, and in front of the great convents, all sorts of shows and jugglers' performances go on. Next day a regular Tibetan exhibition takes place. A long cable, twisted of leather thongs, is stretched from a high point in the battlements of Potala slanting down to the plain, where it is strongly moored. Two men slide from top to bottom of this huge hypothenuse, sometimes lying on the chest (which is protected by a breast-plate of strong leather), spreading their arms as if to swim, and descending with the rapidity of an arrow-flight. Occasionally fatal accidents occur in this performance, which is called "the dance of the gods;" but the survivors are rewarded by the court, and the Grand Lama himself is always a witness of it. This practice occurs more or less over the Himalayan plateau, and is known in the neighborhood of the Ganges as *Barat*. It is employed as a kind of expiatory rite in cases of pestilence and the like. And exactly the same performance is described as having been exhibited in St. Paul's Churchyard before King Edward VI., and again before Philip of Spain, as well as, about 1750, at Hertford and other places in England (see Strutt's *Sports*, etc., 2d ed., p. 198).

The most remarkable celebration of the new year's festivities is the great jubilee of the *Monlam* (*sMonlam*, "prayer"), instituted by Tsongkhapa himself in 1409. Lamas from all parts of Tibet, but chiefly from the great convents in the neighborhood, flock to Lhasa, and every road leading thither is thronged with troops of monks on foot or horseback, on yaks or donkeys, and carrying with them their breviaries and their cooking-pots. They descend like swarms of bees upon the city, and those who cannot find lodging bivouac in the streets and squares, or pitch their little black tents in the plain. The festival lasts six days, during which there reigns a kind of saturnalia, and the town is abandoned to these crowds of monks. Unspeakable confusion and disorder reign, whilst gangs of lamas parade the streets, shouting, singing, and coming to blows. The object of this great disorderly gathering is, however, supposed to be devotional. Vast processions take place, with mystic offerings and lama-music, to the Labrang and Moru convents; the Grand Lama himself assists at the festival, and from an elevated throne beside the Labrang receives the offerings of the multitude, and bestows his benediction.

On the 15th of the first month multitudes of torches are kept ablaze, which lighten up the city to a great distance, whilst the interior of the Labrang is illuminated throughout the night by innumerable lanterns shedding light on colored figures in bas-relief, framed in arabesques of animals, birds, and flowers, and representing the history of Buddha, and other subjects, all modelled in butter. The figures are executed on a large scale, and, as described by Huc, who witnessed the festival at Kunbum on the frontier of China, with extraordinary truth and skill. These singular works of art occupy some months in preparation, and on the morrow are thrown away. On other days horse-races take place from Sera to Potala, and foot-races from Potala to the city. On the 27th of the month the holy *Dorjé* is carried in solemn procession from Sera to the Labrang, and to the presence of the Lama at Potala.

Of other great annual feasts, one, in the fourth month, is assigned to the conception of Sakya, but appears to connect itself with the old nature-feast of the entering of spring, and to be more or less identical with the *Hûli* of India. A second, the consecration of the waters, in September-October, appears, on the confines of India, to be associated with the Dasehra.

On the 30th day of the second month there comes off a strange ceremony, akin to that of the scapegoat (which is not unknown in India). It is called the driving out of the demon. A man is hired to perform the part of demon (or victim rather), a part which sometimes ends fatally. He is fantastically dressed, his face mottled with white and black, and is then brought forth from the Labrang to engage in quasi-theological controversy with one who represents the Grand Lama. This ends in their throwing dice against each other (as it were for the weal or woe of Lhasa). If the demon were to win the omen would be appalling; so this is effectually barred by false dice. The victim is then marched outside the city, followed by the troops, and by the whole populace, hooting, shouting, and firing volleys after him. Once he is driven off, the people return, and he is carried off to the Samayé convent. Should he die shortly after, this is auspicious; if not, he is kept in ward at Samayé for a twelvemonth.

Nain Singh, whose habitual accuracy is attested by many facts, mentions a strange practice of comparatively recent origin, according to which the civil power in the city is put up to auction for the first twenty-three days of the new year. The purchaser, who must be a member of the Brebung monastery, and is termed the *Jalno*, is a kind of lord of misrule, who exercises arbitrary authority during that time for his own benefit, levying taxes and capricious fines upon the citizens.

Climate, etc.—Pundit Nain Singh, who lived at Lhasa continuously from 26th January to 21st April (1866), made indoor observations of the thermometer from 9th to 23d February hourly, with the exception of eight hours of sleep (11 P. M. to 7 A. M.); and the extreme variation in the record is from 26° (February 2d, 11 A. M.) to 45°·75 (February 22d, 2 P. M.). He also mentions that the river (Kichu Tsangpo) which flows by Lhasa was frozen in December,—the great river (Brahmaputra) being open and passed by boats. Water kept in the warmest part of a house froze, and burst the vessels holding it. It is not easy to draw very precise conclusions from these facts, but they perhaps indicate a somewhat less severe winter than that of Ladak, where the true air temperature is reckoned by Captain H. Strachey to range between zero and 30° Fahr. In other respects the Pundit's account of the climate does not differ materially from those we possess of western Tibet. He says, besides, that strong and high winds are very prevalent, especially during March and April; but snow fell only twice in the three months of his stay, and not deeper than 3 inches. The fall on the surrounding hills was somewhat heavier, but apparently it did not lie, for in general hardly any snow was to be seen from the city. Should the snowfall in Lhasa ever exceed a foot, it is regarded as an evil omen. What little Desideri says is to like effect. The cold, he says, was never hurtful to health, and he had often spent the night (in winter apparently) under the open sky, without suffering. Lightning, which occurs only in connection with the summer rains, is never known to strike houses or to kill.

It begins to be warm in May, and the sun's power rapidly grows most oppressive. There is a distinct rainy season at Shigatze (July to September), and this appears to extend to Lhasa, though the information is not very precise. Nain Singh was told that earthquakes are unknown in the Lhasa province. Cholera is said to be unknown; but dysentery is often violent, and rapidly fatal. Cough and chest diseases are not prevalent, nor are skin diseases common, in spite of the filthy habits of the people. The most dreaded of all diseases is smallpox. Inoculation is habitually used. Ophthalmia is very prevalent and severe.

History.—The seat of the princes whose family raised Tibet to a position among the powers of Asia was originally on the Yarlung river, in the extreme east of the region now occupied by Tibetan tribes. It was transplanted to Lhasa in the 7th century by the king Srong-dsan-gampo, conqueror, civilizer, and proselytizer, the founder of Buddhism in Tibet, the introducer of the Indian alphabet. On the three-peaked crag now occupied by the palace-monastery of the Great Lama this king is said to have established his fortress, whilst he founded in the plain below temples to receive the sacred images, brought respectively from Nepal and from China, by the brides to whom his own conversion is attributed.

Tibet endured as a conquering power some two centuries, and the more famous among the descendants of the founder added to the city. This-rong-de-tsan (who reigned 740-786) is said to have erected a great temple-palace of which the basement followed the Tibetan style, the middle story the Chinese, and the upper story the Indian—a combination which would aptly symbolize the elements that have moulded the culture of Lhasa, such as it is. His son,[1] the last of the great orthodox kings, in the next century, is said to have summoned artists from Nepal and India, and among many splendid foundations to have erected a sanctuary (at Samayé) of vast height, which had nine stories, the three lower of stone, the three middle of brick, the three uppermost of timber. With this king the glory of Tibet and of ancient Lhasa reached its zenith, and in 822 an obelisk recording his treaty on equal terms with the Great T'ang emperor of China was erected in the city. There followed dark days for Lhasa and the Buddhist Church in the accession of this king's brother Langdharma, who has been called the Julian of the Lamas. This king rejected the doctrine, persecuted and scattered its ministers, and threw down its temples, convents, and images. It was more than a century before Buddhism recovered its hold, and its convents were rehabilitated over Tibet. The country was then split into an infinity of petty states, many of them ruled from the convents by warlike ecclesiastics; but, though the old monarchy never recovered, Lhasa seems to have maintained some supremacy, and probably never lost its claim to be the chief city of that congeries of principalities, with a common faith and a common language, which was called Tibet.

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[1] [Ralpachen, fourth or fifth successor of This-rong, called Lang Darma (p. 229), who died sixty-four (?) years after his so-called father, is the monarch referred to.—AM. ED.]

The Arab geographers of the 10th century speak of Tibet, but it is without real knowledge, and none speak of any city that we can identify with Lhasa. The first passage in any Western author in which such identification can be probably traced occurs in the narrative of Friar Odorico of Pordenone (*c.* 1330). This remarkable traveller's route from Europe to India, and thence by sea to China, can be traced satisfactorily, but of his journey homeward through Asia the indications are very fragmentary. He speaks, however, on this return journey of the realm of Tibet, which lay on the confines of India proper:—"The folk of that country dwell in tents made of black felt. But the chief and royal city is all built with walls of black and white, and all its streets are very well paved. In this city no one shall dare to shed the blood of any, whether man or beast, for the reverence they bear a certain idol that is there worshipped. In that city dwelleth the *Abassi*, *i. e.*, in their tongue the pope, who is the head of all the idolaters, and who has the disposal of all their benefices such as they are after their manner."

We know that Kublai Khan had constituted a young prince of the Lama Church, Mati Dhwaja, as head of that body, and tributary ruler of Tibet, but besides this all is obscure for a century. This passage of Odoric shows that such authority continued under Kublai's descendants, and that some foreshadow of the position since occupied by the Dalai Lama already existed. But it was not till a century after Odoric that the strange heredity of the dynasty of the Dalai Lamas of Lhasa actually began. And in the first two centuries of its existence the residence of these pontiffs was rather at Brebung or Sera than at Lhasa itself, though the latter was the centre of devout resort. A great event for Lhasa was the conversion, or reconversion, of the Mongols to Lamaism (*c.* 1577), which made the city the focus of sanctity and pilgrimage to so vast a tract of Asia. It was in the middle of the 17th century that Lhasa became the residence of the Dalai Lama. A native prince, known as the Tsanpo, with his seat at Shigatzé, had made himself master of southern Tibet, and threatened to absorb the whole. The fifth Dalai Lama, Navang Lobsang, called in the aid of a Calmuck prince, Gushi Khan, from the neighborhood of the Koko-nur, who defeated and slew the Tsanpo and made over full dominion in Tibet to the Lama (1643). The latter now first established his court, and built his palace, on the rock-site of the fortress of the ancient monarchy, which apparently had fallen into ruin, and to this he gave the name of *Potala*.[1]

In the time of this Dalai Lama, Lhasa was visited for the first time by European travellers. In 1624 Antonio d'Andrada, a Portuguese Jesuit, had penetrated to Tibet through the Gangetic Himalaya, and returned the following year with a coadjutor. But the place which he reached was *Caparangue* in the kingdom of *Cogue*, as he calls it, *i. e.*, Chaprang in the province of Gugé on the Tibetan Sutlej, and he never got nearer Lhasa. In June, 1661, the Jesuit fathers, Albert D'Orville and John Grueber, started from Peking, and, by the way of Siningfu and the Koko-nur, reached Lhasa, where they stayed a month, and then went on through Nepal to India. The extracts from Grueber's narrative, given by Athanasius Kircher in his *China Illustrata* (Amst., 1667), are accompanied by a drawing of Potala which, though meagre, appears to be genuine, and is the only European representation in existence of that Tibetan Vatican.

The founder of Potala died in 1682, and his death was followed by events which brought on a time of trouble. He had appointed as "regent" or civil administrator (*Tisri*, or *Deba*), one supposed to be his own natural son. This remarkable personage, Sangje Gyamtso, of great ambition and accomplishment, still renowned in Tibet as the author of some of the most valued works of the native literature, concealed the death of his master, asserting that the latter had retired, in mystic meditation or trance, to the upper chambers of the palace. The government continued to be carried on in the Lama's name by the regent, who leagued with Galdan Khan of Dzungaria against the Chinese (Manchu) power. It was not till the great emperor Kang-hi was marching on Tibet that the death of the Lama, sixteen years before, was admitted. A solemn funeral was then performed, at which 108,000 lamas assisted, and a new incarnation was set up in the person of a youth of fifteen. This young man was the scandal of the Lamaite Church in every kind of evil living and debauchery. But it was under him and the regent Sangje Gyamtso that the Potala palace attained its present scale of grandeur, and that most of the other great buildings of Lhasa were extended and embellished. In 1705–6 a Calmuck prince, Latsan Khan, great grandson of Gushi Khan, taking the renowned name of Jenghiz Khan, made himself master of Tibet, and put to death both the crafty regent and the dissolute lama whom he had set up. The Dzungarians crossed the northern desert in 1717, and stormed Lhasa, but were in turn driven out by the army of Kang-hi in 1720, and from that time the Chinese power, though, as elsewhere, it has been at times severely shaken, has never quite lost its hold of Tibet.

It was in the midst of these troubled times (1708) that a Capuchin mission entered Lhasa. It was unfortunate in the death of its successive heads, and from about 1712 it was abandoned for several years, but after an interval the Capuchins reappeared, twelve in number, reaching Lhasa by Nepal in 1720. Nothing almost was heard of them till the head of the mission, P. Orazio della Penna, appeared at Rome in 1735 to report that nine were dead, and to ask reinforcement. He returned with nine more, carrying presents to the Grand Lama and the so-called "king of Tibet." In 1742 he reported his safe arrival, and that the presents were well received. Called to Nepal, where there was a branch of the mission, he died there in 1747. We possess some of the results collected by this mission in an excellent short treatise on Tibet by P. Orazio himself, as well as in the extraordinary hodge-podge of crude philology, rubbish, and valuable facts (like fossils imbedded in a bank of mud), the *Alphabetum Tibetanum* of the Augustine monk Ant. Giorgi (*Rome*, 1762). The mission seems to have been expelled from Tibet in 1754, and found refuge for a time in Nepal. Some fifty volumes, the relics of the mission library, were in 1847 recovered from Lhasa by Mr. Bryan Hodgson, through the courtesy of the Grand Lama himself, and were transmitted as an offering to Pope Pius IX., then in the first bloom of reputation.

In 1716, moreover, two Jesuits, P. Ipolito Desideri of Pistoia, and P. Freyre, a Portuguese, reached Lhasa by way of Kashmir, Ladak, and the enormous journey from Ladak by the holy lakes and the valley of the Tsanpu. Desideri remained at Lhasa till April, 1721, witnessing the capture of Lhasa successively by Dzungar and Chinese. Of the moderation of the latter, and their abstinence from all outrage or plunder, he speaks highly. His departure was due to controversies between the Jesuits and Capuchins at Rome, which caused an order to be issued for his retirement from Tibet. An interesting letter from him, dated April 10, 1716, is printed in the *Lettres Edifiantes*, Rec. xv., but a large MS. volume of his observations during his residence in Tibet is still unpublished. The next European visitor was Samuel Van de Putte of Flushing, an LL.D. of Leyden, whose thirst for travel carried him through India to Lhasa, where he is said to have resided a long time, to have acquired the language, and to have become intimate with some of the lamas. After travelling from Lhasa to Peking with a lama mission he returned, again by Lhasa, to India, and was an eye-witness of the sack of Delhi by Nadir Shah in 1737. Unhappily he ordered his papers to be burnt after his death, and the knowledge that such a traveller must have accumulated died with him. We pass on to 1811–12 when the first (and last) English visit to Lhasa occurred. The traveller was Thomas Manning, a Cambridge man of Caius College, who had been long devoted to Chinese studies, the "friend M." of Charles Lamb, from whom "Elia" professes to have got that translation of a Chinese MS. which furnished the immortal dissertation on roast pig. After residing some years at Canton, Manning went to Calcutta, bent on reaching the interior of China through Tibet, since from the seaboard it was sealed. He actually did reach Lhasa, stayed there about five months, and had several interviews with the Dalai Lama, but was compelled to return to India. He never published anything regarding his journey, and the very fact of its occurrence was known to few, when his narrative was printed, through the praiseworthy zeal of Mr. C. Markham, in 1876. The man had given the reins to his own eccentricities till he seemed to have lost all power of seriousness, and the account, though containing some passages of great interest, is most disappointing.

The next travellers to reach Lhasa were Huc and Gabet, French Lazarist priests, who travelled from China the route followed by Grueber and by Van de Putte, *via* Siningfu, and reached Lhasa 29th January, 1846. On the 15th of March they were sent off under escort by the rugged road to Sz'-chuen. Huc's book, *Souvenirs d'un Voyage*, etc., is probably still well known, and deserves to be so, for it is one of the most delightful among books of travel. Huc was indeed, not only without science, perhaps without accurate knowledge of any kind, but also without that geographical sense which sometimes enables a traveller to bring back valuable contributions to geographical knowledge though unable to make instrumental observations. He was, however, amazingly clever as a narrator and sketcher of character; and in this his first work his ambition to shine had not gained the upper hand as it did fatally in later works. It was Ke-shen, a well-known Chinese statesman, disgraced for making peace with the English at Canton in 1841, and who was then on a special deputation to Lhasa, who ostensibly expelled them. The Tibetan regent, with his enlightened and kindly spirit, is painted by Huc in most attractive colors, and Mr. Markham expresses strongly the opinion that the native authorities were most willing to receive strangers, whilst the jealousy that excluded them was Chinese only. Recent experiences of attempts to enter Tibet contradict this view. The lamas, whose rule seems to have become more and more grasping and oppressive, appear to be sensible that their system would easily fall to pieces, and are violently opposed to the passage of Europeans across the Tibetan frontier.

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[1] This name is absurdly explained by Abbé Huc as *Buddha-la*—"hill of Buddha." This is not even a possible etymology, for, whilst the actual term *Buddha* seems never to be used untranslated in Tibet, one may discern from Huc's own book that *la* means, not "a hill," but "a pass" over mountains. The name seems to be really taken from the classical traditions of the Buddhists. *Potala*, "the harbor" (the *Pattala* of the Greeks, the modern Hyderabad on the Indus), was in legend the royal seat, for more than a hundred generations, of the Sakya progenitors of Gautama Buddha (see Csoma de Körös in *Journ. As. Soc. Bengal*, ii. 390).

Our latest narrative of a visit to Lhasa is that of the late Pundit Nain Singh, trained as an explorer in the Indian survey department. He reached the city in the course of two most remarkable journeys. In the first, after an ineffectual attempt by Nepal, he travelled by the Manasarowar Lake, and the road thence eastward, parallel to the course of the Tsanpu, reaching Lhasa 10th January, 1866, and leaving it 21st April, 1867. On the second journey (1874) he started from Ladak, crossing the vast and elevated plateau by the Tengri-nor and other great lakes, and again reaching Lhasa 18th November. Between these two journeys Lhasa had also been visited by another native explorer in 1872.[1] Nain Singh, by his extraordinary surveys, and by repeated observations of latitude on his first visit, has fixed for us the position of Lhasa. But he also has given an account of his journeys, and of his residence there, which, though brief, is full of intelligence and interest, and appears to be thoroughly trustworthy. This enterprising and deserving man was, on the completion of his journey in 1875, rewarded by the Indian Government with a pension and grant of land, and afterwards received the gold medal of the Roy. Geog. Soc. and the Companionship of the Star of India. He died early in 1882.

See Koeppen, *Die Lamaische Hierarchie und Kirche* (Berlin, 1859), being the 2d vol. of *Die Religion des Buddha*; Giorgi, *Alphabetum Tibetanum*, Rome, 1762; Huc, *Souvenirs d'un Voyage*, etc., Paris, 1850, vol. ii.; *Desc. du Tubet* (Wei-tsang-thou-chy), edited by Klaproth, Paris, 1831; Pundit Nain Singh (Colonel Montgomerie's Report) in *Journ. Roy. Geog. Soc.*, vol. xxxviii. 129 *sq.*; *Tibet* (Bogle and Manning), by C. Markham, C.B. (2d ed. 1879); MS. narrative of P. Ipolito Desideri (copy in possession of Hakluyt Soc.). Also articles, by Dr. A. Campbell in *Journ. As. Soc. Bengal*, vol. xxiv. p. 215; by the late Wilfrid Heeley, B.C.S., in *Calc. Review*, vol. lix. p. 1; by Col. H. Yule, in *Blackwood's Mag.*, March, 1852, and in the *Times*, May 15, 1876; paper on "Chinese Tea Trade with Tibet," by E. C. Baber, printed in *Suppt. to Gazette of India*, November 8, 1879; "The Silver Coinage of Tibet," by M. Terrien de la Couperie, in *Numism. Chron.*, 3d ser., vol. i. (H. Y.)

L'HÔPITAL, or **L'Hospital, Michel de** (*c.* 1505–1573), chancellor of France from 1560 to 1568, was born near Aigueperse in Auvergne (now Puy-de-Dôme) about the year 1505. His father, who was physician and comptroller of accounts to the constable Charles de Bourbon, sent him to study at Toulouse, whence at the age of eighteen he was driven by the evil fortunes of the family patron, after suffering arrest and imprisonment, to Padua, in which university he studied law and letters for about six years. On the completion of his studies he joined his father at Bologna, and afterwards, the constable having died, went to Rome in the suite of Charles V. For some time he held the position of auditor of the rota at Rome, but in 1534, encouraged by the fair promises of Cardinal de Grammont, he returned to France. The death of his patron soon afterwards seriously impaired his prospects; but after he had entered himself of the Parisian bar, his marriage, in 1537, to a daughter of the lieutenant-criminel procured for him the post of counsellor to the parliament of Paris. This office he held until 1547, when he was sent by Henry II. on a mission to Bologna, where the council of Trent was at that time sitting; after sixteen months of wearisome inactivity there, he was by his own desire recalled at the close of 1548. L'Hôpital now for some time held the position of "chancellor" in the household of the princess Margaret, duchess of Berri, and in 1554 he was made superintendent of the royal finances. In 1559 he accompanied his mistress, now duchess of Savoy, to Nice, where, on the following year, tidings reached him that he had been chosen to succeed Olivier in the chancellorship of France. One of his first acts after entering on the duties of his office (in July, 1560) was to cause the parliament of Paris to register the edict of Romorantin, of which he is sometimes, but erroneously it would seem, said to have been the author. Designed as it was to protect so-called heretics from the secret and summary methods of the Inquisition, it certainly had his sympathy and approval. In accordance with the consistent policy of inclusion and toleration by which the whole of his official life was characterized, he induced the council to call the Assembly of Notables, which met at Fontainebleau in August, 1660, and agreed that the States General should be summoned, all proceedings against heretics being meanwhile suppressed, pending the reformation of the church by a general or national council. The States General met in December; the edict of Orleans (July, 1561) followed, and finally, after the colloquy of Poissy, that of January, 1562, the most liberal (except that of Nantes) ever obtained by the Protestants of France. Its terms, however, were not carried out, and during the war which was the inevitable result of the massacre of Vassy in May, L'Hôpital, whose dismissal had been for some time urged by the papal legate Hippolytus of Este, found it necessary to retire to his estate at Vignay near Étampes, whence he did not return until after the pacification of Amboise (March 19, 1563). It was by his advice that Charles IX. was declared of age (August 17, 1563), at Rouen, a measure which really increased the power of Catherine de' Medici; and it was under his influence also that the parliament of Paris in 1564 refused to sanction the publication of the acts of the council of Trent, on account of their inconsistency with the Gallican liberties. In 1564–66 he accompanied the young king on an extended tour through France; and in 1566 he was instrumental in the promulgation of an important edict for reform of abuses in the administration of justice. The renewal of the religious war in September, 1567, however, was at once a symptom and a cause of diminished influence to L'Hôpital, and in February, 1568, he obtained his letters of discharge, which were registered by the parliament on May 11, his titles, honors, and emoluments being reserved to him during the remainder of his life. Henceforward he lived a life of unbroken literary seclusion at Vignay, his only subsequent public appearance being by means of a "mémoire" which he addressed to the king in 1570 under the title *Le but de la guerre et de la paix, ou Discours du chancelier L'Hospital, pour exhorter Charles IX. à donner la paix à ses subjects.* Though not exempt from considerable danger, he passed in safety through the troubles of the St. Bartholomew, but did not long survive them. His death took place either at Vignay or at Bélesbat (Courdimanche, Etampes) on March 13, 1573.

After his death Pibrac, assisted by De Thou and Scévole de Sainte-Marthe, collected a volume of the *Poemata* of L'Hôpital, and in 1585 his grandson published *Epistolarum seu Sermonum libri sex*. The complete *Œuvres de l'Hôpital* were published for the first time by Dufey (5 vols. 8vo. Paris, 1824-25). They include his "Harangues" and "Remonstrances," the *Epistles*, the *Mémoire* to Charles IX., a *Traité de la Reformation de la Justice*, and the will of L'Hôpital. Haag (*France Prot.*, vii. p. 83) gives the titles of several MSS. still unpublished. Villemain wrote a *Vie de L'Hôpital*, which has recently been reprinted (1874), and there are monographs also by Taillandier (1861) and by Dupré-Lasal (1875).

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[1] See Walker's *Report* for 1873-74.

LIAU-YANG, or Leaou-Yang, a city of China, formerly the chief town of the province of Liau-tung or Shing-king (southern Manchuria), and still a place of considerable mark, 35 miles south of Moukden. It is situated in a rich cotton district, and carries on no small trade. The walls include an area about 2½ miles long by 2 miles broad, and there are pretty extensive suburbs; but a good deal even of the enclosed area is under cultivation. The population is estimated at 80,000.

LIBANIUS, a Sophist, was the most distinguished Greek writer of the 4th century A. D. He was born at Antioch between 314 and 316. He studied at Athens, and spent most of his earlier manhood in Constantinople and Nicomedia. His private classes at Constantinople were much more popular than those of the public professors; and their jealousy found means of having him expelled from Constantinople in 346 on the charge of studying magic. He was recalled from Nicomedia after five years. Ill health obliged him to retire to Antioch, where he spent the later part of his life. Though a pagan by religion, he enjoyed the favor of the Christian emperors. When Julian restored paganism as the state religion, Libanius showed no intolerance. Among his pupils he numbered St. John Chrysostom and St. Basil. His works, consisting chiefly of orations, declamations on set topics, and letters, are very voluminous, and have not yet been published in one single edition. He devoted much time to the study of the classical Greek writers, on whom his style is modelled with considerable success.

The best edition of the orations and declamations is Reiske's, of the letters Wolf's. See Westermann, *Gesch. d. Griech. Beredtsamkeit*; Bernhardy's and other histories of Greek literature; Förster, *Zur Schriftstellerei des Libanios*, and articles in Hermes, vols. ix. and x.

LIBAU (*Leepaja* of the Letts), a port of Russia, on the Baltic Sea, in the government of Courland and district of Grobin, 143 miles by rail south-west of Riga. It is situated at the northern extremity of a narrow sandy peninsula which separates Lake Libau (12 miles long and 2 miles wide) from the Baltic Sea. The town is well built of stone, with good gardens, and has a gymnasium and more than twenty different schools, cigar manufactories, machine works, and a small wharf. The sea throwing up a good deal of amber, many inhabitants are engaged in the fabrication of small articles of that substance. The harbor of Libau was 2 miles south of the town until a canal was dug through the peninsula in 1697; but this canal is liable to be silted up, and the depth at the bar is only 9 feet, or even 6 feet during south-west winds, so that larger ships must lie in the open roadstead. Libau being the most southern Baltic port in Russia has the advantage of freezing only for a few weeks during the winter. Since being brought, in 1872, into railway connection with Moscow, Orel, and Kharkoff, it has become an important Russian port, and competes with the northern ports of Prussia, the exports already exceeding by 100,000 tons those from Königsberg. In 1879 the port of Libau was visited by 1976 ships, and the export of corn, flax, hempseed, and linseed has reached 28,212,600 roubles (about £2,822,000), against 1,980,000 roubles and 367 ships in 1872. The merchants carry on an active trade in grain and flax, making their purchases directly in southern Russia; their warehouses are numerous, spacious, and well built. The yearly fair has some importance for the neighboring districts. The town is also a watering-place, yearly visited by several hundreds of persons. Population in 1881, 27,900; with military and railway servants 30,000.

The port of Libau, *Lyra portus*, is mentioned as early as 1263; it then belonged to the Livonian order. In 1418 it was burned by Lithuanians, and in 1560 it was mortgaged by the grandmaster of the order to the Prussian duke Albert. It was annexed to Russia in 1795

LIBEL AND SLANDER are the terms employed in English law to denote injurious attacks upon a man's reputation or character by words written or spoken, or by equivalent signs. In most early systems of law we find verbal injuries treated as a criminal or quasi-criminal offence, the essence of the injury lying not in pecuniary loss, which may be compensated by damages, but in the personal insult which must be atoned for,—a vindictive penalty coming in the place of personal revenge. By the law of the XII. Tables, the composition of scurrilous songs and gross noisy public affronts were punished by death. Minor offences of the same class seem to have found their place under the general conception of *injuria*, which included ultimately every form of direct personal aggression which involved contumely or insult. In the later Roman jurisprudence, which has, on this point, exercised considerable influence over modern systems of law, we find verbal injuries dealt with in the edict under two heads. The first comprehended defamatory and injurious statements which were made in a public manner (*convicium contra bonos mores*). In this case the essence of the offence lay in the unwarrantable public proclamation, in the contumely which was offered to a man before his fellow-citizens. In such a case the truth of the statements was no justification for the unnecessarily public and insulting manner in which they had been made. The second head included defamatory statements which were made in private, and in this case the offence lay in the imputation itself, not in the manner of its publication. The truth was therefore a sufficient defence, for no man had a right to demand legal protection for a false reputation. Even belief in the truth was enough, because it took away the intention which was essential to the notion of *injuria*. The law thus aimed at giving sufficient scope for the discussion of a man's character, while at the same time it protected him from needless insult and pain. The remedy for verbal injuries was long confined to a civil action for a money penalty, which was estimated according to the gravity of the case, and which, although vindictive in its character, doubtless included practically the element of compensation. But a new remedy was introduced with the extension of the criminal law, under which many kinds of defamation were punished with great severity. We find at the same time increased importance attached to the publication of defamatory books and writings, the *libri* or *libelli famosi*, from which we derive our modern use of the word libel; and under the later emperors the latter term came to be specially applied to anonymous accusations or pasquils, the dissemination of which was regarded as peculiarly dangerous, and visited with very severe punishment, whether the matter contained in them were true or false.

The earlier history of the English law of defamation is somewhat obscure. Civil actions for damages seem to have been tolerably frequent so far back as the reign of Edward I. There was no distinction drawn between words written and spoken. When no pecuniary penalty was involved, such cases fell within the old jurisdiction of the ecclesiastical courts, which was only finally abolished during the present reign. It seems, to say the least, uncertain whether any generally applicable criminal process was in use. The crime of *scandalum magnatum*, spreading false reports about the magnates of the realm, was established by statutes, but the first fully reported case in which libel is affirmed generally to be punishable at common law is one tried in the Star Chamber in the reign of James I. In that case no English authorities are cited except a previous case of the same nature before the same tribunal; the law and terminology appear to be taken directly from Roman sources, with the insertion that libels tended to a breach of the peace; and it seems probable that that not very scrupulous tribunal had simply found it convenient to adopt the very stringent Roman provisions regarding the *libelli famosi* without paying any regard to the Roman limitations. From that time we find both the criminal and civil remedies in full operation, and will now consider how the law stands with regard to each at the present time.

Civil Law.—The first important distinction we encounter is that between slander and libel, between the oral and written promulgation of defamatory statements. In the former case the remedy is limited. The law will not take notice of every kind of abusive or defamatory language. It must be shown either that the plaintiff has suffered actual damage as a direct consequence of the slander, or that the imputation is of such a nature that we are entitled to infer damage as a necessary consequence. The special damage on which an action is founded for slanderous words must be of the nature of pecuniary loss. Loss of reputation or of position in society, or even illness, however clearly it may be traced to the slander, is insufficient. When we cannot prove special damage, the action for slander is only allowed upon certain strictly defined grounds. These are the imputation of a crime or misdemeanor which is punishable corporeally, *e. g.*, by imprisonment; the imputation of a contagious or infectious disease; statements which tend to the disherison of an apparent heir (other cases of slander of title when the party is in possession requiring the allegation of special damage); and lastly, slanders directed against a man's professional or business character, which tend directly to prejudice him in his trade, profession, or means of livelihood. In the latter case the words must either be directly aimed at a man in his business or official character, or they must be such as necessarily to imply unfitness for his particular office or occupation. Thus words which merely reflect generally upon the moral character of a tradesman or professional man are not actionable, but they are actionable if directed against his dealings in the course of his trade or profession. But, in the case of a merchant or trader, an allegation which affects his credit generally is enough, and in the same way it has been held that statements are actionable which affect the ability or moral characters of persons who hold offices, or exercise occupation which require a high degree of ability, or infer peculiar confidence. In every place the plaintiff must have been at the time of the slander in the actual exercise of the occupation or enjoyment of the office with reference to which the slander is supposed to have affected him.

The action for libel is not restricted in the same way as that for slander. Originally, as we have seen, there appears to have been no essential distinction between them, but the establishment of libel as a criminal offence had probably considerable influence, and it soon became settled that written defamatory statements, or pictures and other signs which bore a defamatory meaning, implied greater malice and deliberation, and were generally fraught with greater injury than those which were merely made by word of mouth. The result has been that the action for libel is not limited to special grounds, or by the necessity of proving special damage. It may be founded on any statement which disparages a man's private or professional character, or which tends to hold him up to hatred, contempt, or ridicule. In one of the leading cases, for example, the plaintiff obtained damages because it was said of him that he was a hypocrite, and had used the cloak of religion for unworthy purposes. In another case a charge of ingratitude was held sufficient. In civil cases the libel must be published by being brought by the defendant under the notice of a third party, and it has even been held that it is sufficient if this has been done by gross carelessness, without deliberate intention to publish. Every person is liable to an action who is concerned in the publication of a libel, whether he be the author, printer, or publisher; and the extent and manner of the publication, although not affecting the ground of the action, is a material element in estimating the damages.

It is not necessary that the defamatory character of the words or writing complained of should be apparent on their face. They may be couched in the form of an insinuation, or may derive their sting from a reference to circumstances understood by the persons to whom they are addressed. In such a case the plaintiff must make the injurious sense clear by an averment called an innuendo, and it is for the jury to say whether the words bore the meaning thus ascribed to them.

In all civil actions for slander and libel the falsity of the injurious statements is an essential element, so that the defendant is always entitled to justify his statements by their truth; but when the statements are in themselves defamatory, their falsity is presumed, and the burden of proving their truth is laid upon the defendant. There are, however, a large class of false defamatory statements, commonly called privileged, which are not actionable on account of the particular circumstances in which they are made. The general theory of law with regard to these cases is this. It is assumed that in every case of defamation intention is a necessary element; but in the ordinary case, when a statement is false and defamatory, the law presumes that it has been made or published with an evil intent, and will not allow this presumption to be rebutted by evidence or submitted as matter of fact to a jury. But there are certain circumstances in which the natural presumption is quite the other way. There are certain natural and proper occasions on which statements may be made which are in themselves defamatory, and which may be false, but which naturally suggest that the statements may have been made from a perfectly proper motive and with entire belief in their truth. In the cases of this kind which are recognized by law, the presumption is reversed. It lies with the plaintiff to show that the defendant was actuated by what is called *express malice*, by an intention to do harm, and in this case the question is not one of legal inference for the court, but a matter of fact to be decided by the jury. Although, however, the theory of the law seems to rest entirely upon natural presumption of intention, it is pretty clear that in determining the limits of privilege the courts have been almost wholly guided by considerations of public or general expediency.

In some cases the privilege is absolute, so that we cannot have an action for defamation even although we prove express malice. Thus no action of this kind can be maintained for statements made in the course of judicial proceedings if they are in any sense relevant to the matter in hand. In the same way no statements or publications are actionable which are made in the ordinary course of parliamentary proceedings. Papers published under the authority of parliament are protected by a special Act, 3 & 4 Vict. c. 9, which was passed after a decree of the law courts adverse to the privilege claimed. The reports of judicial and parliamentary proceedings stand in a somewhat different position, which has only been attained after a long and interesting conflict. The general rule now is that all reports of parliamentary or judicial proceedings are privileged in so far as they are honest and impartial. Even *ex parte* proceedings, in so far as they take place in public, now fall within the same rule. But if the report is garbled, or if part of it only is published, the party who is injured in consequence is entitled to maintain an action, and to have the question of malice submitted to a jury. Comments on subjects of public interest, on the proceedings of courts or public bodies, on publications, exhibitions, and on persons who have in any way chosen to invite the public attention, fall within a similar rule. The public interest demands that on all these subjects a fair latitude for discussion should be permitted; the critic is entitled to the utmost liberty so long as he expresses nothing more than his honest opinion of the subject before him, but if it can be proved that he has used false and defamatory language out of malice, and especially if he has travelled beyond the facts which are properly before the public, he is no longer protected by his privilege. In private life a large number of statements are privileged so long as they remain matters of strictly private communication. It is difficult to define the limits of private privilege without extensive reference to concrete cases; but generally it may be said that it includes all communications which are made in performance of a duty not merely legal but moral or social, answers to *bona fide* inquiries, communications made by persons in confidential relations regarding matters in which one or both are interested, and even statements made within proper limits by persons in the *bona fide* prosecution of their own interest. Common examples of this kind of privilege are to be found in answer to inquiries as to the character of servants or the solvency of a trader, warnings to a friend, communications between persons who are jointly interested in some matters of business. But in every case we must be careful not to exceed the limits of publication required by the occasion, or otherwise the privilege is lost. Thus defamatory statements may be privileged when made to a meeting of shareholders, but not when published to others who have no immediate concern in the business.

In a few instances in which an action cannot be maintained even by the averment of malice, the plaintiff may maintain an action by averring not only malice but also want of reasonable and probable cause. The most common instances of this kind are malicious charges made in the ordinary course of justice and malicious prosecutions. In such cases it would be contrary to public policy to punish or prevent every charge which was made from a purely malicious motive, but there is no reason for protecting accusations which are not only malicious, but destitute of all reasonable probability.

Criminal Law.—Publications which are blasphemous, immoral, or seditious are frequently termed libels, and are punishable both at common law and by various statutes. The matter, however, which constitutes the offence in these publications lies beyond our present scope. Libels upon individuals may be prosecuted by criminal information or indictment, but there can be no criminal prosecution for slander. So far as concerns the definition of libel, and its limitation by the necessity of proving in certain cases express malice, there is no substantial difference between the rules which apply to criminal prosecutions and to civil actions, with the one important exception (now considerably modified) that the falsity of a libel is not in criminal law an essential element of the offence. If the matter alleged were in itself defamatory, the court would not permit inquiry into its truth. The sweeping application of this rule seems chiefly due to the indiscriminate use, in earlier cases, of a rule in Roman law which was only applicable to certain modes of publication, but has been supported by various reasons of general policy, and especially by the view that one main reason for punishing a libel was its tendency to provoke a breach of the peace. The same view has occasioned a difference in the publication required in civil and criminal actions. It is enough in criminal law that the libel has been published to the party against whom it is directed, if it is averred that it is intended or calculated to produce a breach of the peace. Important alterations, however, have been introduced into this branch of the law by 6 & 7 Vict. c. 96. By that Act any person who maliciously publishes a defamatory libel may be punished by fine or imprisonment or both, the imprisonment not to exceed one year. Any person maliciously publishing a defamatory libel, knowing the same to be false, is liable to fine and imprisonment for two years. In every case the truth of the matters charged may be inquired into if it be pleaded, but the truth does not amount to a defence unless it is also proved that the publication was for the public benefit; and if, after such plea, the defendant is convicted, it is competent to the court to consider whether the guilt of the defendant is mitigated or aggravated by the plea, and the evidence given in relation to it. By the same Act a defendant is protected from publication of libels without his knowledge, authority, or consent, if the publication did not arise from the want of due care and caution on his part. The court are further authorized to award costs to the defendant in any information or indictment at the instance of a private prosecutor.

An important dispute about the powers of the jury in cases of libel arose during last century in connection with some well known trials for seditious libels. The point is familiar to readers of Macaulay in connection with the trial of the seven bishops, but the cases in which it was brought most prominently forward, and which led to its final settlement, were those against Woodfall (the printer of *Junius*), Wilkes, and others, and especially the case against Shipley, the dean of St. Asaph (21 St. Tr. 925), in which the question was fought by Mr. Erskine with extraordinary energy and ability. The controversy turned upon the question whether the jury were to be strictly confined to matters of fact which required to be proved by evidence, or whether in every case they were entitled to form their own opinion upon the libellous character of the publication and the intention of the author. There could be no doubt of course that the jury, if they pleased, had it in their power to return a general verdict of guilty or not guilty, but both in theory and practice they were subject in law to the directions of the court, and had to be informed by it as to what they were to take into consideration in determining upon their verdict (see JURY). There is no difficulty about the general application of this principle in criminal trials. In a case of murder, for example, the judge directs the jury that if they are satisfied the accused did so and so they ought to find him guilty. He directs them, not merely as to the definition of the crime, but as to the particular facts which fall within that definition. If the crime is one which is inferred by law from certain facts, they are only concerned with these facts, and must accept the construction which is put upon them by law. Applying these principles to the case of libel, juries were directed that it was for the court to determine whether the publication fell within the definition of libel, and whether the case was one in which malice was to be inferred by construction of law. If the case were one in which malice was inferred by law, the only facts left to the jury were the fact of publication and the meaning averred by innuendoes; they could not go into the question of intention, unless the case were one of privilege, in which express malice had to be proved. In general principle, therefore, the decisions of the court were in accordance with the ordinary principles of criminal law. But there were undoubtedly some peculiarities in the case of libel. The sense of words, the inferences to be drawn from them, and the effect which they produce, are not so easily defined as gross matters of fact. They seem to belong to those cases in which the impression made upon a jury is more to be trusted than the decision of a judge. And further, owing to the mode of procedure, the defendant was often punished before the question of law was determined. But nevertheless the question would scarcely have been raised had the libels related merely to private matters. The real ground of dispute was the liberty to be accorded to political discussion. Had the judges taken as wide a view of privilege in discussing matters of public interest as they do now, the question could scarcely have arisen; for Erskine's whole contention really amounted to this, that the jury were entitled to take into consideration the good or bad intent of the authors, which is precisely the question which would now be put before them in any matter which concerned the public. But at that time the notion of a special privilege attaching to political discussion had scarcely arisen, or was at least confined within very narrow limits, and the cause of free political discussion seemed to be more safely entrusted to juries than to courts. The question was finally settled by Mr. Fox's Libel Act (32 Geo. III. c. 60), by which the jury were entitled to give a general verdict on the whole matter put in issue.

Scotch Law.—In Scotch law there were originally three remedies for defamation. It might be prosecuted by or with the concurrence of the lord advocate before the Court of Justiciary; or, secondly, a criminal remedy might be obtained in the commissary (ecclesiastical) courts, which originally dealt with the defender by public retractation or penance, but subsequently made use of fines payable to their own procurator or to the party injured, these latter being regarded as solatium to his feelings; or, lastly, an action of damages was competent before the Court of Sessions, which was strictly civil in its character, and aimed at the reparation of patrimonial loss. The first remedy has fallen into disuse; the second and third (the commissary courts being now abolished) became mixed up together, and are represented by the present action for damages or solatium. Originally the action before the Court of Session was strictly for damages—founded, not upon the *animus injuriandi*, but upon culpa, and could be defended by proving the truth of the statements. But in time the Court of Session began to assume the original jurisdiction of the commissary courts, and entertained actions for solatium, in which the *animus injuriandi* was a necessary element, and to which, as in Roman law, the truth was not necessarily a defence. Ultimately the two actions got very much confused. We find continual disputes as to the necessity for the *animus injuriandi* and the applicability of the plea of *veritas convicii*, which arose from the fact that the courts were not always conscious that they were dealing with two actions, to one of which these notions were applicable, and to the other not. On the introduction of the jury court, presided over by an English lawyer, it was quite natural that he, finding no very clear distinction maintained between damage and solatium, applied the English plea of truth as a justification to every case, and retained the *animus injuriandi* both in ordinary cases and cases of privilege in the same shape as the English conception of malice. The leading and almost only differences between the English and Scotch law now are that the latter makes no essential distinction between oral and written defamation, that it practically gives an action for every case of defamation oral or written upon which in England a civil action might be maintained for libel, and that it possesses no criminal remedy. In consequence of the latter defect and the indiscriminate application of the plea of veritas to every case both of damages and solatium, there appears to be at present no remedy in Scotland even for the widest and most needless publication of offensive statements if only they are true.

American Law.—In this as in so many other departments the American law scarcely if at all differs from that of England. In so far indeed as the common law is concerned, they may be said to be substantially identical. The principal statutes which have altered the English criminal law, such as Mr. Fox's Act, and 6 & 7 Vict. c. 96, are also represented by equivalent legislation in most American States. (A. GI.)

LIBER AND LIBERA, among the Romans, were a pair of deities, male and female, in whose worship two very different phases exist side by side. In the country feast of the vintage, and the city festival of March 17th called *Liberalia*, we find purely Italian ceremonial unaffected by Greek religion. The country festival was a great merrymaking, where the first-fruits of the new must were offered to the gods. It was full of unbridled rejoicing, and characterized by the grossest symbolism, in honor of the fertility of nature. It is usual to refer the name Liber to the free unrestrained character of his worship, In the city festival, growing civilization had impressed a new character on the primitive religion, and connected it with the framework of society. At this time the youths laid aside the boy's *toga prætexta* and assumed the man's *toga libera* or *virilis*. Cakes of *far*, honey, and oil (*liba*) were offered to the two gods at this festival. Liber is often invoked as *Liber Pater*, and we find even the expression *Jupiter Liber*, taking us back to the primitive stage of religion when no divine hierarchy of gods had been elaborated, and when Liber and Libera were in the sphere of their cultus the sole god and goddess. Originally Liber is probably only an epithet of Jupiter.

At an early period the Hellenic religion of Demeter, common to all the Greek colonies of Italy and Sicily, spread to Rome; then Liber and Libera were identified with Dionysus and Persephone, and associated with another Italian goddess Ceres, who was identified with Demeter. At the order of the Sibylline books, a temple was built to these three deities near the Circus Flaminius; the whole cultus was borrowed from the Greeks, down even to the terminology, and priestesses were brought from the Greek cities. The temple, *Ædes Cereris*, was founded by Aulus Postumius, 496 B. C., and dedicated by Spurius Cassius, 493 B. C. The chief festival of this cultus lasted eight days, from the 12th to the 19th of April; it was accompanied by games, called *Ludi Cereales* or *Liberales*. The plebeian ædiles, appointed about the time when the temple was founded, were closely attached to it, and from that time plebeian liberty continued in intimate relation to the *Ædes Cereris* and the gods there worshipped.

LIBERIA, a Negro republic on the Grain Coast of West Africa. Founded in 1822 by American philanthropists for the settlement of freedmen who wished to return to their tribal land, or to enjoy political and social privileges then denied them in the United States, it remained for twenty-five years under the tutelage of the mother country,[1] but on the 26th July, 1847, it was declared independent. In 1848 it was recognized as a sovereign state by Great Britain, which aided it in various ways, and by other Continental powers, and finally in 1861 by the United States. Its nominal boundaries are from the river Jong, a tributary of the Sherbro, in 7° 35′ N. lat., 12° 20′ W. long., and the river San Pedro, in 4° 45′ N. lat., 6° 40′ W. long., a distance of 380 miles, the limits of the state in the interior being usually stated at from 80 to 100 miles eastward, though this is unsettled, and the entire area of the country at 24,000 square miles, or 1000 miles less than Holland and Belgium combined. Like that of northern Guinea generally, the Liberian shore is low, but the country rises towards the interior, and is well wooded and watered by numerous streams. The climate is, however, hot and unhealthy for Europeans, though of late years it has been improved by drainage, and is considered superior to that of any part of the neighboring coast. The soil is fertile and well suited for the growth of tropical crops, such as cotton, rice, sugar, indigo, yams, ground-nuts, bananas, ginger, cassava, pineapples, cocoa-nuts, limes, oranges, tamarinds, and the Liberian variety of coffee[2] held in such high esteem. These products, in addition to palm oil, form the main support of the inhabitants, who in return import arms, ammunition, tobacco, salt provisions, implements of husbandry, cutlery, British cottons, and other manufactured goods. Coffee, palm oil, palm-kernels, rubber, ivory, dye woods, hides, arrowroot, sugar, cocoa, ginger, and rice form the principal articles of its commerce, which is carried on chiefly with Great Britain, Holland, Hamburg, and America. Copper, gold, iron, and deposits of gum-copal exist, but they are not worked; and all the large wild animals have long since been killed or driven out of the woods. Stock can be kept in the higher lands. The government is modelled on that of the United States, and consists of a president, and a congress composed of a senate of eight members elected for four years, and of a house of representatives of thirteen members elected for three years, in addition to a supreme court, and a cabinet of the American type. One additional representative is given for each additional 10,000 inhabitants by which the population may increase. Military service in the militia is obligatory on every male citizen between the ages of sixteen and fifty, but there is no standing army. There is no established church, and all faiths are equally tolerated. The state is divided into four counties (Mezurada, Grand Bassa, Sinoe, and Maryland[3]), and these again into townships, each 64 square miles in area. There are a number of little villages, but the only place of any consequence is Monrovia, the capital, containing 13,000 inhabitants, and in appearance very like a town in the southern United States, but in no way remarkable except for the large number of churches within its bounds. Besides Monrovia the chief ports are Robertsport, Marshall, Edina or Buchanan, Greenville, Sesters River, Sasstown, and Harper, and in 1881 foreigners were further permitted to trade at any point to the north of Robertsport. The present population of the republic (1882) comprises 18,000 civilized negroes, chiefly of American origin, and 1,050,000 half-wild natives, some of whom are adopting a settled life, and conforming to the habits of their tamed countrymen. Among the more interesting tribes are the Veis, the Bassas, the Krus, and the Mandingoes. The American Methodist Episcopal mission dates from 1833, the American Episcopal from 1834, and that of the American Baptist from 1835. The revenue of the state was returned at September 30, 1875, as 111,457 dollars, chiefly derived from customs, the national debt being 500,000 dollars, contracted in England in 1871. Of this neither principal nor interest has been paid. Socially and politically the state cannot be pronounced a marked success. The negroes in America display little desire to throw in their fortunes with it, now that they are free to go whither they list, nor do the barbarous tribes on the border of the republic seem to admire the black parody on a white man's government, which for sixty years has been presented to them. There is now and again a small immigration from the United States, but the Liberian civilization, cut off from the benefit of intercourse with a higher and broader culture, is apt to deteriorate, while neither the climate nor the laws and social surroundings are ever likely to attract many white men to its shores. It is, however, only fair to add that, though internal disorder is too often the rule, the state shows an appreciation of education and religion, and a keen desire to stand well in the good opinion of the powers with which it has relations by accredited representatives. It has formed treaties with most of the European countries, and with Hayti and the United States; and, though it has not paid its debts, successive Governments are in the habit of registering vows to meet this first obligation of a nation towards its neighbors. British coin and an irredeemable paper currency are the money chiefly in circulation, but all accounts are kept in United States dollars and cents. The weights employed are also British, except that gold from the interior is bought and sold by the usano = 16 akis = 16,000 cowries = 314·76 grains troy. The gondar-ardeb (7·74 imperial pints), the massuah-ardeb (2·32 imp. gals.), and the kuba (1·788 imp. pints) are also in common use.

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[1] [The American Colonisation Society founded Liberia, sending its first emigrants thither in 1820. The United States had no official responsibility in the matter, but maintained a station there to receive negroes captured from slave ships under the Piracy Laws.—AM. ED.]

[2] Liberian coffee (see COFFEE, vol. vi. p. 100) has been introduced into Brazil, Ceylon, the Dutch Indies, etc. The quantity actually exported from Liberia is comparatively small.

[3] Maryland was originally a separate colony, founded in 1831; it became an independent republic in 1854, and about 1860 was incorporated with its older neighbor.

See Gurley's *Life of Jehudi Ashmun*, 1835; Stockwell, *The Republic of Liberia*, 1868; Wilson, *West Africa*, 1856; Hutchinson, *Impressions of West Africa*, 1858; Ritter, in *Zeitschrift für allgemeine Erdkunde*, vol. i., 1853; Brown, *Countries of the World*, vol. vi. pp. 123-127, 1881; Bowen, *Central Africa*, 1857; Thomas, *West Coast of Africa*, 1860; "Die Negerrepublik Liberia," in *Unsere Zeit*, vol. iii., 1858; U. S. Consular Reports, 1881.

LIBERIUS, pope from 352 to 366, the successor of Julius I., was consecrated according to the *Catalogus Liberianus* on May 22. His first recorded act was, after a synod had been held at Rome, to write to Constantius, then in quarters at Arles (353-54), asking that a council might be called at Aquileia with reference to the affairs of Athanasius; but his messenger Vincentius of Capua, so far from being successful in his mission, was himself compelled by the emperor at a conciliabulum held in Arles to subscribe against his will a condemnation of the orthodox patriarch of Alexandria. In 355 Liberius was one of the few who, along with Eusebius of Vercelli, Dionysius of Milan, and Lucifer of Cagliari, refused to sign the condemnation of Athanasius, which had anew been imposed at Milan by imperial command upon all the Western bishops; the consequence was his relegation to Berœa in Thrace, Felix II. (antipope) at the same time being consecrated his successor by three "catascopi haud episcopi," as Athanasius called them. At the end of an exile of more than two years he yielded so far as to subscribe the third Sirmian formula giving up the "homoousion,"—an act which procured his immediate and triumphant return to Rome, but has ever since caused considerable embarrassment to maintainers of the indefectibility of Roman orthodoxy. The remainder of his pontificate was uneventful. He died on September 24, 366, and was succeeded by Damasus I. With the rest of the first sixty popes he shares the title of "Saint." His biographers used to be perplexed by a letter purporting to be from Liberius, in the works of Hilary, in which he seems to write, in 352, that he had excommunicated Athanasius at the instance of the Oriental bishops; but the document is now held to be spurious. See Hefele, *Conciliengesch.*, i. p. 648 *sq.*

LIBOURNE, the chief town of an arrondissement, and in point of population the second town of the department of Gironde, France, is situated at the confluence of the Isle with the Dordogne, 337 miles by rail south-west from Paris, and 22 miles east from Bordeaux. The sea is 56 miles off, but the tide affects the river so as to admit of vessels of 300 tons burden reaching the town. The Dordogne is here crossed by a stone bridge 492 feet long, and a suspension bridge across the Isle connects Libourne with the adjoining Fronsac, the citadel of which, 235 feet above the sea, was at one time occupied by a palace of Charlemagne, and subsequently became an important fortress. Libourne is regularly built, but has no monuments of much architectural or historical interest; the (restored) Gothic church has a stone spire 232 feet high. On the quay there is a machicolated clock-tower which is a remnant of the ramparts of the 14th century; and the townhouse, containing a small museum, is a quaint relic of the 16th century. There is a statue of the Duc Decazes, who was born in the neighborhood. The principal articles of commerce are the wines and brandies of the district, the growths of chief repute being those of St. Emilion, a short distance above Libourne, on the right bank of the Dordogne, and of Canon, a little below Fronsac. There is also some trade in yarn, grain, and wood for cooperage. Woollen stuffs and some articles of army outfit are manufactured; and nailmaking, tanning, shoemaking, and shipbuilding are also carried on. The harbor is used exclusively by small vessels for the export of wines; the shipping owned in the place does not exceed 2500 tons. The population of Libourne in 1876 was 15,231.

Like other sites at the confluence of important rivers, that of Libourne was appropriated at an early period. Under the Romans *Condate* stood rather more than a mile to the south of the present Libourne, where the old Gothic chapelle de Condat now is; it was destroyed during the troubles of the 5th century. Resuscitated by Charlemagne, it was rebuilt, under its present name, and on the site and plan it still retains, by Edward, prince of Wales, in 1270. It suffered considerably in the struggles of the French and English for the possession of Guienne in the 14th century, and again during the religious wars, and finally in the war of the Fronde in the minority of Louis XIV. Nevertheless it ultimately outgrew both its powerful neighbors, Fronsac and Saint Émilion, the latter of which is archæologically one of the most curious spots in France.

LIBRARIES.

HISTORY AND DESCRIPTION.

Ancient Period.

LIBRARIES, in our modern sense of collections of printed or written literature, imply an advanced and elaborate civilization. If the term be extended to any considerable collection of written documents, they must be nearly as old as civilization itself. The earliest use to which the invention of inscribed or written signs was put was probably to record important religious and political transactions. These records would naturally be preserved in sacred places, and accordingly the earliest libraries of the world were probably temples, and the earliest librarians priests. And indeed before the extension of the arts of writing and reading the priests were the only persons who could perform such work as, *e. g.*, the compilation of the *Annales Maximi*, which was the duty of the pontifices in ancient Rome. The beginnings of literature proper in the shape of ballads and songs may have continued to be conveyed orally only from one generation to another, long after the record of important religious or civil events was regularly committed to writing. The earliest collections of which we know anything, therefore, were collections of archives. Of this character appear to have been such famous collections as that of the Medians at Ecbatana or the Persians at Susa. It is not until the development of arts and sciences, and the growth of a considerable written literature, and even of a distinct literary class, that we find collections of books which can be called libraries in our modern sense. It is of libraries in the modern sense, and not, except incidentally, of archives that we are to speak.

The researches which have followed the discoveries of Botta and Layard have thrown unexpected light not only upon the history but upon the arts, the sciences, and the literatures of the ancient civilizations of Babylonia and Assyria. In all these wondrous revelations no facts are more interesting than those which show the existence of extensive libraries so many ages ago, and none are more eloquent of the elaborateness of these forgotten civilizations.

Assyria.

In the course of his excavations at Nineveh in 1850, Layard came upon some chambers in the south-west palace, the floor of which, as well as of the adjoining rooms, was covered to the depth of a foot with tablets of clay, covered with cuneiform characters, in many cases so small as to require a magnifying glass. These varied in size from an inch to a foot square. A great number of them were broken, as Layard supposed by the falling in of the roof, but as the late Mr. George Smith thought by having fallen from the upper story, upon which he believed the collection to have been placed. These tablets formed the library of the great monarch Assur-bani-pal—the Sardanapalus of the Greeks—the greatest patron of literature amongst the Assyrians. It is estimated that this library consisted of some ten thousand distinct works and documents, some of the works extending over several tablets. The tablets appear to have been methodically arranged and catalogued, and the library seems to have been thrown open for the general use of the king's subjects.[1] A great portion of this library has already been brought to England and deposited in the British Museum, but it is calculated that there still remain some 20,000 fragments to be gathered up. For further details as to Assyrian libraries, and the still earlier Babylonian libraries from which the Assyrians drew their science and literature, see Babylonia, vol. iii. p. 165.

Egypt.

Of the libraries of ancient Egypt our knowledge is much less full and precise. It seems to be ascertained that the oldest hieroglyphic writings now extant run some centuries farther back than 2000 B. C. We possess a papyrus manuscript which is assigned to the age of Amenophis I. of the 18th dynasty, perhaps about 1600 B. C., and the fabric is so perfect as to point to a much earlier invention.[2] With the invention of papyrus came the age of books. The temples were the centres of literary activity, and to each of them were attached professional scribes who occupied a very respectable position. Their function was regarded as a religious one, for the distinction between religion and science had not yet been made. The sacred books of Thoth—forty-two in number—constituted as it were a complete encyclopædia of religion and science. But they did not forbid speculation, or a wider development of the principles contained in them. So there arose a great mass of literature in the shape of exposition and commentary. To such an extent did this increase that at the time of the Greek conquest of Egypt the Thoth literature is said to have amounted to 36,525 books.[3] Books were collected not only in the temples but also at the tombs of kings. The most famous of these libraries dates from the 14th century B. C., and was the so-called library of King Osymandyas, described by Diodorus Siculus, who relates that it bore an inscription which he renders by the Greek words ΨΥΧΗΣ ΙΑΤΡΕΙΟΝ, "the dispensary of the soul." Osymandyas has been identified with the great king Ramses I., and the seat of the library is supposed by Wilkinson to have been the Ramesseum, the magnificent palace temple near Thebes.[4] Lepsius thinks he has found the tombs of two of the librarians of Osymandyas.[5] According to Eustathius there was also a great collection in a temple at Memphis. A heavy blow was dealt to the old Egyptian literature by the Persian invasion, and many of their books were carried away by the conquerors. They were only delivered from the yoke of Persia to succumb to that of Greece, and henceforward their civilization was dominated by foreign influences. Of the libraries of Greece under the Ptolemies we shall therefore speak a little further on.

Greece.

Of the libraries of ancient Greece we have very little knowledge, and such knowledge as we possess comes to us for the most part from late compilers. Amongst those who are known to have collected books are Pisistratus, Polycrates of Samos, Euclid the Athenian, Nicocrates of Cyprus, Euripides and Aristotle (Athenæus, i. 4). At Cnidus there is said to have been a special collection of works upon medicine. Pisistratus is said to have been the first of the Greeks who collected books on a large scale. Aulus Gellius, indeed, tells us in language perhaps "not well suited to the 6th century B. C.,"[6] that he was the first to establish a public library. The authority of Aulus Gellius is hardly sufficient to secure credit for the story that this library was carried away into Persia by Xerxes and subsequently restored to the Athenians by Seleucus Nicator. Plato is known to have been a collector; and Xenophon tells us of the library of Euthydemus. The library of Aristotle was bequeathed by him to his disciple Theophrastus, and by Theophrastus to Neleus, who carried it to Scepsis, where it is said to have been concealed under ground to avoid the literary cupidity of the kings of Pergamus. Its subsequent fate has given rise to much controversy, but, according to Strabo (xiii. pp. 608, 609), it was sold to Apellicon of Teos, who carried it to Athens, where after Apellicon's death it fell a prey to the conqueror Sulla, and was transported by him to Rome. The story told by Athenæus (i. 4) is that the library of Neleus was purchased by Ptolemy Philadelphus. The names of a few other libraries in Greece are barely known to us from inscriptions; of their character and contents we know nothing. If indeed we are to trust Strabo entirely, we must believe that Aristotle was the first person who collected a library, and that he communicated the taste for collecting to the sovereigns of Egypt. **Alexandria.** It is at all events certain that the libraries of Alexandria were the most important as they were the most celebrated of the ancient world. Under the enlightened rule of the Ptolemies a society of scholars and men of science was attracted to their capital. It seems pretty certain that Ptolemy Soter had already begun to collect books, but it was in the reign of Ptolemy Philadelphus that the libraries were properly organized and established in separate buildings. Ptolemy Philadelphus sent into every part of Greece and Asia to secure the most valuable works, and no exertions or expense were spared in enriching the collections. Ptolemy Euergetes, his successor, is said to have caused all books brought into Egypt by foreigners to be seized for the benefit of the library, while the owners had to be content with receiving copies of them in exchange. Nor did the Alexandrian scholars exhibit the usual Hellenic exclusiveness, and many of the treasures of Egyptian and even of Hebrew literature were by their means translated into Greek. There were two libraries at Alexandria; the larger, in the Bruchium quarter, was in connection with the Museum, a sort of academy, while the smaller was placed in the Serapeum. The number of volumes in these libraries was very large, although it is difficult to attain any certainty as to the real numbers amongst the widely varying accounts. According to a scholium of Tzetzes, who appears to draw his information from the authority of Callimachus and Eratosthenes, who had been librarians at Alexandria, there were 42,800 volumes or rolls in the Serapeum and 490,000 in the Bruchium.[1] This enumeration seems to refer to the librarianship of Callimachus himself under Ptolemy Euergetes. In any case the figures agree tolerably well with those given by Aulus Gellius[2] (700,000) and Seneca[3] (400,000). It should be observed that, as the ancient roll or volume usually contained a much smaller quantity of matter than a modern book—so that, *e. g.*, the history of Herodotus might form nine "books" or volumes, and the *Iliad* of Homer twenty-four—these numbers must be discounted for the purposes of comparison with modern collections.[4] The series of the first five librarians at Alexandria appears to be pretty well established as follows:—Zenodotus, Callimachus, Eratosthenes, Apollonius, and Aristophanes; and their activity covers a period of about a century.[5] The first experiments in bibliography appear to have been made in producing catalogues of the Alexandrian libraries. Amongst other lists, two catalogues were prepared by order of Ptolemy Philadelphus, one of the tragedies, the other of the comedies contained in the collections. The Πίνακες of Callimachus formed a catalogue of all the principal books arranged in 120 classes. When Cæsar set fire to the fleet in the harbor of Alexandria, the flames accidentally extended to the larger library of the Bruchium, and it was destroyed.[6] Antony endeavored to repair the loss by presenting to Cleopatra the library from Pergamus. This was very probably placed in the Bruchium, as this continued to be the literary quarter of Alexandria until the time of Aurelian. Thenceforward the Serapeum became the principal library. The usual statement that from the date of the restoration of the Bruchium under Cleopatra the libraries continued in a flourishing condition until they were destroyed after the conquest of Alexandria by the Saracens in 640 A. D. can hardly be supported. It is very possible that one of the libraries perished when the Bruchium quarter was destroyed by Aurelian, 273 A. D. In 389 or 391 an edict of Theodosius ordered the destruction of the Serapeum, and its books were pillaged by the Christians. When we take into account the disordered condition of the times, and the neglect into which literature and science had fallen, there can be little difficulty in believing that there were but few books left to be destroyed by the soldiers of 'Amr. The familiar anecdote of the caliph's message to his general (vol. i. p. 436) rests mainly upon the evidence of Abulfaragius, so that we may be tempted to agree with Gibbon that the report of a stranger who wrote at the end of six hundred years is overbalanced by the silence of earlier and native annalists. It is, however, so far from easy to settle the question that a cloud of names could easily be cited upon either side, while some of the most careful inquirers confess the difficulty of a decision.[7]

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[1] See Menant, *Bibliothèque du Palais de Ninive*, Paris, 1880.

[2] Wuttke, *Entstehung der Schrift*, p. 531, Leipsic, 1872.

[3] Lepsius, *Chronologie der Aegypter*, p. 42, Berlin, 1849.

[4] Wilkinson, *Ancient Egypt*, i., 111 *sq.*

[5] Lepsius, *Chronologie der Aegypter*, p. 39.

[6] Grote, *History of Greece*, iv. 37, following Becker.

Pergamus.

The magnificence and renown of the libraries of the Ptolemies excited the rivalry of the kings of Pergamus, who vied with the Egyptian rulers in their encouragement of literature. Despite the obstacles presented by the embargo placed by the Ptolemies upon the export of papyrus, the library of the Attali attained considerable importance, and, as we have seen, when it was transported to Egypt numbered 200,000 volumes. We learn from a notice in Suidas that in 221 B. C. Antiochus the Great summoned the poet and grammarian Euphorion of Chalcis to be his librarian.

Rome.

The early Romans were far too warlike and practical a people to devote much attention to literature, and it is not until the last century of the republic that we hear of libraries in Rome. The collections of Carthage, which fell into their hands when Scipio sacked that city (146 B. C.), had no attractions for them; and with the exception of the writings of Mago upon agriculture, which the senate reserved for translation into Latin, they bestowed all the books upon the kinglets of Africa.[8] It is in accordance with the military character of the Romans that the first considerable collections of which we hear in Rome were brought there as the spoils of war. The first of these was that brought by Æmilius Paulus from Macedonia after the conquest of Perseus (167 B. C.). The library of the conquered monarch was all that he reserved from the prizes of victory for himself and his sons, who were fond of letters. Next came the library of Apellicon the Teian, brought from Athens by Sulla (86 B. C.). This passed at his death into the hands of his son, but of its later history nothing is known. The rich stores of literature brought home by Lucullus from his eastern conquests (about 67 B. C.) were freely thrown open to his friends and to men of letters. Accordingly his library and the neighboring walks were much resorted to, especially by Greeks. It was now becoming fashionable for rich men to furnish their libraries well, and the fashion prevailed until it became the subject of Seneca's scorn and Lucian's wit. The zeal of Cicero and Atticus in adding to their collections is well known to every reader of the classics. Tyrannion is said to have had 30,000 volumes of his own; and that M. Terentius Varro had large collections we may infer from Cicero's writing to him: "Si hortum in bibliotheca habes, nihil deerit." Not to prolong the list of private collectors, Serenus Sammonicus is said to have left to his pupil the younger Gordian no less than 62,000 volumes. Amongst the numerous projects entertained by Cæsar was that of presenting Rome with public libraries, though it is doubtful whether any steps were actually taken towards its execution. The task of collecting and arranging the books was entrusted to Varro. This commission, as well as his own fondness for books, may have led Varro to write the book upon libraries of which a few words only have come down to us, preserved by a grammarian. Varro also appears to have been the first to ornament a library with the statues and busts of learned men, though the idea is sometimes attributed to Asinius Pollio. The greater honor of being the first actually to dedicate a library to the public is said by Pliny and Ovid to have fallen to Pollio, who erected a library in the Atrium Libertatis on Mount Aventine, defraying the cost from the spoils of his Illyrian campaign. The library of Pollio was followed by the public libraries established by Augustus. That emperor, who did so much for the embellishment of the city, erected two libraries, the Octavian and the Palatine. The former was founded (33 B. C.) in honor of his sister, and was placed in the Porticus Octaviæ, the lower part of which served as a promenade, while the upper part contained the library. The charge of the books was committed to C. Melissus. The other library formed by Augustus was attached to the temple of Apollo on the Palatine hill, and appears from inscriptions to have consisted of two departments, a Greek and a Latin one, which seem to have been separately administered. The charge of the Palatine collections was given to Pompeius Macer, who was succeeded by Julius Hyginus, the grammarian and friend of Ovid. The Octavian library perished in the fire which raged at Rome for three days in the reign of Titus. The Palatine was, at all events in great part, destroyed by fire in the reign of Commodus. The story that its collections were destroyed by order of Pope Gregory the Great in the 6th century is now generally rejected. The successors of Augustus, though they did not equal him in their patronage of learning, maintained the tradition of forming libraries. Tiberius, his immediate successor, established one in his splendid house on the Palatine, to which Gellius refers as the "Tiberian library," and Suetonius relates that he caused the writings and images of his favorite Greek poets to be placed in the public libraries. Vespasian established a library in the Temple of Peace erected after the burning of the city under Nero. Domitian restored the libraries which had been destroyed in the same conflagration, procuring books from every quarter, and even sending to Alexandria to have copies made. He is also said to have founded the Capitoline library, though others give the credit to Hadrian. The most famous and important of the imperial libraries, however, was that created by Ulpius Trajanus, known as the Ulpian library, which was first established in the Forum of Trajan, but was afterwards removed to the baths of Diocletian. In this library were deposited by Trajan the "libri lintei" and "libri elephantini," upon which the senatus consulta and other transactions relating to the emperors were written. The library of Domitian, which had been destroyed by fire in the reign of Commodus, was restored by Gordian, who added to it the books bequeathed to him by Serenus Sammonicus. Altogether in the 4th century there are said to have been twenty-eight public libraries in Rome.

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[1] Ritschl, *Die Alexandrinischen Bibliotheken*, p. 22; *Opusc. Phil.*, i. 123.

[2] *N. A.*, vi. 17.

[3] *De Tranq. An.*, 9.

[4] This view as to the smallness of the ancient book before Callimachus has been pushed perhaps a little too far. See Theodor Birt's ingenious suggestions in *Das antike Buchwesen*, Berlin, 1882, p. 489 *sq.*, etc. Birt, indeed, agrees that these large numbers must be discounted, but only on the ground of the very considerable number of duplicates in the Alexandrian libraries.

[5] Ritschl, *loc. cit.*, 19.

[6] Parthey (*Alexandrinisches Museum*) assigns topographical reasons for doubting this story.

[7] Some of the authorities have been collected by Parthey, *op. cit.*

[8] Pliny, *H. N.*, xviii. 5.

Nor were public libraries confined to Rome. Besides a library at Tibur, which is twice mentioned by Gellius, and was probably founded by Hadrian, the younger Pliny mentions that he had himself dedicated a library to his fellow-townsmen at Comum; and an inscription discovered at Milan proves that he also contributed a large sum to the support of a library there. Hadrian established a library at Athens; and Strabo mentions the library of Smyrna. Gellius also mentions a library at Patræ. From one of his references (xix. 5) to the Tiburtine library we may infer that it was not unusual for books to be lent out from these libraries. Considerable care was bestowed by the Romans upon the placing of their libraries. The room or building generally had an eastern aspect. The books or rolls were arranged upon the shelves of presses running round the walls, with additional presses placed in the middle of the room. Thus the library discovered at Herculaneum contained 1756 MSS. placed on shelves running round the room to a height of some 6 feet, with a detached central press. These presses in large libraries were numbered. They were often made of precious woods and richly ornamented, while the room was adorned with portraits and statues.

As the number of libraries in Rome increased, the librarian, who was generally a slave or freedman, became a recognized public functionary. The names of several librarians are preserved to us in inscriptions, including that of C. Hymenæus, who appears to have fulfilled the double function of physician and librarian to Augustus. The general superintendence of the public libraries was committed to a special official. Thus from Nero to Trajan Dionysius, an Alexandrian rhetorician, discharged this function. Under Hadrian it was entrusted to his former tutor C. Julius Vestinus, who afterwards became administrator of the Museum at Alexandria.

Constantinople.

When the seat of empire was removed by Constantine to his new capital upon the Bosphorus, the emperor established a collection there, in which Christian literature was probably admitted for the first time into an imperial library. Diligent search was made after the Christian books which had been doomed to destruction by Diocletian. Even at the death of Constantine, however, the number of books which had been brought together amounted only to 6900. The smallness of the number, it has been suggested, seems to show that Constantine's library was mainly intended as a repository of Christian literature. However this may be, the collection was greatly enlarged by some of Constantine's successors, especially by Julian and Theodosius, at whose death it is said to have increased to 100,000 volumes. Julian, himself a close student and voluminous writer, though he did his best to discourage learning among the Christians, and to destroy their libraries, not only augmented the library at Constantinople, but founded others, including one at Nisibis, which was soon afterwards destroyed by fire. From the Theodosian code we learn that in the time of that emperor a staff of seven copyists was attached to the library at Constantinople under the direction of the librarian. The library was burnt under the emperor Zeno in 477, but was again restored.

Meanwhile, as Christianity made its way and a distinctively Christian literature grew up, the institution of libraries became part of the organization of the church. When the church of Jerusalem was founded in the 3d century a library was added to it, and it became the rule to attach to every church a collection of the books necessary for the inculcation of Christian doctrine. The largest of these libraries, that founded by Pamphilus at Cæsarea, and said to have been increased by Eusebius, the historian of the church, to 30,000 volumes, is frequently mentioned by St. Jerome. St. Augustine bequeathed his collection to the library of the church at Hippo, which was fortunate enough to escape destruction at the hands of the Vandals.

The removal of the capital to Byzantium was in its result a serious blow to literature. Henceforward the science and learning of the East and West were divorced. The libraries of Rome ceased to collect the writings of the Greeks, while the Greek libraries had never cared much to collect Latin literature. The influence of the church became increasingly hostile to the study of pagan letters. The repeated irruptions of the barbarians soon swept the old learning and libraries alike from the soil of Italy. With the close of the Western empire in 476 the ancient history of libraries may be said to cease.

MEDIÆVAL PERIOD.

During the first few centuries after the fall of the Western empire, literary activity at Constantinople had

Gaul.

fallen to its lowest ebb. In the West, amidst the general neglect of learning and literature, the collecting of books, though not wholly forgotten, was cared for by few. Sidonius Apollinaris tells us of the libraries of several private collectors in Gaul. Publius Consentius possessed a library at his villa near Narbonne which was due to the labor of three generations. The most notable of these appears to have been the prefect Tonantius Ferreolus, who had formed in his villa of Prusiana, near Nîmes, a collection which his friend playfully compares to that of Alexandria. The Goths, who had been introduced to the Scriptures in their own language by Ulfilas in the 4th century, began to pay some attention to Latin literature. Cassiodorus, the favorite minister of Theodoric, was a collector as well as an author, and on giving up the cares of government retired to a monastery which he founded in Calabria, where he employed his monks in the transcription of books.

Henceforward the charge of books as well as of education fell more and more exclusively into the hands of the church. While the old schools of the rhetoricians died out new monasteries arose everywhere. Knowledge was no longer pursued for its own sake, but became subsidiary to religious and theological teaching. The proscription of the old classical literature, which is symbolized in the fable of the destruction of the Palatine library by Gregory the Great, was only too effectual. The Gregorian tradition of opposition to pagan learning long continued to dominate the literary pursuits of the monastic orders and the labors of the scriptorium.

British Islands.

Alcuin.

Charlemagne.

During the 6th and 7th centuries the learning which had been driven from the Continent took refuge in the British Islands, where it was removed from the political disturbances of the mainland. In the Irish monasteries during this period there appear to have been many books, and the Venerable Bede was superior to any scholar of his age. Theodore of Tarsus brought a considerable number of books to Canterbury from Rome in the 7th century, including several Greek authors. The library of York, which was founded by Archbishop Egbert, was almost more famous than that of Canterbury. The verses are well known in which Alcuin describes the extensive library under his charge, and the long list of authors whom he enumerates is superior to that of any other library possessed by either England or France in the 12th century, when it was unhappily burnt. The inroads of the Northmen in the 9th and 10th centuries had been fatal to the monastic libraries on both sides of the channel. It was from York that Alcuin came to Charlemagne to superintend the school attached to his palace; and it was doubtless inspired by Alcuin that Charles issued the memorable document which enjoined that in the bishoprics and monasteries within his realm care should be taken that there shall be not only a regular manner of life, but also the study of letters. When Alcuin finally retired from the court to the abbacy of Tours, there to carry out his own theory of monastic discipline and instruction, he wrote to Charles for leave to send to York for copies of the books of which they had so much need at Tours. While Alcuin thus increased the library at Tours, Charlemagne enlarged that at Fulda, which had been founded in 774, and which all through the Middle Ages stood in great respect. Lupus Servatus, a pupil of Hrabanus Maurus at Fulda, and afterwards abbot of Ferrières, was a devoted student of the classics and a great collector of books. His correspondence illustrates the difficulties which then attended the study of literature through the paucity and dearness of books, the declining care for learning, and the increasing troubles of the time. Nor were private collections of books altogether wanting during the period in which Charlemagne and his successors labored to restore the lost traditions of liberal education and literature. Pepin le Bref had indeed met with scanty response to the request for books which he addressed to the pontiff Paul I. Charlemagne, however, collected a considerable number of choice books for his private use in two places. Although these collections were dispersed at his death, his son Louis formed a library which continued to exist under Charles the Bald. About the same time Everard, count of Friuli, formed a considerable collection which he bequeathed to a monastery. But the greatest private collector of the Middle Ages was doubtless Gerbert, Pope Sylvester II., who showed the utmost zeal and spent large sums in collecting books, not only in Rome and Italy, but from Germany, Belgium, and even from Spain.

St. Benedict.

The hopes of a revival of secular literature fell with the decline of the schools established by Charles and his successors. The knowledge of letters remained the prerogative of the church, and for the next four or five centuries the collecting and multiplication of books were almost entirely confined to the monasteries. Several of the greater orders made these an express duty; this was especially the case with the Benedictines. It was the first care of St. Benedict, we are told, that in each newly founded monastery there should be a library, "et velut curia quedam illustrium auctorum." Monte Cassino became the starting point of a long line of institutions which were destined to be the centres of religion and of literature. It must indeed be remembered that literature in the sense of St. Benedict meant Biblical and theological works, the lives of the saints and martyrs, and the lives and writings of the fathers. Of the reformed Benedictine orders the Carthusians and the Cistercians were those most devoted to literary pursuits. The abbeys of Fleury, of Melk, and of St. Gall were remarkable for the splendor of their libraries. In a later age the labors of the congregation of St. Maur form one of the most striking chapters in the history of learning. The Augustinians and the Dominicans rank next to the Benedictines in their care for literature. The libraries of St. Geneviève and St. Victor, belonging to the former, were amongst the largest of the monastic collections. Although their poverty might seem to put them at a disadvantage as collectors, the mendicant orders cultivated literature with much assiduity, and were closely connected with the intellectual movement to which the universities owed their rise. In England Richard of Bury praises them for their extraordinary diligence in collecting books. Sir Richard Whittington built a large library for the Grey Friars in London, and they possessed considerable libraries at Oxford.

Monastic libraries.

It would be impossible to attempt here an account of all the libraries established by the monastic orders. We must be content to enumerate a few of the most eminent.

In Italy Monte Cassino is a striking example of the dangers and vicissitudes to which monastic collections were exposed. Ruined by the Lombards in the 6th century, the monastery was rebuilt and a library established, to fall a prey to Saracens and to fire in the 9th. The collection then reformed survived many other chances and changes, and still exists. It affords a conspicuous example of monastic industry in the transcription not only of theological but also of classical works. The library of Bobbio was famous for its palimpsests. The collection, of which a catalogue of the 10th century is given by Muratori,[1] was finally transferred to the Ambrosian library at Milan. Of the library of Pomposia, near Ravenna, Montfaucon has printed a catalogue dating from the 11th century.[2]

Of the monastic libraries of France the principal were those of Fleury, of Cluny, of St. Riquier, and of Corbie. At Fleury Abbot Macharius in 1146 imposed a contribution for library purposes upon the officers of the community and its dependencies, an example which was followed elsewhere. After many vicissitudes, its

[1] *Antiq. Ital. Med. Æv.*, III. 817-24.

[2] *Diarium Italicum*, chap. xxii.

MSS., numbering 238, were deposited in 1793 in the town library of Orleans. The library of St. Riquier in the time of Louis the Pious contained 256 MSS., with over 500 works.[1] Of the collection at Corbie in Picardy we have also catalogues dating from the 12th and from the 17th centuries. Corbie was famous for the industry of its transcribers, and appears to have stood in active literary intercourse with other monasteries. In 1638, 400 of its choicest manuscripts were removed to St. Germain-des-Prés. The remainder were removed after 1794, partly to the national library at Paris, partly to the town library of Amiens.

The chief monastic libraries of Germany were at Fulda, Corvey, Reichenau, and Sponheim. The library at Fulda owed much to Charlemagne and to its abbot Hrabanus Maurus. Under Abbot Sturmius four hundred monks were hired as copyists. In 1561 the collection numbered 774 volumes. The library of Corvey on the Weser, after being despoiled of some of its treasures in the Reformation age, was presented to the university of Marburg in 1811. It then contained 109 volumes, with 400 or 500 titles. The library of Reichenau, of which several catalogues are extant, fell a prey to fire and neglect, and its ruin was consummated by the Thirty Years' War. The library of Sponheim owes its great renown to John Tritheim, who was abbot at the close of the 15th century. He found it reduced to 10 volumes, and left it with upwards of 2000 at his retirement. The library at St. Gall, formed as early as 816 by Gozbert, its second abbot, still exists.

England.

In England the principal collections were those of Canterbury, York, Wearmouth, Whitby, Glastonbury, Croyland, Peterborough, and Durham. Of the library of the monastery of Christ Church, Canterbury, originally founded by Augustine and Theodore, and restored by Lanfranc and Anselm, a catalogue has been preserved dating from the 13th or 14th century, and containing 698 volumes, with about 3000 works. Bennet Biscop, the first abbot of Wearmouth, made five journeys to Rome, and on each occasion returned with a store of books for the library. It was destroyed by the Danes about 867. Of the library at Whitby there is a catalogue dating from the 12th century. The catalogue of Glastonbury has also been printed.[2] When the library of Croyland perished by fire in 1091 it contained about 700 volumes. The library at Peterborough was also rich; from a catalogue of about the end of the 14th century it had 344 volumes, with nearly 1700 titles. The catalogues of the library at the monastery of Durham have been printed by the Surtees Society, and form an interesting series.

These catalogues with many others[3] afford abundant evidence of the limited character of the monkish collections, whether we look at the number of their volumes or at the nature of their contents. We must remember that the beliefs and discipline imposed upon the monk hardly allowed of his caring for literature for its own sake; we must also remember that the transcription of manuscripts so industriously pursued in the monasteries was a mechanical employment. The scriptoria were manufactories of books and not centres of learning. Indeed the very pains bestowed upon carefulness and neatness of transcription, and especially upon the illustrating and ornamenting of the more beautiful manuscripts, were little calculated to divert the attention of the monks from the vehicle to the thought which it expressed. The pride taken by so many communities in the richness and splendor of their libraries was often doubtless the pride of the collector and not of the scholar. That in spite of the labors of so many transcribers the costliness and scarcity of books remained so great may have been partly, but cannot have been wholly, due to the scarcity of writing materials. It may be suspected that indolence and carelessness were the rule in most monasteries, and that but few of the monks keenly realized the whole force of the sentiment expressed by one of their number in the 12th century—"Claustrum sine armario quasi castrum sine armamentario." Nevertheless it must be admitted that to the labors of the monkish transcribers we are indebted for the preservation of Latin literature.

Arabians.

The first conquests of the Arabians, as we have already seen, threatened hostility to literature. But, as soon as their conquests were secured, the caliphs became the patrons of learning and science. Greek manuscripts were eagerly sought for and translated into Arabic, and colleges and libraries everywhere arose. Baghdad in the East and Cordova in the West became the seats of a rich development of letters and science during the age when the civilization of Europe was most obscured. Cairo and Tripoli were also distinguished for their libraries. The royal library of the Fatimites in Africa is said to have numbered 100,000 manuscripts, while that collected by the Omayyads of Spain is reported to have contained six times as many. It is said that there were no less than seventy libraries opened in the cities of Andalusia. Whether these figures be exaggerated or not—and they are much below those given by some Arabian writers, which are undoubtedly so—it is certain that the libraries of the Arabians and the Moors of Spain offer a very remarkable contrast to those of the Christian nations during the same period.[4]

Renaissance.

The literary and scientific activity of the Arabians appears to have been the cause of a revival of letters amongst the Greeks of the Byzantine empire in the 9th century. Under Leo the Philosopher and Constantine Porphyrogenitus the libraries of Constantinople awoke into renewed life. The compilations of such writers as Stobæus, Photius, and Suidas, as well as the labors of innumerable critics and commentators, bear witness to the activity, if not to the lofty character of the pursuits, of the Byzantine scholars. The labors of transcription were industriously pursued in the libraries and in the monasteries of Mount Athos and the Ægean, and it was from these quarters that the restorers of learning brought into Italy so many Greek manuscripts. In this way many of the treasures of ancient literature had been already conveyed to the West before the fate which overtook the libraries of Constantinople on the fall of the city in 1453.

Meanwhile in the West, with the reviving interest in literature which already marks the 14th century, we find arising outside the monasteries a taste for collecting books. St. Louis of France and his successors had formed small collections, none of which survived its possessor. It was reserved for Charles V. to form a considerable library which he intended to be permanent. In 1373 he had amassed 910 volumes, and had a catalogue of them prepared, from which we see that it included a good deal of the new literature. In our own country Guy, earl of Warwick, formed a curious collection of French romances, which he bequeathed to Bordesley Abbey on his death in 1315. Richard d'Aungervyle of Bury, the author of the *Philobiblon*, amassed a noble collection of books, and had special opportunities of doing so as Edward III.'s chancellor and ambassador. He founded Durham College at Oxford, and equipped it with a library a hundred years before Humphrey, duke of Gloucester, made his benefaction of books to the university. The taste for secular literature, and the enthusiasm for the ancient classics, gave a fresh direction to the researches of collectors. A disposition to encourage literature began to show itself amongst the great. This was most notable amongst the

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[1] Catalogue printed in Edwards, *Memoirs of Libraries*, i. 297-301.

[2] By Hearne in his edition of John of Glastonbury.

[3] Many such catalogues may be found in the collections of D'Achery, Martene and Durand, and Pez, and in the bibliographical periodicals of Naumann and Petzholdt. The Rev. Joseph Hunter has collected some particulars as to the contents of the English monastic libraries, and Mr. Edwards has printed a list of the catalogues known to exist (*Libraries and Founders of Libraries*, 1865, pp. 448-54). There are said to be over six hundred such catalogues in the Royal Library at Munich

[4] Among the Arabs, however, as among the Christians, theological bigotry did not always approve of non-theological literature, and the great library of Cordova was sacrificed by Almansor to his reputation for orthodoxy, 978 A. D.

Italian princes. Cosimo de' Medici formed a library at Venice while living there in exile in 1433, and on his return to Florence laid the foundation of the great Medicean library. The honor of establishing the first modern public library in Italy had been already secured by Niccolo Niccoli, who left his library of over 800 volumes for the use of the public on his death in 1436. Frederick, duke of Urbino, collected all the writings in Greek and Latin which he could procure, and we have an interesting account of his collection written by his first librarian, Vespasiano. The ardor for classical studies led to those active researches for the Latin writers who were buried in the monastic libraries which are especially identified with the name of Poggio. For some time before the fall of that capital, the perilous state of the Eastern empire had driven many Greek scholars from Constantinople into western Europe, where they had directed the studies and formed the taste of the zealous students of the Greek language and literature. The enthusiasm of the Italian princes extended itself beyond the Alps. Matthias Corvinus, king of Hungary, amassed a collection of splendidly executed and magnificently bound manuscripts, which at his death are said to have reached the almost incredible number of 50,000 volumes. The library was not destined long to survive its founder. There is reason to believe that it had been very seriously despoiled even before it perished at the hands of the Turks on the fall of Buda in 1527. A few of its treasures are still preserved in some of the libraries of Europe. While these munificent patrons of learning were thus taking pains to recover and multiply the treasures of ancient literature by the patient labor of transcribers and calligraphers, an art was being elaborated which was destined to revolutionize the whole condition of literature and libraries. With the invention of printing, so happily coinciding with the revival of true learning and sound science, the modern history of libraries may be said to begin.

Modern Libraries.

These are most conveniently described in geographical order, and a general survey on this method will be found in the tables at the end of this article. The following sketch supplies additional details.

The United Kingdom.

British Museum. The British Museum ranks in importance before all the great libraries of the world, with the single exception of the Bibliothèque Nationale at Paris, and far excels the latter institution in the systematic arrangement and accessibility of its contents. Recent changes have somewhat limited its former universality of character, but it still remains the grand national repository of literature and archæology. The library consists of over 1,550,000 printed volumes and 50,000 manuscripts. This extraordinary opulence is principally due to the enlightened energy of the late Sir Antonio Panizzi. The number of volumes in the printed book department, when he took the keepership in 1837, was only 240,000; and during the nineteen years he held that office about 400,000 were added, mostly by purchase, under his advice and direction. It was Panizzi likewise who first seriously set to work to see that the national library reaped all the benefits bestowed upon it by the Copyright Act.

The foundation of the British Museum dates from 1753, when effect was given to the bequest (in exchange for £20,000 to be paid to his executors) by Sir Hans Sloane, of his books, manuscripts, curiosities, etc., to be held by trustees for the use of the nation. A bill was passed through parliament for the purchase of the Sloane collections and of the Harleian MSS., costing £10,000. To these, with the Cottonian MSS., acquired by the country in 1700, was added by George II., in 1757, the royal library of the former kings of England, coupled with the privilege, which that library had for many years enjoyed, of obtaining a copy of every publication entered at Stationers' Hall. This addition was of the highest importance, as it enriched the museum with the old collections of Archbishop Cranmer, Henry prince of Wales, and other patrons of literature, while the transfer of the privilege with regard to the acquisition of new books, a right which has been maintained by successive Copyright Acts, secured a large and continuous augmentation, the yearly average of which has now reached 8000 or 9000 volumes. A lottery having been authorized to defray the expenses of purchases, as well as for providing suitable accommodation, the museum and library were established in Montague House, and opened to the public 15th January, 1759. In 1763 George III. presented the well-known Thomason collection (in 2220 volumes) of books and pamphlets issued in England between 1640 and 1662, embracing all the controversial literature which appeared during that period. The Rev. C. M. Cracherode, one of the trustees, bequeathed his collection of choice books in 1799; and in 1820 Sir Joseph Banks left to the nation his important library of 16,000 volumes. Many other libraries have since then been incorporated in the museum, the most valuable being George III.'s royal collection (15,000 volumes of tracts, and 65,259 volumes of printed books, including many of the utmost rarity, which had cost the king about £130,000), which was presented (for a pecuniary consideration, it has been said) by George IV. in 1823, and that of the Right Honorable Thomas Grenville (20,240 volumes of rare books, all in fine condition and binding), which was acquired under bequest in 1846. The Cracherode, Banksian, King's, and Grenville libraries are still preserved as separate collections. Other libraries of minor note have also been absorbed in a similar way, while, at least since the time of Panizzi, no opportunity has been neglected of making useful purchases at all the British and Continental book auctions.

The collection of English books is far from approaching completeness, but, apart from the enormous number of volumes, the library contains an extraordinary quantity of rarities. Few libraries in the United States equal either in number or value the American books in the museum. The collection of Slavonic literature, due to the initiative of the late Mr. Watts, is a remarkable feature; after that of the St. Petersburg Imperial Library it is believed to be the largest in existence. Indeed, in cosmopolitan interest the museum is without a rival in the world, possessing as it does the best Hungarian collection out of that country, the best Dutch library out of Holland, and in short the best library in any European language out of the territory in which the language is vernacular. The Hebrew books number over 12,000, the Chinese nearly 27,000, and the printed books in other Oriental languages about 13,000 volumes. Periodical literature has not been forgotten, and the series of newspapers is of great extent and interest. Great pains are taken by the authorities to obtain the copies of the newspapers published in the United Kingdom to which they are entitled by the provisions of the Copyright Act, and upwards of 1900 are annually collected, filed, and bound. Under the English Copyright Act there were received, in 1881, not counting single pieces, such as broadsides, songs, etc., 8857 volumes and pamphlets, and 21,792 parts of volumes, and through the international copyright treaties 941 volumes and 433 parts.

The department of MSS. is at least equal in importance to that of the printed books. The collection of MSS. in European languages ranges from the 2d century before Christ down to our own times, and includes the ALEXANDRIAN MS. (*q. v.*). The old historical chronicles of England, the charters of the Anglo-Saxon kings, and the celebrated series of Arthurian romances are well represented; and care has been taken to acquire on every available opportunity the unprinted works of English writers. The famous collections of MSS. made by Sir Robert Cotton, and Harley earl of

Oxford, have already been mentioned, and from these and other sources the museum has become rich in early Anglo-Saxon and Latin codices, some of them exhibiting marvels of skill in calligraphy and ornamentation, such as the charters of King Edgar and Henry I. to Hyde Abbey, which are written in gold letters, others interesting for different reasons, such as the book of Durham, in Latin and Anglo-Saxon, reputed to have been Bede's own copy. The Burney collection of classical MSS. furnished important additions, so that from this source and from the collection of Arundel MSS. (transferred from the Royal Society in 1831), the museum can boast of an early copy of the *Iliad*, and one of the earliest known codices of the *Odyssey*. There is likewise an extensive series of ancient Irish texts, with many modern transcripts, the Bridgewater MSS. on French history, and Lord Guilford's similar collection to illustrate the history of Italy. Special reference may be made to the celebrated Bedford Missal, illuminated for the duke of Bedford, regent of France, and to Henry VI.'s copy of Hardyng's chronicle. The Oriental collection is also extremely rich and ample, including the library formed by Mr. Rich (consul at Baghdad in the early part of this century), and a vast quantity of Arabic, Persian, and Turkish MSS.; the Chambers collection of Sanskrit MSS.; several other collections of Indian MSS.; and a copious library of Hebrew MSS. (including that of the great scholar Michaelis, and codices of great age, recently brought from Yemen). The collection of Syriac MSS., embracing the relics of the famous library of the convent of St. Mary Deipara in the Nitrian desert, formed by the abbot Moses of Nisibis, in the 10th century, is the most important in existence; of the large store of Abyssinian volumes many were amassed after the campaign against King Theodore. The number of genealogical rolls and documents relating to the local and family history of Great Britain is very large. Altogether there are now over 50,000 MSS. (of which 8500 are Oriental), besides 45,000 charters and rolls.

The musical works comprise upwards of 11,000 volumes of vocal and nearly 6000 volumes of instrumental music, the number of separate pieces amounting to more than 70,000. The catalogue is in manuscript. The collection of maps, charts, plans, and topographical drawings is also a remarkable one. The maps are nearly 116,000 in number. Letter A of a printed catalogue of the maps is already in type.

The name of Panizzi is inseparably connected with his circular reading-room, opened in 1857. This is encompassed by the new library, with shelf space for a million and a half volumes. The presses inside the reading-room, arranged in three tiers, contain upwards of 80,000 volumes, those on the ground floor (20,000) being books of reference to which readers have unlimited access. The comfortable accommodation for readers is briefly described below. Perhaps not the least convenient arrangement here is the presence of the superintendent, whose duty it is to help readers in their difficulties; the varied qualifications of the present holder of the office are well known. The electric light has been successfully used until 8 o'clock, P. M., through the darker months from the earlier part of October. In order to enjoy the privilege of reading at the British Museum, the applicant (who must be over twenty-one years of age) must obtain a renewable ticket of admission through a recommendation from a householder addressed to the principal librarian. Formerly no person was admitted until the ticket had been presented at the entrance, but latterly this rule has been considerably relaxed. During 1881 the number of readers was 133,842. In spite of the hostile criticism to which it has sometimes been subjected, it cannot be denied that the general catalogue of the printed books (which now runs to upwards of 2000 volumes in manuscript) is a marvellous work executed in a praiseworthy manner. Some slight notion of the extent of the catalogue may be derived from the fact that it contains the works of over 2400 authors of the name of Smith. But the rapidly increasing size of the catalogue has impelled the trustees to resort to print in order to diminish the bulk. Since 1880 the titles of all accessions have been printed, and as it becomes necessary to break the manuscript volumes, the titles contained in them are also printed; in course of time, therefore, the whole of the titles will have been put into type. The sheets are published at regular intervals, and can be purchased. It is proposed to issue separately headings of special interest, whether of subjects or of authors, *e. g.*, Shakespeare, Bible, Liturgies, etc. Considerable progress has been made in the preparation for the press of a catalogue of English books printed before the year 1640.

The printed catalogues of books commence with one published in 2 vols., folio, 1787, followed by that of 1813–19 in 7 vols. 8vo; the next is that of the library of George III., 1820–29, 5 vols. folio, with 2 vols. 8vo, 1834, describing the geographical and topographical collections; and then the *Bibliotheca Grenvilliana*, 1842–72, 4 vols. 8vc. The first vol. (letter A) of a general catalogue appeared in 1841 in a folio volume which has never been added to. The octavo catalogue of the Hebrew books came out in 1867; that of the Sanskirt and Pali literature is in 4to, 1876; and the Chinese catalogue is also in 4to, 1877. There are also printed lists of the books of reference (1871) and bibliographies (1881) in the reading-room. Private enterprise has done a great deal towards cataloguing the American books (by Mr. H. Stevens, 4 vols. 8vo), and the British topographical literature has recently been the subject of a similar publication by Mr. J. P. Anderson, 8vo, 1881.

The printed catalogues of the MSS. are—that of the old Royal Library, 1734, 4to; the Sloane and others hitherto undescribed, 1782, 2 vols. 4to; the Cottonian, 1802, folio; the Harleian, 1808, 4 vols. folio; the Hargrave, 1818, 4to; the Lansdowne, 1819, folio; the Arundel, 1840, folio; the Burney, 1840, folio; the Oriental (Arabic and Ethiopic), 5 pts., folio, 1838–71; the Syriac, 1870–73, 3 pts., 4to; the Ethiopic, 1877, 4to; the Persian, 1879–80, 2 vols. 4to; and the Spanish, 1875–80, 3 vols. 8vo. There are also catalogues of the Greek and Egyptian papyri, 1839–46, 5 pts., folio. The additional MSS. from 1831–75 are described in 10 vols. 8vo, 1835–77, with indexes (1783–1835) in folio and (1854–75) in 8vo. A catalogue of the MS. music was produced in 1842, 8vo; and one of the MS. maps in 1844, 2 vols. 8vo.

The binding is done upon the premises, and the sum expended each year is £9000. The average sum annually spent upon the purchase of books is about £10,000, and upon MSS. £2500. Since the catalogues ceased to be transcribed, £3000 is annually spent on printing.

Other London libraries.

London is very badly off as regards public libraries, and the largest general collection which is available without any tedious preliminary forms is that of the corporation of the city of London at the Guildhall. A library was established here by Sir Richard Whittington between 1421–26, and several notices in the civic records show how well in those times the citizens cared for their books. But it did not remain without accident: in 1522 the Lord Protector Somerset carried off three cart-loads of books, and during the great fire of 1666 the remainder was destroyed together with the library buildings. Nothing was done to repair the loss until 1824, when a committee was appointed, and rooms set apart for library purposes. In 1840 a catalogue of 10,000 volumes was printed, and in 1859 a second was prepared of 40,000 volumes. In consequence of the large and increasing number of the readers, the present fine building was commenced about ten years later, and, after having cost £90,000, was opened in 1873 as a free public library. There are now upwards of 80,000 printed volumes and 300 MSS. The contents are of a general character, and include a special collection of books about London, the Solomons Hebrew and rabbinical library, and the libraries of the Clockmakers' Company and the old Dutch church in Austin Friars. The only rate-supported library in the metropolis is that of the united parishes of St. Margaret and St. John at Westminster (13,527 volumes), founded in 1857, principally by the influence of the late Lord Hatherley, with a small branch at Knightsbridge. The Notting Hill Free Public Library (5000 volumes) is supported by Mr. James Heywood, and the Bethnal Green Free Library and South London Free Library by voluntary subscriptions.

Of libraries of a more special character, those principally devoted to theology have perhaps the first claim to notice. The archiepiscopal library at Lambeth was founded in 1610 by Archbishop Bancroft, and has been enriched by the gifts of Laud, Tenison, Manners Sutton, and others of his successors; it is now lodged in the noble hall built by Juxon. The treasures consist of the illuminated MSS., and a rich store of early printed books; of the latter two catalogues have been issued by S. R. Maitland. The MSS. are described in H. J. Todd's catalogue, 1812. Sion College is a guild of the parochial clergy of the city and suburbs of London, and the library was founded in 1629 for their use; laymen may also read (but not borrow) the books when recommended by some beneficed metropolitan clergyman. The library is especially rich in liturgies, Port-Royal authors, pamphlets, etc. The copyright privilege was commuted in 1835 for an annual sum of £363, 15s. 2d. The present building was erected immediately after the great fire. The chamber in the old cloisters, in which the library of the dean and chapter of Westminster is preserved, is well known from the charming description by Washington Irving in his *Sketch Book*. There are about 11,000 volumes, mostly of old theology and history, including many rare Bibles and other valuable books. The library of the dean and chapter of St. Paul's was founded in very early times, and now numbers some 8700 volumes, mainly theological, besides over 10,300 pamphlets, with a good collection of early Bibles and Testaments, Paul's Cross Sermons, and works connected with the cathedral. Dr. Williams's library was founded by the will of an eminent Presbyterian divine of that name; it was opened in 1729. The books (30,000 printed volumes and 1000 MSS.) are housed in a new building, completed in 1873. Theology of all schools of opinion is represented, and there are special collections of theosophical books and MSS., the works of Boehme, Law, and other mystical writers. The MSS. include the original minutes of the Westminster Assembly, letters and treatises of Richard Baxter, etc. The British and Foreign Bible Society has a remarkable collection of Bibles and Biblical literature, of which a printed catalogue was published in 1855. Perhaps the best library of Catholic theology in London is that of the Oratory at South Kensington, established in 1849.

Of the law libraries, that at Lincoln's Inn is the oldest and the largest. It dates from 1497, when John Nethersale, a member of the society, made a bequest of forty marks, part of which was to be devoted to the building of a library for the benefit of the students of the laws of England. A catalogue of the printed books was published in 1859, and the MSS. were catalogued by the Rev. Joseph Hunter in 1837. The library of the Inner Temple is known to have existed in 1540. In the middle of the 17th century it received a considerable benefaction from William Petyt, the well-known keeper of the Tower records. There are now about 36,000 volumes, including the pamphlets collected by John Adolphus for his *History of England*, books on crime and prisons brought together by Mr. Crawford, and a selection of works on jurisprudence made by John Austin. A library in connection with the Middle Temple was in existence during the reign of Henry VIII., but the date usually assigned to its foundation is 1641, when Robert Ashley left his books to the inn of which he had been a member. Gray's Inn Library was perhaps established before 1555. In 1669 was made the first catalogue of the books, and the next, still extant, in 1689. The Incorporated Law Society (1831) has a good law and general library (30,000 volumes), including the best collection of private Acts of Parliament in England, and a large number of pamphlets relating to the Anglo-Catholic controversies brought together by the late Rev. Joseph Mendham. The catalogue was printed in 1869.

The collegiate library at Dulwich dates from 1619, and a list of its earliest accessions, in the handwriting of the founder, may still be seen. There are now about 7000 volumes of miscellaneous works of the 17th and 18th centuries, with a few rare books. A catalogue of them was printed in 1880; and one describing the MSS. (567) and the muniments (606) was issued during the succeeding year. The last two classes are very important, and include the well-known "Alleyn Papers" and the theatrical diary of Philip Henslow. Soon after the foundation of the University of London in 1837, an endeavor was made to provide a library, but it has had to look to gifts rather than to purchases for its accessions. In 1871 the university obtained, in this manner, the library of the historian Grote, and in the same year Lord Overstone purchased and presented the mathematical collection of De Morgan. A catalogue was printed in 1875. The books at University College (1828) are much more numerous, and here also a considerable proportion are donations, including the Morrison Chinese library of 10,000 volumes, the Daulby-Roscoe Icelandic books, the Graves mathematical and physical library, and the Barlow Dante bequest. A printed catalogue of the greater portion was brought out in 1879. The library at King's College includes a collection of works on Eastern subjects bequeathed by Dr. Marsden, as well as the scientific books formerly belonging to Sir Charles Wheatstone. The medical library is distinct. The educational library at the South Kensington Museum numbers about 42,200 volumes, and may be consulted by teachers and students of the departmental schools, and by other persons on the same terms as the art library mentioned below. The ninth edition of the catalogue appeared in 1876.

The library of the Patent Office is the largest scientific and technical collection, indeed the only one which is readily open to the public. There are at present 80,000 volumes, including a very extensive series of the transactions and journals of learned bodies. A catalogue is now in the press. Transactions and proceedings of societies, with scientific periodicals, compose almost the whole library of the Royal Society, which extends to about 40,000 volumes. The diarist Evelyn induced the seventh duke of Norfolk to present to the Society the Arundel library, part of which had formerly belonged to Matthias Corvinus. The MSS., however, were sold to the British Museum in 1831 for £3559, and a quantity of rare printed books have also been disposed of. Scientific inquirers are freely admitted to the Museum of Practical Geology in Jermyn Street, where there are over 30,000 volumes on geology, mineralogy, mining, and metallurgy, including the former collections of De la Beche and Murchison. A printed catalogue was issued in 1878. For the libraries of other scientific institutions see the tables.

Medical and surgical libraries are attached to all the chief hospitals and medical societies (see the tables).

For the fine arts there is the National Art Library (1852) at the South Kensington Museum, which is now an excellent collection of 56,000 volumes, 56,000 photographs, 25,000 drawings, and 80,000 prints. Art students are admitted free, as are ordinary visitors on Museum pay days; otherwise a charge of 6d. per week is made to the latter. The library of the Royal Academy of Arts, after its journey from Somerset House to Trafalgar Square, has been lodged in the old ball-room of Burlington House since 1875. At the National Gallery is preserved for official use the library (3500 volumes) formerly belonging to Sir C. L. Eastlake, P. R. A., which is particularly rich in catalogues and descriptions of picture galleries. The Royal Institution of British Architects (1834) possesses over 6500 volumes on architectural and allied subjects, including an almost complete collection of editions of Vitruvius. The library of the Royal Academy of Music (1822) is almost exclusively musical, and, although numbering less than 1000 volumes, contains many rare and interesting works. The library of the Sacred Harmonic Society is said to be one of the best arranged and most valuable musical collections in England. A third edition of the printed catalogue appeared in 1872, when the library contained 4851 volumes.[1]

The best library of archæology and kindred subjects is that of the Society of Antiquaries, consisting of nearly 20,000 printed volumes and 500 MSS. It is rich in early printed books, topography, heraldry, and numismatics, and includes a curious collection of books on pageants presented by Mr. Fairholt, and the remarkable assemblage of lexicographical works formerly belonging to the late Albert Way, given by his widow. There is a good muster of heraldic works at the Herald's College, and the library of Sir John Soane (15,000 volumes) is still preserved in the museum at his house in Lincoln's Inn Fields. The printed catalogue (1878) shows that it is a fairly good collection of books on architecture and antiquities.

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[1] For a very complete account of the chief public and private musical collections both at home and abroad, see the article "Musical Libraries," in Dr. Grove's *Dictionary of Music*, ii. 417.

Among subscription libraries, the London Library stands first in order of importance. It was founded in 1841 as a lending library for the use of scholars, and Dean Milman, Sir G. C. Lewis, Mr. Gladstone, Thomas Carlyle, Henry Hallam, and other eminent men took part in its formation. By means of a moderate subscription, funds were raised for the purchase of books on general subjects, which now amount to about 90,000 volumes. The latest catalogue was printed in 1875, with a supplement in 1881. The London Institution (1805) is a proprietary library to which proprietor's nominees and yearly subscribers also have admission. For reference purposes reader's tickets are very liberally granted to other persons. The books now number about 70,000 volumes in general literature; the departments of history and topography are especially rich, and the number is rapidly growing. A complete catalogue was published in 1837–43; almost the whole collection, including reference and circulating libraries very minutely classified, is contained in one room. Porson filled the position of librarian here at the close of his life, but he proved no better a librarian than did Casaubon before him at Paris. The library of the Royal Institution of Great Britain was founded in 1803 by the subscriptions of the members, amounting in 1806 to £6000. There are now 40,000 volumes in scientific and general literature; they are not lent out. There is an interesting series of 56 volumes of MS. correspondence relating to the American war.

The libraries of the two branches of the legislature may be named with those of the great public offices. The Foreign Office library contains about 70,000 volumes, including the old library of the Board of Trade (20,000 volumes); history, geography, and law are well represented, and the department of treaties and diplomacy is of course very complete. The India Office library was formed by a vote of the court of directors of the East India Company in 1801. The services in India were also invited to aid in the creation of an institution which should become a permanent repository of Oriental lore, and many munificent donations were received in consequence of the appeal. The printed books now number nearly 40,000, chiefly on Indian and Oriental subjects, with about 10,000 Sanskrit, Arabic, Persian, Pali, and other Oriental manuscripts. Loth's excellent catalogue of the Arabic codices was published in 1877, and other catalogues are now ready for the press. At the Colonial Office there is a collection of about 12,000 works relating to colonial history and administration, and the Home Office possesses about 5000 volumes of parliamentary, historical, and legal works. The Admiralty library extends to about 25,000 volumes, chiefly voyages and travels; a printed catalogue was issued in 1875. At the War Office there are also 25,000 volumes, mainly topographical and military. The MS. records are estimated to extend to 100,000 volumes, but only those of the last twenty years are kept in Pall Mall, the remainder being at the Record Office. These records extend from the time of Queen Elizabeth, and there are some of earlier date. The older volumes belonged to the late Board of Ordnance, and the series also includes the despatches from generals commanding armies on foreign service. All these libraries are for official use only, but at the India Office strangers are admitted upon proper introduction.

Many of the principal clubs possess libraries; that of the Athenæum is by far the most important. It now numbers about 48,000 volumes of books in all departments of literature, and is especially rich in well-bound and fine copies of works on the fine arts, archæology, topography, and history. The pamphlets, of which there is a complete printed catalogue, as well as of the books, form a remarkable series, including those collected by Gibbon and Mackintosh. Next comes the Reform Club, with about 30,000 volumes, chiefly in belles-lettres, with a fair proportion of parliamentary and historical works. The Oxford and Cambridge Club has 20,000 volumes in general and classical literature. At the Garrick there is a small dramatic collection; and the United Service Club, besides a number of books on professional subjects, possesses the fine library which formerly belonged to Dugald Stewart.

A few libraries which could not be brought into any of the foregoing classes may now be spoken of. First comes the library of the Royal Geographical Society (1832), a valuable collection of 20,000 volumes of voyages and travels, and works on the sciences connected with geography, with many costly Government publications and geographical serials. The catalogue has been printed with supplements down to 1880. The maps and charts number 35,000, with 500 atlases and 240 large diagrams. Since 1854, in consideration of an annual grant of £500 from the treasury, the map room has been opened for public reference. At the Royal United Service Institution there are also about 20,000 volumes, chiefly naval and military, with a printed catalogue, 1865. Besides the members, officers of both services are admitted. The Royal Asiatic Society has a library of nearly 8000 printed books, with 750 MSS. in Sanskrit, Persian, Turkish, etc., 5000 Chinese books, and 220 Japanese. Besides the art and educational libraries at South Kensington, there are also deposited at the museum, and open under the same regulations, the library of the Rev. Alexander Dyce, bequeathed in 1869, and the books of John Forster, left in 1876. The Dyce collection (15,000 volumes) is strong in the English drama and poetry, Italian literature, and classical authors. The Forster library (19,000 volumes) abounds in history, biography, travels, plays, and fiction, tracts, Americana, proclamations, ballads, etc.; the manuscripts include three note-books of Leonardo da Vinci, and the Garrick correspondence in 39 volumes.

Notices of a considerable number of other metropolitan libraries, not mentioned in the preceding pages, may be found in the tables at the end of this article.

Cathedral libraries.

With one or two exceptions, libraries are attached to the cathedrals of England and Wales. Though they are of course intended for the use of the cathedral or diocesan clergy, they are in most cases open to any respectable person who may be properly introduced. They seldom contain very much modern literature, chiefly consisting of older theology, with more or less addition of classical and historical literature. They vary in extent from a few volumes, as at Llandaff or St. David's, to 15,000 volumes, as at Durham. Together they possess nearly 150,000 printed and manuscript volumes. As a rule, very little is spent upon them, and they are very little used.

The library of Christ Church, Oxford, belongs alike to the college and the cathedral, but will be more properly described as a college library. The cathedral library of Durham dates from monastic times, and possesses many of the books which belonged to the monastery. These were added to by Dean Sudbury, the second founder of the library, and Bishop Cosin. The collection has been considerably increased in more modern times, and now contains 15,000 volumes. It is especially rich in MSS., some of which are of great beauty and value; a catalogue of them was printed in 1825. The library has good topographical and entomological collections. The chapter spend £370 per annum in salaries and in books. The library at York numbers about 11,000 volumes, and has been very liberally thrown open to the public. It is kept in the former chapel of the archbishop's palace, and has many valuable MSS. and early printed books. The foundation of the library at

Canterbury dates probably from the Roman mission to England, 596 A.D., although the library does not retain any of the books then brought over, or even of the books said to have been sent by Pope Gregory to the first archbishop in 601. It is recorded that among Lanfranc's buildings was a new library, and Becket is said to have collected books abroad to present to the library. The collection now numbers about 9900 printed books, with about 110 MS. volumes, and between 6000 and 7000 documents. A catalogue was printed in 1802. The present building was erected in 1867 on part of the site of the monastic dormitory. The library at Lincoln contains 7400 volumes, of which a catalogue was printed in 1859. It possesses a fine collection of political tracts of the age of Elizabeth, James, and Charles I. The present collection at Chichester dates from the Restoration only; that at Ely is rich in books and tracts relating to the non-jurors. The library at Exeter possesses many Saxon MSS. of extreme interest, one of them being the gift of Leofric, the first bishop. The treasures of Lichfield were destroyed by the Puritans during the civil war, and the existing library is of later formation. Frances, duchess of Somerset, bequeathed to it nearly 1000 volumes, including the famous Evangeliary of St. Chad. The collection at Norwich is chiefly modern, and was presented by Dr. Sayers. The earlier library at Peterborough having almost wholly perished in the civil war, Bishop White Kennett became the virtual founder of the present collection. Salisbury is rich in incunabula, and a catalogue has recently been printed. Winchester Cathedral Library is mainly the bequest of Bishop Morley in the 17th century. The library at Bristol, then numbering 6000 or 7000 volumes, was burnt and pillaged by the mob in the riots of 1831. Only about 1000 volumes were saved, many of which were recovered, but few additions have been made to them. At Chester in 1691 Dean Arderne bequeathed his books and part of his estate "as the beginning of a public library for the clergy and city." The library of Hereford is a good specimen of an old monastic library; the books are placed in the Lady Chapel, and about 230 choice MSS. are chained to oaken desks. The books are ranged with the edges outwards upon open shelves, to which they are attached by chains and bars. The four Welsh cathedrals were supplied with libraries by a deed of settlement in 1709. The largest of them, that of St. Asaph, has about 1750 volumes.

Oxford. The Bodleian Library, though it had been preceded by various efforts towards a university library, owed its origin to Sir Thomas Bodley. After a long and honorable career as a diplomatist he determined, as he says, to take his farewell of state employments, and concluded to set up his staff at the library door in Oxon. Contributing largely himself, and procuring contributions from others, he opened the library with upwards of 2000 volumes in 1602. In 1610 he obtained a grant from the Stationers' Company of a copy of every work printed in the country. The additions made to the library soon surpassed the capacity of the room, and the founder proceeded to enlarge it. By his will he left considerable property to the university for the maintenance and increase of the library. The example set by Bodley found many noble imitators. Amongst the chief benefactors have been Sir Henry Savile, Archbishop Laud, John Selden, Sir Kenelm Digby, Lord Fairfax, Richard Gough, Francis Douce, Richard Rawlinson, Rev. Robert Mason, and F. W. Hope. The library now contains almost 400,000 printed volumes, and about 30,000 manuscripts. The number of separate works exceeds a million. But the number of volumes conveys a very inadequate idea of the valuable character of the collection. In the department of Oriental manuscripts it is perhaps superior to any other European library; and it is exceedingly rich in other manuscript treasures. It possesses a splendid series of Greek and Latin *editiones principes*, and of the earliest productions of English presses. Its historical manuscripts contain most valuable materials for the general and literary history of the country.

The last general catalogue of the printed books was printed in 4 vols. folio, 1843–51. In 1859 it was decided to prepare a new manuscript catalogue on the plan of the great catalogue of the British Museum, and this has recently been completed in duplicate. It extends to over 700 folio volumes, in which the books are entered on manifolded slips. It is an alphabetical author-catalogue; and the Bodleian, like the British Museum, has no accessible subject index. A catalogue on subjects is now, however, in course of preparation. There are also printed catalogues of the books belonging to several of the separate collections. The MSS. are in general catalogued according to the collections to which they belong, and they are all indexed, although they are not all catalogued as yet. Five volumes have been published under the late Mr. Coxe's editorship of the "Catalogi Codicum MSS. Bibliothecæ Bodleianæ," 1853–63, in quarto, and there is a folio catalogue of Oriental MSS.

In 1860 the beautiful building known as the "Radcliffe Library," now called the "Camera Bodleiana," was offered to the curators of the Bodleian by the Radcliffe trustees. It is used as a storehouse for the more modern books, including the new periodicals, which lie upon its tables; and it also serves as a reading-room. It is the only room open after the hour when the older building is closed owing to the rule as to the exclusion of artificial light. The separation of the books is a source of some inconvenience in practice, and it has been proposed of late years to remove the entire collections to a new building which should be erected for the purpose of accommodating them.

The library is open by right to all graduate members of the university, and to others (over eighteen years of age) upon producing a satisfactory recommendation. No books are allowed to be sent out of the library except by special leave of the curators, in which respect there is a marked contrast with the practice at the University Library at Cambridge, and still more so with the conspicuous liberality in this respect of the university libraries of Germany. The hours are from 9 to 4 and 9 to 3, according to the time of year, the Camera being open from 10 to 10 all the year round. The library is only closed altogether some twenty-nine working days in the year. The general control of the library is committed to a board of thirteen curators. The permanent endowment is comparatively small; the ordinary expenditure, chiefly defrayed from the university chest, is about £4500.

The other important collections not connected with particular colleges are the Radcliffe Library and the library of the Taylor Institution. The former was founded by the famous physician Dr. John Radcliffe, who died in 1714, and bequeathed, besides a permanent endowment of £350 a year, the sum of £40,000 for a building. The library was opened in 1749. Many years ago the trustees resolved to confine their purchases of books to works on medicine and natural science. When the university museum and laboratories were built in 1860, the trustees allowed the books to be transferred to the museum. The completeness and convenience of the arrangements make the Radcliffe the model of a working scientific library. The Taylor Institution is due to the benefaction of Sir Robert Taylor, an architect, who died in 1788, leaving his property to found an establishment for the teaching of modern languages. The library was established in 1848, and is devoted to the literature of the modern European languages. It contains a fair collection of works on European philology, with a special Dante collection, about 1000 Mazarinades and 400 Luther pamphlets. It contains altogether 30,000 volumes, with a few MSS. The Finch collection, left to the university in 1830, is also kept with the Taylor Library. Books are lent out to members of the university and to others on a proper introduction. The endowment affords an income of £800 to £1000 for library purposes, and about 2000 volumes are added yearly.

The libraries of the several colleges vary considerably in extent and character. That of All Souls was established in 1443 by Archbishop Chichele, and enlarged in 1710 by the munificent bequest of Christopher Codrington. It devotes special attention to jurisprudence, of which it has a large collection. It possesses 40,000 printed volumes and 300 MSS., and fills a splendid hall 200 feet long. The library of Brasenose College has a special endowment fund, so that it has, for a college library, the unusually large income of £200. The library of Christ Church is rich in divinity and topography. It embraces the valuable library bequeathed by Charles Boyle, third earl of Orrery, amounting to 10,000 volumes, the books and MSS. of Archbishop Wake, and the Morris collection of Oriental books. The building was finished in 1761, and closely resembles the basilica of Antoninus at Rome, now the Dogana. Corpus possesses a fine collection of Aldines, many of them presented by its founder Bishop Fox, and a collection of 17th century tracts catalogued by Mr. Edwards, with about 400 MSS. Exeter College Library has 25,000 volumes, with special collections of classical dissertations and English theological and political tracts. The library of Jesus College has few books of later date than the early part of the last century. Many of them are from the bequest of Sir Leoline Jenkins, who built the existing library. There are also some valuable Welsh MSS. The library of Keble College consists largely of theology, including the MSS. of many of Keble's works. The library of Magdalen College has about 22,500 volumes (including many volumes of pamphlets) and 250 MSS. It has scientific and topographical collections. The library of Merton College has of late devoted itself to foreign modern history. New College Library has about 17,000 printed volumes and about 350 MSS., several of which were presented by its founder, William of Wykeham. Oriel College Library, besides its other possessions, has a special collection of books on comparative philology and mythology, with a printed catalogue. The fine library of Queen's College is strong in theology, in English and modern European history, and in English county histories. St. John's College Library is largely composed of the literature of theology and jurisprudence before 1750, and possesses a collection of medical books of the 16th and 17th centuries. The newer half of the library building was erected by Inigo Jones at the expense of Laud, who also gave many printed and manuscript books. The room used as a library at Trinity College formed part of Durham College, the library of which was established by Richard of Bury. Wadham College Library includes a collection of botanical books bequeathed by Richard Warner in 1775 and a collection of books, relating chiefly to the Spanish Reformers, presented by the executors of Benjamin Wiffen. Worcester College Library has of late specially devoted itself to classical archæology. It is also rich in old plays.

It must be admitted that the college libraries as a rule have not been used to any great extent. Of late, however, there have been signs of awakening interest. About 1871 there was a meeting of college librarians; and it was agreed that the colleges, instead of making merely sporadic purchases from the whole field of literature, should rather husband their limited resources and restrict themselves each to some special department. But the idea has not been carried out very thoroughly, and a good deal must be done before the college libraries can be said to be as useful and efficient as they might be.

Cambridge.

The history of the University Library of Cambridge dates from the earlier part of the 15th century. Two early lists of its contents are preserved, the first embracing 52 volumes dating from about 1425, the second a shelf-list, apparently of 330 volumes, drawn up by the outgoing proctors in 1473. Its first great benefactor was Thomas Scott of Rotherham, archbishop of York, who erected in 1475 the building in which the library continued until 1755. He also gave more than 200 books and manuscripts to the library, some of which still remain. The library received other benefactions, but nevertheless appeared "but mean" to John Evelyn when he visited Cambridge in 1654. In 1666 Tobias Rustat presented a sum of money to be invested to buy the choicest and most useful books. In 1715 George I. presented the library of Bishop Moore, which was very rich in early English printed books, forming over 30,000 volumes of printed books and manuscripts. The funds bequeathed by William Worts and John Manistre, together with that of Rustat, produce at present about £1500 a year. The share of university dues appropriated to library purposes amounts to £3000 a year. In addition the library is entitled to new books under the Copyright Acts. The number of printed volumes in the library cannot be exactly stated, as no recent calculation on the subject exists. It has been variously estimated at a quarter or half a million. The calendar states it as 200,000. It includes a fine series of *editiones principes* of the classics and of the early productions of the English press. The MSS. number 5723, in which are included a considerable number of adversaria or printed books with MS. notes, which form a leading feature in the collection. The most famous of the MSS. is the celebrated copy of the four gospels and the Acts of the Apostles, which is known as *Codex Bezæ*, and which was presented to the university by that Reformer. A catalogue of the MSS. has been published in 4 vols., 1856–61. There is no printed catalogue of the books, although the catalogue is in print, the accessions being printed and cut up and arranged in volumes. The regulations of the library with regard to the lending of books are very liberal, as many as ten volumes being allowed out to one borrower at the same time.

There is a library attached to the Fitzwilliam Museum bequeathed to the university in 1816. It consists of the entire library of Lord Fitzwilliam, with the addition of an archæological library bought from the executors of Colonel Leake, and a small number of works, chiefly on the history of art, since added by purchase or bequest. It contains a collection of engravings of old masters, a collection of music, printed and MS., and a collection of illuminated MSS., chiefly French and Flemish, of the 14th to 16th centuries. The books are not allowed to be taken out.

The library of Trinity College, which is contained in a magnificent hall built by Sir Christopher Wren, has about 90,000 printed and 1918 MS. volumes, and is especially strong in theology, classics, and bibliography. It owes to numerous gifts and bequests the possession of a great number of rare books and manuscripts. Amongst these special collections are the Capell collection of early dramatic and especially Shakespearian literature, the collection of German theology and philosophy bequeathed by Archdeacon Hare, and the Grylls bequest in 1863 of 9600 volumes, including many early printed books. There are printed catalogues of the Sanskrit and other Oriental MSS. by Dr. Aufrecht and Professor Palmer, and of the incunabula by the present librarian, Mr. Sinker. The library is open to all members of the college, and the privilege of using it is liberally extended to properly accredited students.

None of the other college libraries rivals Trinity in the number of books. The library of Christ's College received its first books from the foundress. Clare College Library includes a number of Italian and Spanish plays of the end of the 16th century left by George Ruggle. The library of Corpus Christi College first became notable through the bequest of books and MSS. made by Archbishop Parker in 1575. The printed books are less than 5000 in number, and the additions now made are chiefly in such branches as throw light on the extremely valuable collection of ancient MSS., which attracts scholars from all parts of Europe. There is a printed catalogue of these MSS. Gonville and Caius College Library is of early foundation. A catalogue of the MSS. was printed in 1849, with pictorial illustrations, and a list of the incunabula in 1850. The printed books of King's College include the fine collection bequeathed by Jacob Bryant in 1804. The MSS. are almost wholly Oriental, chiefly Persian and Arabic, and a catalogue of them has been printed. Magdalen College possesses the curious library formed by Pepys and bequeathed by him to the college, together with his collections of prints and drawings and of rare British portraits. It is remarkable for its treasures of popular literature and English ballads, as well as for the Scottish manuscript poetry collected by Sir Richard Maitland. The books are kept in Pepys's own cases, and remain just as he arranged them himself. The library of Peterhouse is the oldest library in Cambridge, and possesses a catalogue of some 600 or 700 books dating from 1418, in which year it was completed. It is chiefly theological, though it possesses a valuable collection of modern works on geology and natural science, and a unique collection of MS. music. Queen's College Library contains about 30,000 volumes, mainly in theology, classics, and Semitic literature, and has a printed class-catalogue. The library of St. John's College is rich in early printed books, and possesses a large collection of English historical tracts. Of the MSS. and rare books there is a printed catalogue. For the other college libraries see the tables.

Free public libraries.

Free Public Libraries.—In the year 1850 Mr. Ewart introduced the first Public Libraries Act into the House of Commons, and it has since been supplemented and amended by the Acts of 1855, 1866, 1871, and 1877. Mr. Ewart had previously carried through parliament the Museums Act of 1845; and small libraries had been established in connection with museums under that Act at Salford and Warrington. The number of towns which have established rate-supported libraries, or in which the Acts have been adopted, now amounts to at least ninety-six, ten of these towns being in Scotland, and one only in Ireland. It is noticeable that the Acts have not been adopted in any of the great capital towns of the three kingdoms, except in one single parish of Westminster. Many of our largest towns are also in default. Glasgow may be considered to be sufficiently provided for by the munificent Mitchell bequest. Of the libraries which have actually been opened sixteen are in places of over 100,000 inhabitants, twenty in towns of between 50,000 and 100,000 inhabitants, sixteen in towns of between 30,000 and 50,000, eleven in towns of between 20,000 and 30,000 inhabitants, seventeen in towns of between 10,000 and 20,000 inhabitants, and finally six in towns of less than 10,000 inhabitants.

Taking the latest returns we have been able to obtain, which are with a few exceptions those of the year 1880–81, the number of volumes in stock and of the total issues is as follows. In eighty-one libraries returning their number of volumes, there is a total of 1,448,192 volumes in stock; while the total issues for the year in seventy-six libraries amounted to the enormous number of 9,023,742 volumes. Even these figures afford a very inadequate idea of the service rendered by these institutions in supplying popular reading. They take no account of the visits made to the newsrooms which are almost invariably connected with the libraries, or of the use made of the magazines and periodicals which lie upon the tables. The free public libraries generally consist of a lending department, with a reference library wherever the institution can provide one. A very large proportion of the issues from the lending departments consists of fiction, the percentage varying in different libraries from about 50 to as much as 75 per cent. of the whole. It is only in the case of the wealthier institutions, such as those in the great towns of Liverpool, Manchester, and Birmingham, that the reference departments are so important as to claim consideration here in respect of the intrinsic character of their collections. Even some of the smaller libraries, however, present features of interest in their collections of local books, or of books illustrating the trade or industry of the district, or the life and writings of some great man connected with or born in the locality.

The Salford Free Public Library was one of the libraries which were established under the Museums Act of 1845, and was opened in 1850 in connection with the museum and picture gallery at Peel Park. The buildings are pleasantly situated in grounds of 46 acres in extent. The reference library now contains 33,500 volumes, and besides the central lending departments there are three branches in different parts of the borough. The income from the penny rate is about £3300; but this is found to be inadequate.

The Manchester Free Library was the first to be established under the Act of 1850. A public subscription of nearly £13,000 was raised to defray the expenses of its establishment, and the library was opened in September, 1852. The working of this library was a success from the outset. The issues in the first year were in the reference departments 61,080 volumes, and in the lending departments, 77,232. The progress made since then may be measured by the number of volumes issued last year (1881), which amounted to 966,468, and by the fact that six branch libraries have been established. The rate produces an income of £11,000. The reference library now possesses a valuable collection of 65,000 volumes, chiefly of standard works. It contains several special collections, chiefly connected with the industries and history of the district. The library of the English Dialect Society, of which a catalogue has been printed, is deposited here. In addition, the library possesses a very extensive series of periodicals, and a larger collection of political and commercial tracts than can be found anywhere in the country except at the British Museum. A good catalogue was printed in 1864, and a new and extensive index has just appeared.

The library at Liverpool, which was established under a special Act passed in 1852, is the most successful of all the free public libraries, and is connected with a splendid museum and art gallery, the former formed around the nucleus of the ornithological specimens bequeathed to the town by the thirteenth earl of Derby. The rapid extension of museum and library soon rendered larger premises a necessity. The late Sir William Brown took upon himself the entire cost of the present extensive buildings, which were opened in 1860. In 1880 was opened the Picton Reading-Room. It is a circular room 100 feet in diameter, surmounted by a dome, the entire height being 56 feet. It contains 50,000 volumes, and will accommodate over 300 readers. Since April, 1881, the electric light has been employed. Under the reading-room is a large circular lecture-room accommodating 1500 persons, in which lectures are regularly delivered. There is a numerous collection of local books and pamphlets. The Binns collection, consisting of maps, plans, drawings, portraits, etc., all having reference to the county of Lancaster, is very interesting and valuable. The issues from the reference library in 1880 were 870,716, and with the issues from the two lending departments make the enormous aggregate of 1,307,131. The rate produces an income of £13,000 per annum, of which more than £5000 is expended upon the libraries. An elaborate catalogue of the reference library was published in 1872, and a supplement is now being printed. In 1853 Bolton established a library which now has a circulation of over 240,000 volumes. In 1855 libraries were established at Birkenhead and Sheffield. At Birkenhead the rate produces £1500, and 130,000 volumes were lent out last year. At Sheffield, where the rate produces £4750, there are three branches, and the total issues last year were 384,266. The reference library has only 9000 volumes.

The Acts, after having been rejected at Birmingham in 1852, were adopted in 1860. By 1868 four branches had been opened in addition to the central reference and lending libraries. The issues from the lending departments last year were 400,000 volumes. The reference library consisted of over 50,000 volumes. The Shakespeare Memorial Library consisted of about 7000 volumes. There were also the Staunton Warwickshire collections of books and MSS. and the Cervantes books. All these collections were unfortunately destroyed by a fire on January 11, 1879. The inhabitants of Birmingham have shown much public spirit in repairing the losses then sustained so far as is possible, and the new central reference and lending libraries are expected to be opened early in 1882, when it is anticipated that there will be as many volumes ready to be placed in the reference library as there were when the former library was destroyed. No town in England is so surrounded with free libraries as Birmingham. The rate at Birmingham produces over £6000.

The free library at Nottingham (1867) has recently had new quarters found for it in the new university buildings. It has two branches, and its issues are about 160,000. The rate produces £2200. The local collections include a Byron library. The library at Leeds (1868) has no less than twenty-one branches, and together they count over 109,000 volumes. The issues last year, in addition to the use made of the central reference library, were 639,613. The rate produces nearly £5000. At Leicester there is only a halfpenny rate, which produces about £800. The issues last year were 192,317. At Bradford (Acts adopted 1871) the rate produces £3200, and there are five branches with a circulation of 291,276 volumes, besides the use made of the reference library. At Plymouth (Acts adopted 1871, library opened 1876) the circulation was 171,851 last year; at Rochdale (Acts adopted 1872) 168,514. At each place there is a good collection of local literature, and at Rochdale a collection of works on the woollen manufacture. The library at Newcastle, opened in 1880, has issued from its lending departments, in its first year, no less than 301,925 volumes to about 14,000 readers. A splendid building is in course of erection to accommodate the reference library. This department is intended to contain a complete collection of all standard works, and also a collection of books and manuscripts relating to Newcastle and the northern counties generally. The rate produces £2800. At Bristol a town library had been established in 1614 by Robert Redwood and Archbishop Matthew, and this has formed the nucleus of the collections formed under the Acts when they were adopted in 1875. The total number of volumes is about 46,000. The issues were 432,646 at the central library and its three branches. At Southport (1875) Mr. Atkinson gave the building called after him for a library and art gallery. The issues last year were 110,778. The rate produced £775, and an additional voluntary rate produced a little over £100 besides.

It will be seen from this summary statement that the libraries established under the Acts have in the cases mentioned been abundantly used. The merit of these results is very largely due to the enlightened energy of those who are entrusted with their administration.

Amongst the English libraries that have not yet been described there are few that call for special mention. Some of these have been founded by individuals, and still bear their names. The most notable of these is the fine old library established by Humphrey Chetham at Manchester in 1653, which is still housed in the old collegiate building where Raleigh was once entertained by Dr. Dee. The collection consists largely of older literature, and numbers 40,000 volumes, with 300 MSS. It is freely open to the public, and may be said to have been the first free library in England. Dr. Shepherd's library at Preston was bequeathed by the founder, a physician of the town, to the corporation of Preston in trust for the inhabitants in the year 1759. It is a library of reference, accessible on a recommendation from an alderman. The William Salt Library, a special Staffordshire library with numerous MSS. and other collections, formed to bring together materials for a history of Staffordshire, was opened to the public in 1874.

Subscription libraries. Some mention should be made also of the more important subscription or proprietary libraries, which were formed for the most part in the latter half of the 18th century. It is difficult for us to realize how few collections of books were accessible to the public of the last century even in London. The earliest circulating library in the metropolis was established about the middle of the century. The first in Birmingham was opened by Hutton in 1757. The idea of a proprietary library appears to have been first carried out at Liverpool in 1758. The library then formed still flourishes at the Lyceum, and possesses a collection of 72,000 volumes and an income of £1200 a year. In 1760 a library was formed at Warrington which has been merged in the Warrington Museum. The Leeds library was established in 1768, and now has 85,000 volumes, and an income of £1430. In 1772 the Bristol museum and library was formed, and numbered Coleridge, Southey, and Landor among its earlier members. It now reckons 50,000 volumes, and an income of £1400 a year. The Birmingham (old) library was formed in 1779, and its rules were drawn up by Dr. Priestley, who had already taken an active share in the management of the libraries at Warrington and Leeds. The library has now 40,000 to 50,000 volumes, and an income of £1600. Many similar institutions are noticed in the tables, while others have given place to the trade circulating libraries and to the libraries established under the Free Libraries Acts.

A few modern collegiate libraries, finally, claim a summary notice. The library of the university of Durham dates only from 1833, and was begun by a gift of books from Bishop Van Mildert, to which many other donations have since succeeded. The Routh collection includes a large collection of early tracts. The Winterbottom collection is chiefly classical, and the Maltby collection classical and theological. The library of the Owens College, Manchester, was formed on the establishment of the college in 1851 by a gift of books from Mr. James Heywood, F.R.S. It has since been largely increased by donations and bequests, including the libraries of Bishop Lee, Mr. Crace Calvert, and others. It has an endowment fund of £2500. The library at Stonyhurst College has gradually grown since the establishment of the college in 1794. There is a printed catalogue of books printed before 1551. The Walshian Library at St. Mary's College, Oscott, was established by Bishop Walsh in 1839, having been purchased by him from the Marchese Marini. It has 70 MSS. and many early printed books.

Scotland. The principal library in Scotland is that of the Faculty of Advocates, who in 1680 appointed a committee of their number, which reported that "it was fitt that, seeing if the recusants could be made pay their entire money, there wold be betwixt three thousand and four thousand pounds in cash; that the same be imployed on the best and fynest lawers and other law bookes, conforme to a catalogue to be be condescended upon by the Facultie, that the samen may be a fonde for ane Bibliothecque whereto many lawers and others may leave their books." In 1682 the active carrying out of the scheme was committed to the Dean of Faculty, Sir George Mackenzie of Rosehaugh, who may be regarded as the founder of the library. In 1684 the first librarian was appointed, and the library appears to have made rapid progress, since it appears from the treasurer's accounts that in 1686 the books and furniture were valued at upwards of £11,000 Scots, exclusive of donations. In the year 1700, the rooms in the Exchange Stairs, Parliament Close, in which the library was kept, being nearly destroyed by fire, the collection was removed to the ground floor of the Parliament House, where it has ever since remained. The library retains the copyright privilege conferred upon it in 1709. The number of volumes in the library is computed to amount to 265,000; of the special collections the most important are the Astorga collection of old Spanish books, purchased by the faculty in 1824 for £4000; the Thorkelin collection, consisting of about 1200 volumes relating chiefly to the history and antiquities of the northern nations, and including some rare books on old Scottish poetry; the Dietrich collection of over 100,000 German pamphlets and dissertations, including many of the writings of Luther and Melanchthon, purchased for the small sum of £80; and the Combe collection.

The faculty appear early to have turned their attention to the collection of MSS., and this department of the library now numbers about 3000 volumes. Many of them are of great interest and value, especially for the civil and ecclesiastical history of Scotland before and after the Reformation. There are thirteen monastic chartularies which escaped the destruction of the religious houses to which they belonged. The MSS. relating to Scottish church history include the collections of Spottiswoode, Woodrow, and Calderwood. The Woodrow collection consists of 154 volumes, and includes his correspondence, extending from 1694 to 1726. Sir James Balfour's collection and the Balcarres papers consist largely of original state papers, and include many interesting royal letters of the times of James V., Queen Mary, and James VI. The Sibbald papers, numbering over 30 volumes, are largely topographical. The Riddle notebooks, numbering 156 volumes, contain collections to illustrate the genealogy of Scottish families. There are about one hundred volumes of Icelandic MSS., purchased in 1825 from Professor Finn Magnusson, and some Persian and Sanskrit, with a few classical, manuscripts. The department has some interesting treasures of old poetry, extending to 73 volumes. The most important are the Bannatyne MS., in 2 vols. folio, written by George Bannatyne in 1568, and the Auchinleck MS., a collection of ancient English poetry, named after Alexander Boswell of Auchinleck, who presented it in 1774.

The first catalogue of printed books was compiled in 1692, and contains a preface by Sir George Mackenzie. Another was prepared under the care of Ruddiman in 1742. In 1853, the late Mr. Halkett commenced a catalogue, which has been printed in 6 vols. 4to, with a supplement, and includes all the printed books in the library at the end of 1871, containing about 260,000 entries. It is an illustration of the public spirit with which they conduct their library, that the whole cost of printing this extensive catalogue, over £5000, has been borne by the members of the faculty. The library, managed by a keeper and staff, under a board of six curators, is easily accessible to all persons engaged in literary work, and is for all practical purposes the public consulting library of Scotland.

The origin of the University Library of Edinburgh is to be found in a bequest of his books of theology and law made to the town in 1580 by Clement Little, advocate. This was two years before the foundation of the university, and in 1584 the town council caused the collection to be removed to the college, of which they were the patrons. As it was the only library in the town, it continued to grow and receive many benefactions, so that in 1615 it became necessary to erect a library building. Stimulated perhaps by the example of Bodley at Oxford, Drummond of Hawthornden made a large donation of books, of which he printed a catalogue in 1627, and circulated an appeal for assistance from others. In 1678, the library received a bequest of 2000 volumes from the Rev. James Nairne. In 1709 the library became entitled to the copy privilege, which has since been commuted for a payment of £575 per annum. In 1831 the books were removed to the present library buildings, for which a parliamentary grant had been obtained. The main library hall (190 feet in length) is one of the most splendid apartments in Scotland. One of the rooms is set apart as a memorial to General Reid, by whose benefaction the library has greatly benefited. Amongst the more recent accessions have been the Halliwell-Phillips Shakespeare collection, the Laing collection of Scottish MSS., the Baillie collection of Oriental MSS. (some of which are of great value), and the Hodgson collection of works on political economy. The library now consists of about 140,000 volumes of printed books with 2000 MSS.

The library of the Writers to Her Majesty's Signet was established by the society in 1755. At first it consisted of law books exclusively, but in 1788 they began to collect the best editions of works in other departments of literature. During the librarianship of Macvey Napier (1805–37), the number of volumes was more than sextupled, and in 1812 the library was removed to the new hall adjoining the Parliament House. In 1834 the upper hall was devoted to the collection. This is a magnificent apartment 142 feet long, with a beautiful cupola painted by Stothard. The library now contains nearly 70,000 volumes, exclusive of pamphlets, and includes some fine specimens of early printing, as well as many other rare and costly works. It is especially rich in county histories and British topography and antiquities. A catalogue of the law books was printed in 1856. The late David Laing, who became librarian in 1837, published the first volume of a new catalogue in 1871. The second volume is nearly completed. The books are lent out to the Writers and even to strangers recommended by them. This library, like that of the Advocates, is most liberally opened to literary inquirers, and has thus acquired a quasi-public or national character.

There are various other important libraries in Edinburgh, but no considerable lending library open freely to the poorest of the people, and two attempts which have been made to introduce the Libraries' Acts have been unsuccessful.

The first mention of a library at St. Andrews is as early as 1456. The three colleges were provided with libraries of their own about the time of their foundation—St. Salvator's 1455, St. Leonard's 1512, St. Mary's 1537. The University Library was established about 1612 by King James VI., and in the course of the 18th century the college libraries were merged in it. The copyright privilege was commuted in 1837. The collection numbers 90,000 volumes exclusive of pamphlets, with about 200 MSS., chiefly of local interest. About 1200 volumes are added yearly. A library is supposed to have existed at Aberdeen since the foundation of King's College by Bishop Elphinstone in 1494. The present collection combines the libraries of King's College and Marischal College, now incorporated in the university. The latter had its origin in a collection of books formed by the town authorities at the time of the Reformation, and for some time kept in one of the churches. The library has benefited by the Melvin bequest, chiefly of classical books, and those of Henderson and Wilson, and contains some very valuable books. The general library is located in Old Aberdeen, while the medical and law books are in the New Town. The library has a grant, in lieu of the copy privilege, of £320. The library of the university of Glasgow dates from the 15th century, and numbers George Buchanan and many other distinguished men amongst its early benefactors. A classified subject-catalogue is in progress. The annual accessions are about 1500, and the commutation grant £707. Connected with the university, which is trustee for the public, is the library of the Hunterian Museum, formed by the eminent anatomist Dr. William Hunter. It is a collection of great bibliographical interest, as it is rich in MSS. and in fine specimens of the early printing, especially in Greek and Latin classics. The printed books number about 13,000 volumes, and the MSS. some 600 volumes. All the Scottish university libraries lends books to students, on deposit of £1, to graduates, for an annual subscription of half a guinea, and to persons engaged in literary research, by permission of the senatus.

The Mitchell Library at Glasgow bids fair to be the most important public library outside Edinburgh. It was founded by a munificent bequest of £70,000 from the late Mr. Stephen Mitchell. The library was opened in 1877, in temporary premises, and already contains over 36,000 volumes. It includes a special collection of Scottish poetry called "The Poet's Corner," and a collection of Glasgow literature, including early specimens of Glasgow printing. The library is open to all persons over fourteen years of age, and the number of readers during the first three years in which the library has been opened is believed to be without precedent. The number of volumes issued in 1880 was 390,732.

The English Libraries' Act of 1850 was extended to Scotland in 1854, and the first town to put it into operation was Airdrie, in 1856. The largest of the libraries which have been opened under the Acts is at Dundee, which possesses 35,500 volumes, with a circulation of 252,314. The rate produces £2390. Although the resources of the other towns in which the Acts have so far been adopted do not enable them to rival the larger English towns, the results are proportionately quite as satisfactory. The turnover of their stock of books is generally large, and the reading done appears to be more solid and serious than in England. The percentage of fiction issued is at least 10 or 15 per cent. below the average rate in the English free libraries.

Ireland.

The establishment of the library of Trinity College, Dublin, is contemporaneous with that of the Bodleian at Oxford, and it is an interesting circumstance that, when Challoner and Ussher (afterwards the archbishop) were in London purchasing books to form the library, they met Bodley there, and entered into friendly intercourse and co-operation with him to procure the choicest and best books. The commission was given to Ussher and Challoner as trustees of the singular donation which laid the foundation of the library. In the year 1601 the English army determined to commemorate their victory over the Spanish troops at Kinsale by some permanent monument. Accordingly they subscribed the sum of £1800 to establish a library in the university of Dublin. For Ussher's own collection, consisting of 10,000 volumes and many valuable MSS., the college was also indebted to military generosity. On his death in 1655 the officers and soldiers of the English army then in Ireland purchased the whole collection for £22,000 with the design of presenting it to the college. Cromwell, however, interfered, alleging that he proposed to found a new college, where the books might more conveniently be preserved. They were deposited therefore in Dublin Castle, and the college only obtained them after the Restoration. In 1674 Sir Jerome Alexander left his law books with some valuable MSS. to the college. In 1726 Dr. Palliser, archbishop of Cashel, bequeathed over 4000 volumes to the library; and ten years later Dr. Gilbert gave the library nearly 13,000 volumes which he had himself collected and arranged. In 1741 the library received a valuable collection of MSS. as a bequest from Dr. Stearne. In 1802 the collection formed by the pensionary Fagel, which had been removed to England on the French invasion of Holland, was acquired for £10,000. It consisted of over 20,000 volumes. In 1805 Mr. Quin bequeathed a choice collection of classical and Italian books. There have been many other smaller donations, in addition to which the library is continually increased by the books received under the Copyright Act. The library now contains 192,000 volumes and 1880 MSS., and about 3000 volumes are added every year. There is no permanent endowment, and purchases are made by grants from the board. The whole collections are contained in one building, erected in 1732, consisting of eight rooms. The great library hall is a magnificent apartment over 200 feet long. A new reading-room was opened in 1848. A catalogue of the books acquired before 1872 is now in course of printing. There is no printed catalogue of the MSS. Graduates of Dublin, Oxford, and Cambridge are admitted to read permanently, and temporary admission is granted by the board to any fit person who makes application. Books and MSS. are lent out only under special regulations. A lending library has been established to make provision for the needs of the students.

The public library, St. Patrick's, Dublin, sometimes called Marsh's Library after its founder, was established about 1694 by Archbishop Marsh, was incorporated by Act of Parliament in 1707, and endowed by its founder at his death in 1713. The building was erected by the founder, and the original oak fittings still remain. There is no room for additions, and a large collection of modern books was refused a few years ago on that account. The endowment is too small to allow of purchases from the funds of the library, so that it still retains the character of a 17th century library. The books are chiefly theological, and in the learned languages; they include the libraries of Bishop Stillingfleet and of Elias Bouhereau, a French refugee, who was the first librarian.

The library of the Royal Dublin Society was commenced shortly after the formation of the society in 1731. With the exception of about 10,000 volumes of the publications of learned societies and scientific periodicals, with a few early editions, its books were transferred to the state, in 1877, to assist in forming the national library of Ireland. The manuscript collections of Walter Harris on Irish history were purchased and placed in the library for public use by the Irish parliament. The library of the Royal Irish Academy was established on the formation of the Academy in 1785, for the purpose of promoting the study of science, literature, and antiquities in Ireland. The library possesses about 40,000 printed volumes and about 1400 MSS. There is a large collection of MSS. and books relating to the history, ancient language, and antiquities of Ireland. They include the Betham collection, acquired partly by public subscription in 1851. The library is partly supported by a Government grant of £200 per annum, and is freely open on a proper introduction. Under the direction of the present honorary librarian, the publication of Irish MSS. in the library was begun in 1870, and has since continued. The library of King's Inns was founded, pursuant to a bequest of books and legal MSS. under the will of Mr. Justice Robinson in 1787, to form the nucleus of a library for law students. It is partly supported from the funds of the benchers, but partly also by a treasury grant of £433, 6s. 8d. in lieu of the copy privilege. No books are lent out, and the use of the library is confined to students and barristers; so that the public has no advantage in return for the annual contribution of public money.

There is no library in Dublin corresponding in extent and public accessibility to the British Museum in London, or the Advocates' Library in Edinburgh. About 1850 it was proposed to supply the deficiency by combining the libraries of the Dublin Society and the Irish Academy, both of which had long received grants of public money, together with the collection of Archbishop Marsh. Accordingly in 1854 an Act of Parliament was passed "for the establishment of a national gallery and for the care of a public library in Dublin." The scheme thus authorized has never been carried out. In 1877, however, the National Library of Ireland was established in the apartments of Leinster House. The library is under the Science and Art Department of South Kensington, and is superintended by a body of twelve trustees in Dublin. For the last two years it has received an annual vote of £1000 from parliament for the purchase of books. As already mentioned, the books of the Royal Dublin Society have been transferred to it. It is freely open to the public on a respectable introduction, and is much used.

The public library of Armagh was founded by Lord Primate Robinson in 1770, who gave a considerable number of books and an endowment. The books are freely available either on the spot, or by loan on deposit of double the value of the work applied for. At Belfast the Queen's College Library has about 36,000 volumes, with a special collection of books on the languages and literatures of the East. The library of the Queen's College, Cork, contains about 25,000 volumes, 1600 of the most valuable of which have been presented by Mr. Crawford. The library is easily accessible to literary inquirers, and is much used by strangers. The library of Maynooth College is chiefly theological, and contains the collections bequeathed by the late president, Monsignor Russell. There are about 40,000 volumes and a few MSS.

Dundalk is at present the only town that has a library under the Public Libraries Acts, which were adopted there in 1856. The rate produces only about £80.

France.

France. French libraries (other than those in private hands) belong either to the state, to the departments, to the communes, or to learned societies, educational establishments, and other public institutions; the libraries of judicial or administrative bodies are not considered to be owned by them, but to be state property. Besides the unrivalled library accommodation of the capital, France possesses a remarkable assemblage of provincial libraries. The communal and school libraries also form striking features of the French free library system.

Five and twenty years ago (see *Tableau statistique bibliothèques publiques*, 1857) there were in the departments,—exclusive of those not literally free, and of all Parisian libraries,—340 public libraries containing 3,734,260 volumes and 44,436 MSS. In 1857 there were only 32 provincial libraries which owned more than 30,000 volumes each; there are now 54 which are of that extent and upwards.[1] In Paris there are now 16 containing over 30,000 volumes each.

Paris. *Libraries of Paris.*—The Bibliothèque Nationale (still the most extensive library in the world) has had an advantage over all others in the length of time during which its contents have been accumulating, and in the great zeal shown for it by several kings and other eminent men. Enthusiastic writers find the original of this library in the MS. collections of Charlemagne and Charles the Bald, but these were dispersed in course of time, and the few precious relics of them which the national library now possesses have been acquired at a much later date. Of the library which St. Louis formed in the 13th century (in imitation of what he had seen in the East) nothing has fallen into the possession of the Bibliothèque Nationale, but much has remained of the royal collections made by kings of the later dynasties. The real foundation of the institution (formerly known as the Bibliothèque du Roi) may be said to date from the reign of King John, the Black Prince's captive, who had a considerable taste for books, and bequeathed his "royal library" of MSS. to his successor Charles V. Charles V. organized his library in a very effective manner, removing it from the Palais de la Cité to the Louvre, where it was arranged on desks in a large hall of three stories, and placed under the management of the first librarian and cataloguer, Claude Mallet, the king's valet-de-chambre. His catalogue was a mere shelf-list, entitled *Inventaire des Livres du Roy nostre Seigneur estans au chastel du Louvre;* it is still extant, as well as the further inventories made by Jean Blanchet in 1380, and by Jean le Bègue in 1411 and 1424. Charles V. was very liberal in his patronage of literature, and many of the early monuments of the French language are due to his having employed Nicholas Oresme, Raoul de Presle, and other scholars to make translations from ancient texts. Charles VI. added some hundreds of MSS. to the royal library, which, however, was sold to the regent, duke of Bedford, after a valuation had been established by the inventory of 1424. The regent transferred it to England, and it was finally dispersed at his death in 1435. Charles VII. and Louis XI. did little to repair the loss of the precious Louvre library, but the news of the invention of printing served as a stimulus to the creation of another one, of which the first librarian was Laurent Paulmier. The famous miniaturist Jean Foucquet of Tours was named the king's *enlumineur*, and although Louis XI. neglected to avail himself of many precious opportunities that occurred in his reign, still the new library developed gradually with the help of confiscation. Charles VIII. enriched it with many fine MSS. executed by his order, and also with most of the books that had formed the library of the kings of Aragon, seized by him at Naples. Louis XII., on coming to the throne, incorporated the Bibliothèque du Roi with the fine Orleans library at Blois, which he had inherited. The Blois library, thus augmented, and further enriched by plunder from the palaces of Pavia, and by the purchase of the famous Gruthuyse collection, was described at the time as one of the four marvels of France. Francis I. removed it to Fontainebleau in 1534, enlarged by the addition of his private library. He was the first to set the fashion of fine artistic bindings, which was still more cultivated by Henry II., and which has never died out in France. During the librarianship of Amyot (the translator of Plutarch) the library was transferred from Fontainebleau to Paris, not without the loss of several books coveted by powerful thieves. Henry IV. removed it to the Collége de Clermont, but in 1604 another change was made, and in 1622 it was installed in the Rue de la Harpe. Under the librarianship of J. A. de Thou it acquired the library of Catherine de' Medici, and the glorious Bible of Charles the Bald. In 1617 a decree was passed that two copies of every new publication should be deposited in the library, but this was not rigidly enforced until Louis XIV.'s time. The first catalogue worthy of the name was finished in 1622, and contains a description of some 6000 volumes, chiefly MSS. Many additions were made during Louis XIII.'s reign, notably that of the Dupuy collection, but a new era dawned for the Bibliothèque du Roi under the patronage of Louis XIV. The enlightened activity of Colbert, one of the greatest of collectors, so enriched the library that it became necessary for want of space to make another removal. It was therefore in 1666 installed in the Rue Vivien (now Vivienne) not far from its present habitat. The departments of engravings and medals were now created, and before long rose to nearly equal importance with that of books. Marolles's prints, Foucquet's books, and many from the Mazarin library were added to the collection, and, in short, the Bibliothèque du Roi had its future pre-eminence undoubtedly secured. Nic. Clément made a catalogue in 1684 according to an arrangement which has been followed ever since (that is, in twenty-three classes, each one designated by a letter of the alphabet), with an alphabetical index to it. After Colbert's death Louvois emulated his predecessor's labors, and employed Mabillon, Thevenot, and others to procure fresh accessions from all parts of the world. A new catalogue was compiled in 1688 in eight volumes by several distinguished scholars. The Abbé Louvois, the minister's son, became head of the library in 1691, and opened it to all students—a privilege which although soon withdrawn was afterwards restored. Towards the end of Louis XIV.'s reign it contained over 70,000 volumes. Under the management of the Abbé Bignon numerous additions were made in all departments, and the library was removed to its present home in the Rue Richelieu. Among the more important acquisitions were 6000 MSS. from the private library of the Colbert family, Bishop Huet's forfeited collection, and a large number of Oriental books imported by missionaries from the further East, and by special agents from the Levant. Between 1739 and 1753 a catalogue in eleven volumes was printed, which enabled the administration to discover and to sell its duplicates. In Louis XVI.'s reign the sale of the La Vallière library furnished a valuable increase both in MSS. and printed books. A few years before the Revolution broke out the latter department contained over 300,000 volumes and opuscules. The Revolution was serviceable to the library, now called the Bibliothèque Nationale, by increasing it with the forfeited collections of the *émigrés*, as well as of the suppressed religious communities. In the midst of the difficulties of placing and cataloguing these numerous acquisitions, the name of Van Praet appears as an administrator of the first order. Napoleon increased the amount of the Government grant; and by the strict enforcement of the law concerning new publications, as well as by the acquisition of several special collections, the Bibliothèque made considerable progress during his reign towards realizing his idea that it should be universal in character. At the beginning of this century the recorded numbers were 250,000 printed volumes, 83,000 MSS., and 1,500,000 engravings. After Napoleon's downfall the MSS. which he had transferred from Berlin, Hanover, Florence, Venice, Rome, the Hague, and other places had to be returned to their proper owners. The MacCarthy sale in 1817 brought a rich store of MSS. and incunabula. From that time onwards to the present, under the enlightened administration of MM. Taschereau and Delisle, the accessions have been very extensive.

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[1] In 1877 a *questionnaire* was issued in order to obtain materials for a more complete report, but the results have not yet been made public.

The official estimate of the number of volumes in the *Département des Imprimés* now reaches the extraordinary total of about 2,290,000, but the contents have not been actually counted since 1791, and as the above enumerates pieces of which many are included in one volume, perhaps something like 1,827,000 is nearer the proper number. The annual additions are about 45,000. The *réserve* (consisting of articles of the highest importance) extends to more than 50,000 volumes. The collection of books on French history is in itself an enormous library, amounting to 440,000 volumes. The maps and charts, said to number 300,000, are included in this department. The *Département des MSS.* comprehended, in 1876, 91,700 volumes. The *Département des Médailles* possessed, in 1873, 143,030 coins, medals, engraved stones, etc., and since that date has acquired many important accessions. More than 2,200,000 engravings are in the *Département des Estampes*, where 20,000 pieces are annually received under the copyright law. The annual vote for purchases and binding is 200,000 francs.

Admittance to the *Salle de Travail* is obtained by a *bulletin personnel*, which is procurable without difficulty. This, the reading room for students, was built in 1868, and affords accommodation for 344 readers. There are but few books of reference, and readers are only allowed five books a day. The *Salle publique* contains 40,000 books, which are freely available to the public. Plans are now under consideration for an enlargement of the Bibliothèque, and a sum of 3,700,000 francs is to be devoted to that purpose.

The Bibliothèque Nationale does not possess a general catalogue at the disposal of readers; the MS. catalogues of the various classes of the printed books are for official use only. Besides the old catalogue of 1739–53, there is the very elaborate *Catalogue de l'Histoire de France* (1855–79, 11 vols. 4to), with a lithographed supplement; the indexes will appear shortly. The third volume of the *Catalogue des Sciences Médicales* is now in the press, and that devoted to English history is nearly finished in manuscript. The vellum books have been described by Van Praet (1822–23, 6 vols. 8vo, and supplement, 1877). The MSS. are much better provided for. The printed catalogues of these commence with that of Anicet Melot, 1739–44, 4 vols. folio, continued in a way by the *Notices et extraits des MSS. du Bibl. du Roi*, 1787–1875. The work of M. Paulin Paris, *Les MSS. Français; leur histoire et celle des textes allemands, anglois, italiens, et espagnols* (1836–48, 7 vols. 8vo), is well known. Catalogues of the Italian, Spanish, Belgian, Pali, Sanskrit, Ethiopian, and Chinese MSS. have also appeared between 1807 and 1844. The first and second volumes in 4to of a new *Catalogue des MSS. Français* have been printed, and two volumes of the *Inventaire* of M. Delisle, besides five parts of his *Inventaire des MSS. Latins* (1863–71). The authorities have also brought out a *Catalogue des Manuscrits Hebreux et Samaritains* (1866, 4to), besides those of *MSS. Syriaques et Sabéens* (1874, 4to), *MSS. Ethiopiens* (1877), and *MSS. Espagnols* (1879).

Paris is much better provided than London or any other city in the world with great public libraries. Besides the Bibliothèque Nationale there are four libraries, each over 120,000 volumes (with others less extensive), to which the public have free access, the Bibliothèque de l'Arsenal being the largest of them. The collection of the Marquis de Paulmy d'Argensen was the basis of this library, which also acquired a portion of the books of the Duc de la Vallière in 1781. It is peculiarly rich in romances, the drama, and French poetry, and possesses 80,000 volumes on French history alone. It is freely open, but there are not many readers. The Bibliothèque Mazarine was founded by the great cardinal, who in 1643 placed about 12,000 volumes at the disposal of the public. The books were chiefly brought together through the exertions of Gabriel Naudé, who tells us that in 1648 they amounted to 40,000 volumes. After the death of Mazarin, his magnificent library was bequeathed to the college bearing his name; it remained under the direction of the Sorbonne from 1688 to 1791, since which time it has been subject to the control of the state. It is rich in incunabula and theology, including the works of Protestant divines, and is annually visited by over 12,000 readers.—The Bibliothèque St. Geneviève was founded in 1624, at the abbey of that name, by Cardinal François de la Rochefoucauld. Other persons also gave books, and in 1687 the library is said to have contained 20,000 printed volumes and 400 MSS. In 1710 C. M. Le Tellier bequeathed his collection, and in the *Almanach Royal* of the same year an announcement appeared that the library would be open to students during certain hours every day. Louis, Duc d'Orléans, the son of the Regent, took up his abode here, and in 1730 the library was considerably enlarged by him. It was opened to the public in 1790, and at the time of the Revolution there were 80,000 printed volumes and 2000 MSS.; there are now 120,000 volumes and 2392 MSS. The reading-room is open in the evening, and is much frequented, especially by students. The library contains a good collection of incunabula, many of which have been described by Dibdin, a number of rare Italian and Spanish chronicles, and a very complete series of periodicals from the 17th century to the empire.—The Bibliothèque de l'Université (or the Sorbonne) was formerly restricted to the use of the members of the five facalties of Paris, but the public has been freely admitted during the last thirty years.—The Bibliothèque de l'Institut having been plundered during the Revolution, the old town library was transferred to it. Persons not members are admitted upon the recommendation (which lasts twelve months) of any academician.—The Bibliothèque de la Ville, founded in the 18th century, and reorganized at the time of the Revolution, was destroyed in 1871. It has since been entirely re-established in the Hôtel Carnavalet, which contains the historical museum of the city, and comprehends 60,000 volumes of books and 40,000 engravings, entirely relating to the history and description of Paris. The other public libraries are under the authority of the minister of public instruction, but the Bibliothèque de la Ville is under the control of the prefect of the Seine. The municipal libraries in Paris are 20 in number, with 70,000 volumes; there are besides 440 school libraries, with 44,120 books.

Of other libraries in Paris, not included in our tables, we may name the Bibliothèque de la Préfecture de Police (10,000 volumes, with curious MSS. relating to the Revolution), Bibliothèque du Tribunal de première instance (28,000 volumes), Bibliothèque de l'École Polytechnique (30,000 volumes), Bibliothèque de l'École Normale (26,000 volumes, which acquired the library of Georges Cuvier in 1833), Bibliothèque des Invalides (28,000 volumes, a good collection on history and military affairs), Bibliothèque de l'École Nationale des Beaux Arts (15,000 volumes, 12,000 drawings, 100,000 prints and photographs), Bibliothèque du Conservatoire de Musique (30,000 volumes, one of the finest collections of musical literature in the world), Bibliothèque des Archives Nationales (founded by Danon in 1808, containing 25,000 volumes on palæography, history, and jurisprudence,—as this is the record office of France, the archives are very extensive), Bibliothèque du Luxembourg (25,000 volumes), Bibliothèque du Lycée Louis le Grand (30,000 volumes), Bibliothèque du Ministère de l'Intérieur (17,000 volumes, including Parisian and provincial history and documents).

Provinces of France.

Besides the various collections belonging to learned and scientific societies, educational institutions, and other bodies, outside Paris, over 215 French provincial towns possess public libraries, which range in number of volumes from 2000 or 3000 to 190,000, as at Bordeaux. Most of them were founded at the end of the last or the beginning of the present century, but some are earlier. The library at Lyons was established by Francis I. in 1530, that at Nantes dates from 1588, La Rochelle from 1604, Abbeville, Besançon, and Troyes from the latter part of the same century, and Orléans from the beginning of the 17th century. The large majority were formed by confiscation at the time of the Revolution. In February, 1790, the Assemblée Nationale abolished the different religious communities, and in September of the same year the provincial tribunals and parliaments met with the same fate. The books (said to number 10 or 12 millions) of these corporations were declared national property, a committee was appointed to consider what should be done with them, and a general catalogue of all the sequestered effects ordered to be drawn up. In consequence of the recommendations of the committee, the Convention Nationale (January 27, 1794) decreed the establishment and augmentation of public libraries. The orders of the Convention were not carefully executed, and pitiable stories are told of valuable works sold by the yard as they lay upon the ground, of precious manuscripts and printed rarities left to rot in the open air or burnt for fuel. As the government became more settled, the libraries (when not destroyed) of condemned persons were restored to their representatives. A very large number of books still remained, however, and it is to them that the town libraries of France chiefly owe their riches. Theology, law, history, and the severer literature of the 17th and 18th centuries consequently predominate, although for many years more modern requirements have been mainly considered in the acquisition of books. Many collections of local and provincial literature have been formed, as at Angers, Auxerre, Chaumont, Grenoble, La Rochelle, Lille, Marseilles, Orléans, Toulouse, Tours, and Versailles. Some of the libraries are very extensive. Douai and Troyes have 100,000 volumes each; Lyons and Rouen over 120,000; Besançon, 130,000; Aix and Nantes, 150,000; Grenoble, 170,000; and Bordeaux, 190,000 volumes. All have catalogues, mostly alphabetical; a few of them are in print. The *Catalogue général des MSS. des bibliothèques publiques des départements* is a noble undertaking on the part of the French Government. The first volume came out in 1849, and the latest, the sixth, in 1879; the treasures of eighteen libraries have now been catalogued (about 9650 MSS.), and there remain over 45,000 MSS. to be described. Besides this, Angers, Amiens, Auxerre, Caen, Carpentras, Chartres, Orléans, and Tours possess separate printed catalogues of their MSS. The chambers annually vote large sums for books, which are distributed to the town libraries by the minister of public instruction. The sums granted by the different municipalities for their libraries vary in amount; for instance, Grenoble (170,000 volumes and eight persons employed) gives 26,314 francs, Bordeaux (190,000 volumes and eight persons) 21,350 francs, and Nantes (150,000 volumes and four persons) 13,600 francs.

Popular libraries of every description, including military and workmen's libraries, owe much to the "Société Franklin pour la propagation des bibliothèques populaires," which, founded in 1862, has since been of immense service in originating and helping those institutions. Between 1868 and 1878 the Société had spent 550,000 francs on these purposes. It issues a *Catalogue Populaire* of a good selection of recommended books, and publishes a journal of its proceedings.

School libraries had an organized existence in France as far back as 1831, and by 1848 the books which had been distributed by the state amounted in value to 2 millions of francs; two years later, however, no trace of books or libraries could be found.[1] In 1860 the question was again taken up, and in 1862 the minister of public instruction ordered that in every primary school a library should be established under the care of the schoolmaster. For some years the Government annually granted 120,000 francs, a sum which was raised to 200,000 francs in 1878; for their share of the expenses the departments contributed in 1875 as much as 170,000 francs. As an instance of the rapidity with which the school libraries have increased, it may be stated that Haute-Marne, which only possessed 44 of them in 1866, ten years later had 548; in 1877 there were about 17,764 *bibliothèques scolaires* possessing 1,716,904 works, and there are now over 20,000 of them in France. The libraries, which are intended not only for the use of school children, but also for their parents and other adults, are regulated by a commission sitting at the ministry of public instruction.

Germany (with Austria and Switzerland).

Germany.

Germany is emphatically the home of large libraries; her want of political unity and consequent multiplicity of capitals have had the effect of giving her a considerable number of large state libraries, and the number of her universities has tended to multiply considerable collections.

Berlin.

Berlin is well supplied with libraries, seventy-two being registered by Petzholdt in 1875, with about 1,293,030 printed volumes. The largest of them is the Royal Library, which was founded by the "Great Elector" Frederick William, and opened as a public library in a wing of the electoral palace in 1661. From 1699 the library became entitled to a copy of every book published within the royal territories, and it has received many valuable accessions by purchase and otherwise. It is now estimated to contain upwards of 700,000 printed volumes and over 15,000 MSS. The amount yearly expended upon binding and the acquisition of books, etc., is £4800. The catalogues are in manuscript, and include a general alphabetical author-catalogue, and a systematic subject-catalogue in a handy form. The building, erected about 1780 by Frederick the Great, has long been too small, and a new one is in contemplation. The conditions as to the use of the collections are, as in most German libraries, very liberal. Any adult person is allowed to have books in the reading-room. Books are lent out to all higher officials, including those holding educational offices in the university, etc., and by guarantee to almost any one recommended by persons of standing; admission to the journal-room is more strictly limited. By special leave of the librarian, books and MSS. may be sent to a scholar at a distance, or, if especially valuable, may be deposited in some public library where he can conveniently use them. There appears to be no limit to the number of books which may be borrowed, although it is prescribed that not more than "three works" must be asked for on one day. Professor Lepsius reports the issues for last year as 71,400 works, to about 5000 readers. The University

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[1] See De Watteville, *Rapport sur les Bibliothèques scolaires*, 1879.

Library (1831) numbers 200,000 volumes with 353 MSS. The number of volumes lent out in 1880 was 40,101. The library possesses the right to receive a copy of every work published in the province of Brandenburg. Some of the government libraries are important, especially those of the Military Academy and the General Staff, which was increased in 1872 by acquiring the library of the "École d'Application" at Metz. In 1850 some popular libraries were established by a society for giving scientific lectures. There are now thirteen such libraries with over 54,000 volumes, but the yearly number of readers is only about 12,000.

Munich. The libraries of Munich, though not so numerous as those of Berlin, include two of great importance. The Royal Library, the largest collection of books in Germany, was founded by Duke Albrecht V. of Bavaria (1550–79), who made numerous purchases from Italy, and incorporated the libraries of the Nuremberg physician and historian Schedel, of Widmannstadt, and of J. J. Fugger. The number of printed volumes is estimated at about one million, although it is long since any exact enumeration has been made. The library is especially rich in incunabula, many of them being derived from the libraries of the monasteries closed in 1803. The Oriental MSS. are numerous and valuable, and include the library of Martin Haug. The amount annually spent upon the library is £5400, of which £2050 is expended upon books and binding. The catalogues of the printed books are in manuscript, and include (1) a general alphabetical catalogue, (2) an alphabetical repertorium of each of the 195 subdivisions of the library, (3) biographical and other subject catalogues. A printed catalogue of the MSS. in 8 volumes is nearly complete; the first was published in 1858. The library is open only twenty-nine hours during the week, while the Royal Library at Berlin is, except in the three winter months, open for thirty-nine. The library of the British Museum is now open for sixty-six hours per week, but it lends no books out. The regulations for the use of the library are very similar to those of the Royal Library at Berlin. The building erected for this collection under King Louis I. in 1832–43 is regarded as a model library structure. The archives are bestowed on the ground floor, and the two upper floors are devoted to the library, which occupies seventy-seven apartments. The University Library was originally founded at Ingolstadt in 1472, and removed with the university to Munich in 1826. It participated in 1803 in the division of the literary treasures of the disestablished monasteries. At present the number of volumes in the general library amounts to 290,000, besides which several special collections are also deposited in the library to the number of 32,800 volumes. The MSS. number 1744. The various libraries of Munich have upwards of 1,400,000 volumes.

Dresden. Dr. Petzholdt has registered no less than 49 libraries in Dresden, where indeed his inquiries were likely to be particularly exhaustive. The Royal Public Library in the Japanese Palace was founded in the 16th century. Among its numerous acquisitions have been the library of Count Bünau in 1764, and the manuscripts of Ebert. Special attention is devoted to history and literature. The library does not claim to possess more than 350,000 volumes, although Petzholdt in 1875 reckoned them as at least 500,000 printed books, as well as 400,000 dissertations. The MSS. number 6500 volumes. Admission to the reading-room is granted to any respectable adult on giving his name, and books are lent out to persons qualified by their position or by a suitable guarantee. Here, as at other large libraries in Germany, works of belles-lettres are only supplied for a literary purpose. The number of persons using the reading-room in a year is about 3900, and about 10,000 works (not volumes) are lent to about 500 readers.—The "Prinzliche Secundo-Genitur" Library, now in the possession of Prince George of Saxony, and of which Dr. Petzholdt, the Nestor of bibliographers, is librarian, is a private library to which access is permitted.

Stuttgart. The Royal Public Library of Stuttgart, although only established in 1765, has grown so rapidly that it now possesses about 425,000 "numbers" of printed works and 3800 MSS. There is a famous collection of Bibles, containing 7200 volumes. The annual expenditure is about £2640, of which £1250 is devoted to books and binding. The library also enjoys the copy-privilege in Würtemberg. "The borrowing of books for home use is open to all members of the German empire resident in Stuttgart, whose personal and economic circumstances offer the necessary guarantees for the safety of the national property. The library may, moreover, be used from any part of Würtemberg on payment of the cost of carriage." The annual number of borrowers is over 1800, who use nearly 17,000 volumes. The number issued in the reading-room is at least twice as great. The number of parcels despatched from Stuttgart is nearly 900.—Admission is also gladly granted to the Royal Private Library, founded in 1810, which contains about 50,000 volumes and 600 MSS. The other libraries of Stuttgart, of which Petzholdt reckons 11, are not of importance.—**Darmstadt.** The Grand-ducal Library of Darmstadt was established by the grand-duke Louis I. in 1817, on the basis of the still older library formed in the 17th century. The number of volumes used in the course of the year is about 30,000, of which 9000 are lent out to about 5000 readers.—**Gotha.** The Ducal Library of Gotha was established by Duke Ernest the Pious in the 17th century, and contains many valuable books and MSS. from monastic collections. It numbers about 240,000 works, with upwards of 6000 MSS. The catalogue, now in course of publication, of the Oriental MSS., chiefly collected by Seetzen, and forming one-half of the collection, is one of the best in existence. Other great Ducal Libraries are noticed in the tables.

University libraries. Libraries of varying extent and importance are attached to all the twenty-one universities of Germany, most of them being coeval with the universities themselves. Thus the oldest library is that of Heidelberg, which in its earlier form dates from 1386. In 1608 it had become so important that Joseph Scaliger wrote of it "Locupletior est et meliorum librorum quam Vaticana." In 1623 the library was carried to Rome as a present to the pope, but some of the treasures were ultimately restored. The later collection was first formed in 1703. The collection of MSS. is extremely valuable.—The library of Leipsic university dates from 1409, although it was not until the middle of the 16th century that it was properly organized.—The library of Göttingen owes much to the labors of the illustrious Heyne. It ranks as one of the most complete and best arranged of the German libraries. New buildings for its accommodation are in course of erection.—The library at Strasburg, although founded only in 1871 to replace that which had been destroyed in the siege, already ranks amongst the largest libraries of the empire. Its books and MSS. together amount to 513,000. The remaining university libraries are noticed in the tables.

Some of the town libraries of Germany mentioned in the tables were amongst the earliest established after the revival of learning. The oldest of them is perhaps that of Ratisbon, which was founded at least as early as 1430. Since Ratisbon has ceased to be an imperial city it has had to part with many of its treasures to the library at Munich.

The whole number of libraries in the German empire enumerated by Dr. Petzholdt is 1547, distributed amongst 584 towns.

Austria. A report issued in 1873–74 by the Austrian Statistical Commission, furnishes an account of the condition of the libraries in those portions of Austria which are represented in the Reichsrath, as they were at the end of the year 1870. The number of libraries registered was 577, of which 23, however, were private libraries. Of the rest 159 belonged to religious corporations and seminaries, 105 were military libraries, 56 belonged to literary and scientific societies, 189 were of an educational and scholastic, and the remaining 45 of a public character.

The largest library in Austria, and one of the most important collections in Europe, is the Imperial Public Library at Vienna, apparently founded by the emperor Frederick III. in 1440, although its illustrious librarian Lambecius, in the well-known inscription over the entrance to the library which summarizes its history, attributes this honor to Frederick's son Maximilian. However this may be, the munificence of succeeding emperors greatly added to the wealth of the collection, including a not inconsiderable portion of the dispersed library of Corvinus. Since 1808 the library has also been entitled to the copy privilege in respect of all books published in the empire. The sum devoted to the purchase of books is 26,250 florins annually. The main library apartment is one of the most splendid halls in Europe. Admission to the reading-room is free to everybody, and books are also lent out under stricter limitations.—The University Library of Vienna was established by Maria Theresa. The reading-room is open to all comers, and the library is open much longer than is the rule with university libraries generally. In winter, for instance, it is open from 5 to 8 in the evening, and it is even open from 9 to 12 on Sundays. In 1879, 159,768 volumes were used in the library, 16,300 volumes lent out in Vienna, and 4418 sent carriage free to borrowers outside Vienna. The total number of libraries in Vienna enumerated by Dr. Petzholdt is 101, and many of them are of considerable extent.

Monastic libraries. The number of monastic libraries in Austria is very considerable. Particulars are furnished, in the report already quoted, of 107 of them, varying from a few hundreds of volumes to as many as 80,000. Many other such libraries are known to exist in the 463 monasteries. The oldest of them, and the oldest library in Austria, is that of the monastery of St. Peter at Salzburg, which was established by St. Rupert in the 6th century. It possesses 60,000 volumes, with nearly 20,000 incunabula. The four next in point of antiquity are Kremsmünster (50,000), Lambach (22,000), Admont (80,000), and Melk (60,000), all of them dating from the 11th century. Of the 107 libraries enumerated in the report, 56 possessed 5000 volumes or upwards at the end of 1870. For further particulars as to the larger Austrian libraries the reader is referred to the tables.

The libraries in the Hungarian kingdom are not included in the report, and, as will be seen from the tables, are not very numerous. The most important of them are at Buda-Pest.

Switzerland. The public libraries of Switzerland have been very carefully registered by Dr. Ernest Heitz, as they existed in 1868. Altogether no less than 2096 libraries are recorded, four-fifths of these belong to the class of "bibliothèques populaires et celles pour la jeunesse," and few are of literary importance. Only eighteen have as many as 30,000 volumes. The largest collection of books in Switzerland is the University Library of Basel, founded with the university in 1460. The monastic libraries of St. Gall and Einsiedeln date respectively from the years 830 and 946, and are of great historical and literary interest.

ITALY.

Italy. As the former centre of civilization, Italy is of course the country in which the oldest existing libraries must be looked for, and in which the rarest and most valuable MSS. are preserved. The Vatican at Rome and the Laurentian Library at Florence are sufficient in themselves to entitle Italy to rank before most other states in that respect, and the venerable relics at Vercelli, Milan, and La Cava bear witness to the enlightenment of the peninsula in times when other nations were slowly taking their places in the circle of Christian polity. The local rights and interests which so long helped to impede the unification of Italy were useful in creating and preserving at numerous minor centres many libraries which otherwise would probably have been lost during the progress of absorption that results from such centralization as exists in England. In spite of long centuries of suffering and of the aggression of foreign swords and foreign gold, Italy is still rich in books and MSS.; there are probably more books in united Italy than in any other country except France. When the Italian Government published its valuable report on "Biblioteche" in the *Statistica del Regno d'Italia* in 1865, a table of relative statistics was given, which professed to show that, while the number of books in Austria (2,408,000) was greater than the total contents of the public libraries in any one of the countries of Great Britain, Prussia, Bavaria, or Russia, it was surpassed in France (4,389,000) and in Italy (4,149,281), the latter country thus exhibiting a greater proportion of books to inhabitants than any other state in Europe, except only Bavaria. The opulent libraries of Rome and Venice had not yet become Italian, and were not included in the report.[1]

Public libraries. The public libraries (*biblioteche governative*) are under the authority of the minister of public instruction, and are subject to certain regulations finally agreed upon during the ministry of Signor Ruggiero Bongi in 1876.[2] They are classed under the headings of (1) national libraries of Florence, Naples, Turin, Palermo, Vittorio Emanuele of Rome, the Brera of Milan, and the Marciana of Venice; (2) the libraries of the universities of the first class—Bologna, Naples, Padua, Pavia, Pisa, and Rome; (3) those of the universities of the second class—Cagliari, Catania, Genoa, Messina, Modena, Parma, and Sassari; (4) those of academies and institutions of fine arts; the last, although under Government control, are ruled by special regulations of their own. Small collections are sometimes handed over to the local authorities, should this be considered desirable, and the state will take into its own hands the administration of provincial or communal libraries if necessary. The librarians and subordinates are divided into (1) prefects, librarians, and sublibrarians; (2) assistant librarians; (3) attendants, or book distributors; (4) ushers, etc. Those of class 1 constitute the "board of direction," which is presided over by the prefect or librarian, and meets from time to time to consider important measures connected with the administration of the library. The candidates for posts in classes 1 and 2 must possess certain scholastic qualifications and serve for a specified time as *alunni* on probation. An important feature of the regulations consists of the scheme (unfortunately not yet in working order) which is eventually to supply Italy with a body of young librarians properly trained in all the theoretical and technical branches of their profession. Each library is to possess, alike for books and MSS., a general inventory or accessions-catalogue, an alphabetical author-catalogue, and a subject-catalogue. When they are ready, catalogues of the special collections are to be compiled, and these the Government intends to print, together with the subject-catalogues of the MSS. Various other small registers are provided for. The sums granted by the state for library purposes must be applied to (1) salaries and maintenance, (2) binding and repairs; (3) purchase of books, MSS., etc. Books are chosen by a committee nominated by the minister, which, in the national libraries, includes the members of the council of direction. In other libraries two members only of the council form part of the committee. In the university libraries two-fifths of the expenditure is decided by the committee, and the remainder by a council formed by the professors of the different faculties. The rules for lending books and MSS. allow them to be sent to other countries under very special circumstances.

The *biblioteche governative* are now 32 in number, and annually spend about 150,000 lire in books. From the three sources of gifts, copyright, and purchases, their accessions in 1879 were 35,541, being 5187 more than the previous year. The number of readers is now gradually increasing. In 1879 there were 895,749, who made use of 1,154,853 volumes, showing an increase of 10,393 readers and 130,051 books as contrasted with the statistics of the previous year.[3]

The minister of public instruction has kept a watchful eye upon the literary treasures of the suppressed monastic bodies. In 1875 there were 1700 of these confiscated libraries, containing two millions and a half of volumes. About 650 of the collections were added to the contents of the public libraries already in existence; the remaining 1050 were handed over to the different local authorities, and served to form 371 new communal libraries, and in 1876 the number of new libraries so composed was 415.

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[1] The *Statistica* describes 210 libraries, of which 164 were open to the public and 46 not accessible; 171 were general and 39 special libraries, the latter including 25 devoted to ascetic theology, 11 to science and literature, and 3 to the fine arts. Tuscany, Sicily, and Emilia were the richest in books, the latter province alone containing one quarter of the whole number.

[2] See the "Regulations of Italian Public Libraries," by Count Ugo Balzani, *Library Journal*, iv. pp. 183-87.

[3] Lists of foreign accessions to the *biblioteche governative* are published by the minister of public instruction from time to time. In 1877 E. Narducci made proposals for a general catalogue of their contents, and issued a specimen of *Boccaccio*.

Vatican. The Biblioteca Vaticana stands in the very first rank among European libraries as regards antiquity, since from the middle of the 5th century we have evidence of the existence of a pontifical library at Rome; and Pope Zachary (d. 752), himself a Greek, is known to have added considerably to the store of Greek codices. The Lateran Library shared in the removal of the papal court to Avignon, and it was on the return of the popes to Rome that the collection was permanently fixed at the Vatican. Nicholas V. (d. 1455) may, however, be considered the true founder of the library, and is said to have added 5000 MSS. to the original store. Calixtus III. also enriched the library with many volumes saved from the hands of the Turks after the siege of Constantinople. So large a proportion of the printed books of the 15th century having been produced by the Italian presses, it is natural to expect that a great number of specimens may be found in the papal library, and, but for the wholesale destruction of books and MSS. during the sack of Rome by the duke of Bourbon in 1527, the Vatican Library would have been as rich in early printed literature as it is now rich in manuscripts. Sixtus V. erected the present building in 1588, and considerably augmented the collection. Gregory XV. received as a gift from Maximilian, duke of Bavaria, the library of the elector Palatine seized by Tilly at the capture of Heidelberg in 1622. The greater part of the library at Urbino, founded by Duke Federigo, was acquired in 1655 by Alexander VII. for the sum of 10,000 scudi, and some of the famous palimpsests from the Benedictine monastery of Bobbio were also added to the treasures of the Vatican. After the death of Christina, queen of Sweden, her collection of books and manuscripts, formed from the plunder seized at Prague, Würtzburg, and Bremen by her father Gustavus Adolphus, became by succession the property of the Ottoboni family, the head of which, Alexander VIII., in 1689 placed 1900 of the MSS. in one of the galleries. Clement VII. and Pius II. also enriched the Vatican with valuable manuscripts, including many Oriental. In 1740 Benedict XIV. united with it the Ottoboniana, and in the same pontificate the Marchese Aless. Capponi bequeathed his precious collections. Clement XIII. in 1758, Clement XIV. in 1769, and Pius VI. in 1775 were also important benefactors. For over two hundred years the history of the Vatican was one of unbroken prosperity, but it suffered a serious blow at the close of the 18th century, when MSS. dating before the 9th century, and the most choice artistic specimens, altogether to the number of 500, were carried off by the French to Paris in 1798. The greater part were, however, restored in 1815, and most of the Palatine MSS., which formed part of the plunder, ultimately found their way to the university of Heidelberg in 1816. Pius VII. acquired for the Vatican the library of Cardinal Zelada in 1800; Leo XII. was able to add the noble collection of fine art literature of Count Cicognara in 1823; and Gregory XVI. also largely augmented the library. Pius IX. in 1856 added 40,000 volumes belonging to Cardinal Mai.

Few libraries are so magnificently housed as the Biblioteca Vaticana. The famous *Codici Vaticani* are placed in the *salone* or great double hall, which is decorated with frescos depicting ancient libraries and councils of the church. At the end of the great hall an immense gallery, also richly decorated, and extending to 1200 feet, opens out from right to left. Here are preserved in different rooms the codici Palatini, Regin., Ottoboniani, Capponiani, etc. Most of the printed books are contained in a series of six chambers known as the *Appartamento Borgia*. The printed books only are on open shelves, the MSS. being preserved in closed cases.

The present official estimate of the number of printed volumes is about 220,000, including 2500 15th century editions, of which many are vellum copies, 500 Aldines, and a great number of bibliographical rarities.[1] There are 25,600 MSS., of which 19,641 are Latin, 3613 Greek, 609 Hebrew, 900 Arabic, 460 Syriac, 78 Coptic, etc. Among the Greek and Latin MSS. are some of the most valuable in the world, alike for antiquity and intrinsic importance. It is sufficient to mention the famous Biblical *Codex Vaticanus* of the 4th century, the *Virgil* of the 4th or 5th century, the *Terence* equally ancient, the palimpsest *De Republica* of Cicero, conjectured to be of the 3d century, discovered by Cardinal Mai, and an immense number of richly ornamented codices of extraordinary beauty and costliness. The archives are apart from the library, and are quite inaccessible to the public; no catalogue is known to exist. Leo XIII. has appointed a committee to consider what documents of general interest may expediently be published, and a greater liberality in the use of them is said to be contemplated.

The Biblioteca Vaticana is now open from 8 to 12 every morning between November and June, with the exception of Sundays, Thursdays, and the principal feast days. Permission to study is obtained from the cardinal secretary of state. The want of proper catalogues for the use of readers is a great drawback. There are imperfect written lists (for the use of the librarians alone) of the printed books, and various catalogues of special classes of the MSS. have been published. New catalogues, however, are in course of preparation. The Oriental MSS. have been described by J. S. Assemanni, *Bibliotheca orientalis Clementino-Vaticana*, Rome, 1719–28, 4 vols. folio, and *Bibl. Vat. codd. MSS. catalogus ab S. E. et J. S. Assemanno redactus*, ib., 1756–59, 3 vols. folio, and by Cardinal Mai in *Script. Vet. nova collectio*. The Coptic MSS. have been specially treated by G. Zoega, Rome, 1810, folio; and by F. G. Bonjour, Rome, 1699, 4to. There are printed catalogues of the Capponi (1747) and the Cicognara (1820) libraries.

Other Roman libraries. Next in importance to the Vatican library is the Casanatense, so called from the name of its founder, Cardinal Casanata (1700). It contains about 130,000 volumes of printed books, including a large number of 15th century impressions and early editions with woodcuts, as well as about 2500 MSS., amongst which are one of the 7th century and several of the 8th, 9th, and 10th centuries. They are carefully arranged in eleven rooms, the large central hall being one of the finest in Rome. Books are not allowed to be taken out of the reading-rooms, but admission is freely granted, and the annual number of readers is about 18,000. The subvention is a small one, but additions continue to be made, and the library is well administered. All the officials, in accordance with the founder's will, belong to the Dominican order. The incomplete catalogue of the printed books, prepared by A. Audiffredi (Rome, 1761–88, 4 vols. folio), still remains a model of cataloguing.—The Biblioteca Vittorio Emanuele forms part of the Collegio Romano, and was made up from the old Jesuit library, enriched by accessions from a number of other suppressed institutions. It now consists of 360,000 volumes, with 5000 MSS., and is united to the Casanatense by a bridge. The entire edifice is spacious enough to contain a million of volumes, besides the Kircherian and other museums which are already located in it.[2]—The Biblioteca Angelica possesses all the authentic acts of the Congregatio de Auxiliis, and the precious collections of Cardinal Passionei and Lucas Holstenius.—The Biblioteca Alessandrina della R. Università di Roma, founded by Alexander VII., is considerably used by students: there were in 1879 57,000 readers. The greater part of the printed books formerly in the collection of the dukes of Urbino is now in this library.[3]—The Biblioteca del Senato is very rich in collections of municipal history and statutes of Italian cities. The printed catalogue (1878) describes no less than 1067 statutes or volumes containing them, relating to 443 localities.—The Biblioteca Vallicelliana was founded by S. Filippo Neri, and contains some valuable manuscripts, including a Latin Bible of the 8th century attributed to Alcuin, and some inedited writings of Baronius.—In 1877 Professor A. Sarti presented to the city of Rome his collection of fine-art books, 10,000 volumes, which was placed in charge of the Accademia di San Luca, which already possessed a good artistic library.—Of private libraries accessible by permission, we note the Biblioteca Barberina, including many rare editions with valuable autographs, but especially remarkable for its MSS.; these were chiefly collected by Cardinal Fr. Barberini, the nephew of Urban VIII., and comprehend the letters and papers of Galileo, Bembo, and Bellarmine, the reports on the state of Catholicism in England in the time of Charles I., and a quantity of inedited materials for the history of the Stuarts. A catalogue was published at Rome in 1681, 3 vols. folio.—The Corsiniana, founded by Clement XII. (Lorenzo Corsini), is also a private library; it is rich in incunabula, and includes one of the most remarkable collections of prints in Italy, the series of Marc-Antonios being especially complete.—The library of the Collegium de Propaganda Fide was established by Urban VIII. in 1626, and in 1687 the rector Andrea Bonvicini obtained permission to preserve in it prohibited books. It was destroyed by the French army in 1798, and owes its present richness almost entirely to testamentary gifts, among which may be mentioned those of Cardinals Borgia, Caleppi, and Pietro. It is a private collection for the use of the congregation and of those who belong to it, but permission may be obtained from the superiors. There are at least thirty libraries in Rome which are more or less accessible to the public. One is now in course of formation which will include everything relating to the emancipation of Italy.

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[1] The books have never been actually counted, and this estimate has been reduced by some persons to half the number.

[2] See *Collegio Romano, Discorso di Ruggiero Bonghi*, Rome, 1878.

[3] Signor E. Narducci produced a catalogue of the MSS. other than Oriental in 1877. The Casanatense, Vitt. Emanuele, Angelica, and Alessandrina are Governmental, and in 1878 the minister of public instruction published a catalogue of the Oriental MSS. in the three last. The Oriental MSS. of the other *biblioteche governative* will be treated in subsequent volumes.

Subiaco. At Subiaco, a few miles from Rome, the library of the Benedictine monastery of Santa Scolastica is not a very large one, comprising only 6000 printed volumes and 400 MSS., but the place is remarkable as having been the first seat of typography in Italy. It was in this monastery that Schweynheim and Pannartz, fresh from the dispersion of Fust and Schoeffer's workmen in 1462, established their press and produced a series of very rare and important works which are highly prized throughout Europe. The Subiaco Library, although open daily to readers, is only visited by students who are curious to behold the cradle of the press in Italy, and to inspect the series of original editions preserved in their first home.

National libraries. Florence. The great national libraries are as follows:—The Biblioteca Nazionale of Florence, formed from the union of Magliabechi's library with the Palatina, is the largest in Italy. The Magliabechi collection became public property at his death in 1714, and, with the accessions made from time to time, held an independent place until 1862, when the Biblioteca Palatina (formed in 1815 from the old Pitti Library and the collections of Poggiali and Rzewuzky) was incorporated with it. An old statute by which a copy of every work printed in Tuscany was to be presented to the Magliabechi Library was formerly much neglected, but has been maintained rigorously in force since 1860. There are many valuable autograph originals of famous works in this library, and the MSS. include the most important extant *codici* of Dante and later poets, as well as of the historians from Villani to Machiavelli and Guicciardini. Amongst the printed books is a very large assemblage of rare early impressions, a great number of the *Rappresentazioni* of the 16th century, at least 200 books printed on vellum, and a copious collection of municipal histories and statutes, of *testi di lingua*, and of geographical and topographical maps. The MS. portolani, 25 in number, are for the most part of great importance; the oldest is dated 1417, and several seem to be the original charts executed for Sir Robert Dudley (duke of Northumberland) in the preparation of his *Arcano del Mare*. The annual increment of books in this library is about 12,000. It is open freely to the public, and about 50,000 readers annually make use of it. About 60,000 printed volumes and 2500 MSS. are consulted annually, not including some 1500 books and 50 MSS., which are lent out yearly to certain students.—

Naples. The Biblioteca Nazionale at Naples, though only opened to the public in 1804, is the largest library of that city. The nucleus from which it developed was the collection of Cardinal Seripando, which comprised many MSS. and printed books of great value. Acquisitions came in from other sources, especially when in the year 1848 many private and conventual libraries were thrown on the Neapolitan market.[1] The Biblical section is rich in rarities, commencing with the Mainz Bible of 1462, printed on vellum. Other special features are the collection of *testi di lingua*, that of books on volcanoes and that of works printed at famous presses, particularly those executed by the typographers of Naples. The MSS. include a palimpsest containing writings of the 3d, 5th, and 6th centuries under a grammatical treatise of the 8th, 2 Latin papyri of the 6th century, over 50 Latin Bibles, and a great number of illuminated books with miniatures. There are more than 40 books printed on vellum in the 15th and 16th centuries, including a fine first Homer. There are several MS. maps and portolani, one of them dating from the end of the 14th century. About 10,000 readers use this library, consulting some 140,000 books yearly.—

Milan. The Biblioteca Nazionale of Milan, better known as the Brera, founded in 1770 by a decree of the empress Maria Theresa, consists of 163,123 printed volumes and 3646 MSS., with a yearly increment of about 6000 volumes, and the annual number of readers is said to amount to 45,000. It comprises nearly 2300 books printed in the 15th century (including the rare *Monte Santo di Dio* of Bettini, 1477), 913 Aldine impressions, and a xylographic *Biblia Pauperum*. Amongst the MSS. are an early Dante and autograph letters of Galileo, some poems in Tasso's autograph, and a fine series of illustrated service-books, with miniatures representing the advance of Italian art from the 12th to the 16th century. These were formerly in the Certosa at Pavia.—

Palermo. The Biblioteca Nazionale of Palermo, founded from the Collegio Massimo of the Jesuits, with additions from other libraries of that suppressed order, is rich in 15th century books, which have been elaborately described in a catalogue printed in 1875, and in Aldines and bibliographical curiosities of the 16th and following centuries.—

Turin. The Biblioteca Nazionale of Turin is extensively used by readers, whose annual number amounts to 120,000. The majority of the books are works for scientific study, but amongst them are several rarities, comprising a Sedulius MS. of the 5th century, the celebrated MS. of the *De Imitatione* (on which the assignment of its authorship to Gersen is founded,—see KEMPIS), and several productions of the earliest German and Italian printers.—

Venice. The Biblioteca Marciana, or library of St. Mark at Venice, was founded in 1362 by a donation of MSS. from the famous Petrarch (most of them now lost), and instituted as a library by Cardinal Bessarion in the 15th century. It is open daily, and is used by about 40,000 readers annually. The precious contents include Greek MSS. of great value, of which more than 1000 were given by Cardinal Bessarion, important MS. collections of works on Venetian history, rare incunabula, and a great number of volumes, unique or exceedingly rare, on the subject of early geographical research. Amongst the MSS. is a Latin Homer in the autograph of Boccaccio, an invaluable codex of the laws of the Lombards, and the autograph MS. of Sarpi's *History of the Council of Trent*. Since the fall of the republic and the suppression of the monasteries afterwards, a great many private and conventual libraries have been incorporated with the Marciana.

University libraries. Of the university libraries under Government control it is sufficient to notice the Biblioteca della Università at Bologna, founded in 1712 by Count Luigi F. Marsigli or Marsili. The MSS. comprise a rich Oriental collection of 547 MSS. in Arabic, 173 in Turkish, and several in Persian, Armenian, and Hebrew. Amongst the Latin codices is a Lactantius of the 6th or 7th century. The other noteworthy articles include a copy of the Armenian gospels (12th century), the Avicenna, with miniatures dated 1194, described in Montfaucon's *Diarium Italicum*, and some unpublished Greek texts. Amongst the Italian MSS. is a rich assemblage of municipal histories. Mezzofanti was for a long time the custodian here, and his own collection of books has been incorporated in the library, which is remarkable likewise for the number of early editions and Aldines which it contains. It possesses the Mainz Latin Bible dated 1462; the Lactantius and Augustine *De Civitate Dei* printed by Schweynheim and Pannartz, the Foligno Dante of 1472, and a copy of Henry VIII.'s *Assertio Sacramentorum* with the royal author's autograph. A collection of drawings by Agostino Caracci is another special feature of worth. The Manfredi palace, in which the library is arranged, is a fine building begun in 1714 and finished in 1744. The grand hall with its fine furniture in walnut wood merits particular attention. The library is open to the public; the yearly number of readers is about 25,000, and of books consulted 40,000.[1]

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[1] A pamphlet by the present chief librarian, Vito Fornari, Naples, 1874, gives many useful details, although he there overstates the number of MSS. as 10,000 (there may be some confusion between volumes and works).

Of the remaining Government libraries the following may be named.—**La Cava.** The Biblioteca del Monastero della S. Trinità, at La Cava dei Tirreni in the province of Salerno, is after the Biblioteca dell' Archivio Capitolare at Vercelli the most ancient library in the Italian kingdom, its foundation being said to be contemporaneous with that of the Benedictine abbey itself (beginning of the 11th century). It only contains some 10,000 volumes, but these include a number of MSS. of very great rarity and value, ranging from the 8th to the 14th century. Amongst these is the celebrated Codex Legum Longobardorum, dated 1004, besides a well-known geographical chart of the 12th century, over 100 Greek MSS., and about 1000 charters beginning with the year 840, more then 200 of which belong to the Lombard and Norman periods. At Florence the Marucelli Library, founded in 1752, is remarkable for its artistic wealth of early woodcuts and metal engravings. The number of these and of original drawings by the old masters amounts to 80,000 pieces.—**Modena.** At Modena is the famous Biblioteca Palatini, sometimes called the Biblioteca Estense from having been founded by the Este family at Ferrara in 1393; it was transferred to Modena by Cesare D'Este in 1598. Muratori, Zaccaria, and Tiraboschi were librarians here, and made good use of the treasures of the library. It is particularly rich in early printed literature and valuable codices.—The oldest library at Naples is the Biblioteca Brancacciana, with many valuable MSS. relating to the history of Naples. Two planispheres by Coronelli are preserved here. It was founded in 1673 by Cardinal F. M. Brancaccio.—**Parma.** The Regia Biblioteca di Parma, founded definitively in 1779, owes its origin to the grand-duke Philip, who employed the famous scholar Paciaudi to organize it. It is now a public library containing 213,995 volumes, including 4000 MSS., with an annual increment of nearly 1000 volumes. Amongst its treasures is De Rossi's magnificent collection of Biblical and rabbinical MSS.

Mediceo-Laurenziana. Chief among the great libraries not under Government control comes the world-famed Biblioteca Mediceo-Laurenziana at Florence, formed from the collections of Cosimo the Elder, Pietro de' Medici, and Lorenzo the Magnificent (which, however, passed away from the family after the expulsion of the Medici from Florence, and were repurchased by Cardinal Giovanni, afterwards Leo X.). It was first constituted as a public library in Florence by Clement VII., who charged Michelangelo to construct a suitable edifice for its reception. It was opened to the public by Cosimo I. in 1571, and has ever since gone on increasing in value, the accessions in the 18th century alone being enough to double its former importance. The printed books it contains are probably no more than 3000 in number, but are almost all of the highest rarity and interest. It is, however, the precious collection of MSS., amounting to about 7000 articles, which gives its chief importance to this library. They comprise some of the most valuable codices in the world—the famous Virgil of the 4th or 5th century, Justinian's *Pandects* of the 7th, a Homer of the 10th, and several other very early Greek and Latin classical and Biblical texts, as well as copies in the handwriting of Petrarch, about 100 codices of Dante, a *Decameron* copied by a contemporary from Boccaccio's own MS., and Cellini's MS. of his autobiography. Bandini's catalogue of the MSS. occupies 13 vols. folio, printed in 1764-78. At Genoa the Biblioteca Franzoniana, founded about 1770 for the instruction of the poorer classes, is noteworthy as being the first European library lighted up at night for the use of readers.—**Ambrosiana.** The famous Biblioteca Ambrosiana at Milan was founded in 1609 by Cardinal Fed. Borromeo. It contains 164,000 printed volumes and 8100 MSS. Amongst the MSS. are a Greek Pentateuch of the 5th century, the famous Peshito and Syro-Hexaplar from the Nitrian convent of St. Maria Deipara, a Josephus written on papyrus, supposed to be of the 5th century, several palimpsest texts, including an early Plautus, and St. Jerome's commentary on the Psalms in a volume of 7th century execution, full of contemporary glosses in Irish, Gothic fragments of Ulfilas, and a Virgil with notes in Petrarch's handwriting.[2] Noteworthy amongst the printed books is Valdarfer's Boccaccio of 1471, as well as the Virgil of 1470 (Venice), and the editio princeps of Isocrates, both printed on vellum. Cardinal Mai was formerly custodian here. In 1879 Professor C. Mensinger presented his "Biblioteca Europea," consisting of 2500 volumes, 300 maps, and 5000 pieces, all relating to the literature and linguistics of European countries.[3]—The Melzi and Trivulzio libraries should not pass without mention here, although they are private and inaccessible without special permission. The former is remarkable for its collection of early editions with engravings, including the Dante of 1481, with twenty designs by Baccio Bandinelli. The latter is rich in MSS. with miniatures of the finest and rarest kind, and in printed books of which many are unique or nearly so. It consists of 70,000 printed volumes.—**Monte Cassino.** The foundation of the monastery of Monte Cassino is due to St. Benedict, who arrived there in the year 529, and established the prototype of all similar institutions in western Europe. He brought with him a few manuscripts, four or five of which are still to be seen. The library of printed books now extends to about 20,000 volumes, chiefly relating to the theological sciences, but including some rare editions. A collection of the books belonging to the monks is in course of formation; it contains about the same number of volumes. But the chief glory of Monte Cassino consists of the *archivio*, which is quite apart; and this includes 30,000 or 40,000 bulls, diplomas, charters, and other documents, besides 1000 MSS. dating from the 6th century downwards. The latter comprehend some very early Bibles and important codices of patristic and other mediæval writings. There are good written catalogues, and a calendar is now being published, *Bibliotheca Casinensis*, of which 4 volumes have appeared. These libraries enjoy no special revenues, and owe their accessions entirely to donations.—At Ravenna the Biblioteca Classense has a 10th century codex of Aristophanes and two 14th century codices of Dante. Here are also the autograph correspondence of Muratori, and many unpublished letters of modern writers.—**Vercelli.** At Vercelli the Biblioteca dell' Archivio Capitolare, the foundation of which can be assigned to no certain date, but must be referred to the early days when the barbarous conquerors of Italy had become Christianized, comprises nothing but MSS., all of great antiquity and value. Amongst them is an Evangeliarium S. Eusebii in Latin, supposed to be of the 4th century; also the famous codex containing the Anglo-Saxon homilies which have been published by the Ælfric Society. The "Frari" at Venice contains an enormous collection of archives, the invaluable state paper records of the Venetian republic.

Not a few of the communal and municipal libraries, as will be seen from the tables, are of great extent and interest.

Belgium and Holland.

Brussels. The national library of Belgium is the Bibliothèque Royale at Brussels, of which the basis may be said to consist of the famous Bibliothèque des Ducs de Bourgogne, the library of the Austrian sovereigns of the Low Countries, which had gradually accumulated during three centuries.[4] After suffering many losses from thieves and fire, in 1772 the Bibliothèque de Bourgogne received considerable augmentations from the libraries of the suppressed order of Jesuits, and was thrown open to the public. On the occupation of Brussels by the French in 1794 a number of books and MSS. were confiscated and transferred to Paris (whence the majority were returned in 1815); in 1795 the remainder were formed into a public library under the care of La Serna Santander, who was also town librarian, and who was followed by Van Hulthem. At the end of the administration of Van Hulthem a large part of the precious collections of the Bollandists was acquired. In 1830 the Bibliothèque de Bourgogne was added to the state archives, and the whole made available for students. Van Hulthem died in 1832, leaving one of the most important private libraries in Europe, described by Voisin in *Bibliotheca Hulthemiana*, Brus., 1836, 5 vols., and extending to 60,000 printed volumes and 1016 MSS., mostly relating to Belgian history. The collection was purchased by the Government in 1837, and, having been added to the Bibliothèque de Bourgogne (open since 1772) and the Bibliothèque de la Ville (open since 1794), formed what has since been known as the Bibliothèque Royale de Belgique. The printed volumes now number 350,000, with 30,000 MSS., 100,000 prints, and 50,000 coins and medals. The yearly additions to the books amount to between 1500 and 3000; the other departments receive few accessions. The special collections, each with a printed catalogue, consist of the Fonds van Hulthem, for national history; the Fonds Fétis, for music; the Fonds Goethals, for genealogy; and the Fonds Müller, for physiology. The catalogue of the MSS. has been partly printed, but in an imperfect manner.

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[1] Notices of other libraries of this class will be found in the tables.

[2] Ceriani has published many of the unique treasures of this collection in his *Monumenta Sacra et Profana*.

[3] This, as well as the Brera library, is exhaustively described in *Gli Istituti scientifici, letterari, ed artistici di Milano*, published by the Società Storica Lombarda in 1880; a special treatise on the Brera was published in 1873 by the librarian G. Sacchi. See also Boscha, *De origine et statu Bibliothecæ Ambrosianæ*, 1672.

[4] A most interesting account of the history of this library may be read in the introduction to *Catalogue des MSS. de la bibliothèque royale des ducs de Bourgogne*, by M. Marchal, Brussels, 1842, 3 vols. 4to.

Ghent. The University Library of Ghent, known successively as the Bibliothèque de l'École Centrale and Bibliothèque Publique de la Ville, was founded upon the old libraries of the Conseil de Flandres, of the College des Échevins, and of many suppressed religious communities. It was declared public in 1797, and formally opened in 1798. On the foundation of the university in 1817 the town placed the collection at its disposal, and the library has since remained under state control. The printed volumes now amount to 250,000, with 1600 MSS.; the annual increment is about 2500 volumes. There are important special collections on archæology, Netherlands literature, national history, books printed in Flanders, and 23,000 historical pamphlets of the 16th and 17th centuries. There are printed catalogues of the works on jurisprudence (1839), and of the MSS. (1852).—**Louvain.** The Bibliothèque de l'Université Catholique of Louvain is based upon the collection of Beyerlinck, who bequeathed it to his alma mater in 1627; this example was followed by Jacques Romain, professor of medicine, but the proper organization of the library commenced in 1636. There are now said to be 250,000 volumes.—**Liége.** The Bibliothèque de l'Université of Liége dates from 1817, when on the foundation of the university the old Bibliothèque de la Ville was added to it. There are now 105,746 printed volumes, 87,254 pamphlets, 1544 MSS., and 142 incunabula. The Liége collection (of which a printed catalogue appeared in 3 vols. 8vo, 1872), bequeathed by M. Ulysse Capitaine, extends to 12,061 volumes and pamphlets. A printed catalogue of the medical books was published in 1844, and one of the MSS. in 1875.

The Hague. The national library of Holland is the Koninklijke Bibliotheek at the Hague, which was established in 1798, when it was decided to join the library of the princes of Orange with those of the defunct Government bodies in order to form a library for the States General, to be called the National Bibliotheek. In 1805 the present name was adopted; and since 1815 it has became the national library. In 1848 the Baron W. Y. H. van Westreenen van Tiellandt bequeathed his valuable books, MSS., coins, and antiquities to the country, and directed that they should be preserved in his former residence as a branch of the royal library. There are now upwards of 200,000 volumes of printed books, with an annual increment of 4000 volumes. The MSS. number 4000, chiefly historical, but including many fine books of hours with miniatures. Books are lent all over the country. Some twenty-five years ago it was decided for economical reasons to restrict the purchases to political, historical, and legal works, but recently, in consequence of an increase in the yearly subsidy, literature has been added to these three classes. The library boasts of the richest collection in the world of books on chess, Dutch incunabula, Elzevirs, and Spinozana. There is one general written catalogue arranged in classes, with alphabetical indexes. In 1800 a printed catalogue was issued, with four supplements down to 1811; and since 1866 a yearly list of additions has been published. Special mention should be made of the excellent catalogue of the incunabula published in 1856.

Leyden. The next library in numerical importance is the famous Bibliotheca Academiæ Lugduno-Batavæ, which dates from the foundation of the university of Leyden by William I., prince of Orange, on February 8, 1575. It has acquired many valuable additions from the books and MSS. of the distinguished scholars, Golius, Joseph Scaliger, Isaac Voss, Ruhnken, and Hemsterhuis. The MSS. comprehend many of great intrinsic importance; the Oriental codices number 2400. The library of the Society of Netherland Literature has been placed here since 1877; this is rich in the national history and literature. The Arabic and Oriental MSS. known as the Legatum Warnerianum are of great value and interest; and the collection of maps bequeathed in 1870 by J. J. Bodel Nyenhuis is also noteworthy. The library is contained in a building which was formerly a church of the Béguines, adapted in 1860 somewhat after the style of the British Museum. The catalogues (one alphabetical and one classified) are on slips, the titles being printed. A catalogue of books and MSS. was printed in 1716, one of books added between 1814 and 1847 in 1848, and a supplementary part of MSS. only in 1850. A catalogue of the Oriental MSS. was published in 6 vols., 1851–77.

Utrecht. The University Library at Utrecht dates from 1582, when certain conventual collections were brought together in order to form a public library, which was shortly afterwards enriched by the books bequeathed by Hub. Buchelius and Ev. Pollio. Upon the foundation of the university in 1636, the town library passed into its charge. Among the MSS. are some interesting cloister MSS. and the famous "Utrecht Psalter," which contains the oldest text of the Athanasian creed. The last edition of the catalogue was in 2 vols. folio, 1834, with supplement in 1845, index from 1845–55 in 8vo, and additions 1856–70, 2 vols. 8vo. The titles of accessions are now printed in sheets and pasted down for insertion.

Amsterdam. The basis of the University Library at Amsterdam consists of a collection of books brought together in the 15th century and preserved in the Nieuwe Kerk. At the time of the Reformation in 1578 they became the property of the city, but remained in the Nieuwe Kerk for the use of the public till 1632, when they were transferred to the Athenæum. Since 1877 the collection has been known as the University Library, and in 1881 it was removed to a building designed upon the plan of the new library and reading-room of the British Museum. The library includes the best collection of medical works in Holland, and the Bibliotheca Rosenthaliana of Hebrew and Talmudic literature is of great fame and value; a catalogue of the last was printed in 1875. The libraries of the Dutch Geographical and other societies are preserved here. A general printed catalogue was issued in 6 vols. 8vo, Amsterdam, 1856–77; one describing the bequests of J. de Bosch Kemper, E. J. Potgieter, and F. W. Rive, in 3 vols. 8vo, 1878–79; a catalogue of the MSS. of Professor Moll was published in 1880, and one of those of P. Camper in 1881.

Denmark, Norway, and Sweden.

Copenhagen. The commencement of the admirably managed national library of Denmark, the great Royal Library at Copenhagen, may be said to have taken place during the reign of Christian III. (1533–59) who took pride in importing foreign books and choice MSS.; but the true founder was Frederick III. (1648–70); to him is mainly due the famous collection of Icelandic literature and the acquisition of Tycho Brahe's MSS. The present building (in the Christiansborg Castle) was commenced in 1667. Among notable accessions may be mentioned the collections of C. Reitzer, the count of Danneskjöld (8000 volumes and 500 MSS.), and Count de Thott; the last bequeathed 6039 volumes printed before 1531, and the remainder of his books, over 100,000 volumes, were eventually purchased. In 1793 the library was opened to the public, and it has since remained under state control. Two copies of every book published within the kingdom must be deposited here. The incunabula and block books form an important series. There is a general classified catalogue in writing in 295 folio volumes for the use of readers; and an alphabetical one on slips arranged in boxes for the officials. A good catalogue of the De Thott collection was printed in 12 vols. 8vo, 1789–95; a catalogue of the French MSS. appeared in 1844; of Oriental MSS., 1846; of the Danish collection, 1875, 8vo. Annual reports and accounts of notable MSS. have been published since 1864. There were 7000 additions in 1880.

The University Library, founded in 1482, was destroyed by fire in 1728, and re-established shortly afterwards. A copy of every Danish publication must be deposited here. The MSS. include the famous Arne-Magnean collection (see vol. xii. p. 663).

Christiania. The chief library in Norway is the University Library at Christiania, established at the same time as the university, September 2, 1811, by Frederick VI., with a donation from the king of many thousands of duplicates from the Royal Library at Copenhagen, and since augmented by important bequests.

Stockholm. The Royal Library at Stockholm was first established in 1585. The original collection was given to the university of Upsala by Gustavus II., that formed by Christina is at the Vatican, and the library brought together by Charles X. was destroyed by fire in 1697. The present library was organized shortly afterwards. The Benzelstjerna-Engeström Library (14,500 printed volumes and 1200 MSS., rich in materials for Swedish history) is now annexed to it. Natural history, medicine, and mathematics are left to other libraries. Among the MSS. the *Codex Aureus* of the 6th or 7th century, with its interesting Anglo-Saxon inscription, is particularly noteworthy. The catalogues are in writing, and are both alphabetical and classified; printed catalogues have been issued of portions of the MSS. The present building was opened in 1882.

Upsala. The University Library at Upsala was founded by Gustavus Adolphus in 1620, from the remains of several convent libraries; he also provided an endowment. The MSS. chiefly relate to the history of the country, but include the *Codex Argenteus*, containing the Gothic gospels of Ulfilas. The general catalogue is in writing. A catalogue was printed in 1814; special lists of the foreign accessions have been published each year from 1850; the Arabic, Persian, and Turkish MSS. are described by C. J. Tonberg, 1846. The library at Lund dates from the foundation of the university in 1668, and was based upon the old cathedral library. The MSS. include the De la Gardie archives, acquired in 1848.

Spain and Portugal.

Madrid. The chief library in Spain is the Biblioteca Nacional (formerly the Biblioteca Real) at Madrid. The printed volumes number 400,000 volumes, with 200,000 pamphlets; the accessions in 1880 amounted to 25,840 articles. Spanish literature is of course well represented, and, in consequence of the numerous accessions from the libraries of the suppressed convents, the classes of theology, canon law, history, etc., are particularly complete. The number of bibliographical rarities was largely increased by the incorporation of the valuable collection formed by the well-known bibliographer Don Luis de Usoz. There are 30,000 MSS., contained in 10,000 volumes and bundles; they include some finely illuminated codices, historical documents, and many valuable autographs. The collection of prints extends to 120,000 pieces, and was principally formed from the important series bought from Don Valentin Carderera in 1865. In 1880 54,875 books were issued to 51,966 readers. The annual revenue is only £1600. The printed books have one catalogue arranged under authors' names, and one under titles; the departments of music, maps and charts, and prints have subject-catalogues as well. There is a general index of the MSS., with special catalogues of the Greek and Latin codices and genealogical documents. The first (and only) volume of a printed catalogue of the Greek MSS. appeared in 1769. The cabinet of medals is most valuable and well arranged. Of the other Madrid libraries (see the tables) it is enough to mention the Biblioteca de la Academia de la Historia (20,000 volumes and 1500 MSS.), which contains some printed and MS. Spanish books of great value, including the well-known Salazar collection.—**Escorial.** The history of the library of the ESCORIAL has been given in vol. viii. p. 477. In 1808, before the invasion, the Escorial is estimated to have contained 30,000 printed volumes and 3400 MSS.; Joseph removed the collection to Madrid, but when it was returned by Ferdinand 10,000 volumes were missing. There are now 32,142 printed volumes, with 583 Greek, 1905 Arabic, 73 Hebrew, and 2050 Latin MSS. The Arabic MSS. have been described by M. Casiri, 1760–70; and a catalogue of the Greek codices by Müller was issued at the expense of the French Government in 1848. There is an imperfect written catalogue of the printed books, and the present librarian is now engaged upon a catalogue of the Latin MSS. Permission to study at the Escorial, which is one of the royal private libraries, must be obtained by special application.[1]

Lisbon. Among the libraries of Portugal the Bibliotheca Nacional at Lisbon naturally takes the first place. In 1841 it was largely increased from the monastic collections, which, however, seem to have been little cared for, according to a report prepared by the principal librarian three years later. There are now said to be 200,000 volumes of printed books, among which theology, canon law, history, and Portuguese and Spanish literature largely predominate. The MSS. number 9415, including many of great value. There is also a cabinet of 40,000 coins and medals.—The Bibliotheca da Academia, founded in 1780, is preserved in the suppressed convent of the Ordem Terceira da Penitencia. In 1836 the Academy acquired the library of that convent, numbering 30,000 volumes, which have since been kept apart. The Archivo Nacional, in the same building, contains the archives of the kingdom, brought here after the destruction of the Torre do Castello during the great earthquake.

Oporto. The Bibliotheca Publica Municipal at Oporto is the second largest in Portugal, although only dating from July 9, 1833, the anniversary of the debarkation of D. Pedro, and when the memorable siege was still in progress; from that date to 1874 it was styled the Real Bibliotheca do Porto. The regent (ex-emperor of Brazil) gave to the town the libraries of the suppressed convents in the northern provinces, the municipality undertaking to defray the expense of keeping up the collection, but only £180 is yearly spent on books and bindings, and £380 on salaries. Recent accessions consist mainly of Portuguese and French books. The important Camoens collection is described in a printed catalogue, Oporto, 1880. A notice of the MSS. may be found in *Catalogo dos MSS. da B. Publica Eborense*, by H. da Cunha Rivara, Lisbon, 1850–70, 3 vols. folio, and the first part of an *Indice preparatorio do Catalogo dos Manuscriptos* was produced in 1880.

Russia.

St. Petersburg. The Imperial Public Library at St. Petersburg is the third largest library in the world, and now claims to possess 1,000,000 printed volumes. The commencement of this magnificent collection may be said to have been the books seized by the Czar Peter during his invasion of Courland in 1714; the library did not receive any notable augmentation, however, till the year 1795, when, by the acquisition of the famous Zaluski collection, the Imperial Library suddenly attained a place in the first rank among great European libraries. The Zaluski Library was formed by the Polish count Joseph Zaluski, who collected at his own expense during forty-three years no less than 200,000 volumes, which were added to by his brother Andrew, bishop of Cracow, by whom in 1747 the library was thrown open to the public. At his death it was left under the control of the Jesuit College at Warsaw; on the suppression of the order it was taken care of by the Commission of Education; and finally in 1795 it was transferred by Suwaroff to St. Petersburg as a trophy of war. It then extended to 260,000 printed volumes and 10,000 MSS., but in consequence of the withdrawal of many medical and illustrated works to enrich other institutions, hardly 238,000 volumes remained in 1810. Literature, history, and theology formed the main features of the Zaluski Library; the last class alone amounted to one-fourth of the whole number. Since the commencement of this century, through the liberality of the sovereigns, the gifts of individuals, careful purchases, and the application of the law of 1810, whereby two copies of every Russian publication must be deposited here, the Imperial Library has attained its present extensive dimensions. Nearly one hundred different collections, some of them very valuable and extensive, have been added from time to time. They include, for example, the Tolstoi Sclavonic collection (1830), Tischendorf's MSS. (1858), the Dolgorousky Oriental MSS. (1859), and the Firkowitsch Hebrew (Karaite) collection (1862–63), the libraries of Adelung (1858) and Tobler (1877), that of the Slavonic scholar Jungmann (1856), and the national MSS. of Karamzin (1867). This system of acquiring books, while it has made some departments exceedingly rich, has left others comparatively meagre. The library was not regularly opened to the public until 1814; it is under the control of the minister of public instruction. In the printed book department the yearly average of readers is now 107,000, and of books consulted 285,300. The annual grant from the treasury is 79,174 silver roubles; an income of 3438 roubles is derived from other sources. The official estimate of the number of printed books is 1,000,000 volumes, with 19,059 maps and 75,000 prints and photographs. The yearly accessions amount to about 28,000. The Russian books number 100,000 and the Russica 30,000 volumes; the Aldines and Elzevirs form a nearly perfect collection; and the incunabula are numerous and very instructively arranged.

The manuscripts include 26,000 codices, 41,340 autographs, 4689 charters, and 576 maps. The glory of this department is the celebrated *Codex Sinaiticus* of the Greek Bible, brought from the convent of St. Catherine on Mount Sinai by Tischendorf in 1859. Other important Biblical and patristic codices are to be found among the Greek and Latin MSS.; the Hebrew MSS. include some of the most ancient that exist, and the Samaritan collection is one of the largest in Europe; the Oriental MSS. comprehend many valuable texts, and among the French are some of great historical value.

The general catalogues are in writing, but the following special catalogues of the printed books have been published:—the Tolstoi collection of early printed Russian books, 1829; the Aldines, 1854; the Elzevirs, 1862, and another in 1864, by C. F. Walther; editions printed during the reign of Peter the Great, by Bytschkoff, 1867; the foreign books relating to Peter the Great by P. Minsloff, 1872; and the Russica, 2 vols., 1873. Lists of the foreign books have been issued since 1863, and the *Comptes Rendus* published since 1850 contain notices of the most important acquisitions.

The following catalogues of the MSS. are in print:—the Tolstoi Slavonic collection, 1825; Dorn's catalogue of the Oriental MSS., 1852; old German, 1853; the Greek, by Muralt, 1864; the Khanikoff Oriental codices, by Dorn, 1865; Russian MSS. on the history of Peter the Great, by Bytschkoff, 1872; the French. 1874; Samaritan, 1875;

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[1] Gachard, *Les bibliothèques de Madrid et de l'Escorial; notices et extraits des MSS. qui concernent l'histoire de Belgique*, Brussels, 1875, 4to; Ch. Graux, *Essai sur les origines du fonds grec de l'Escurial.*

Hebrew Biblical, 1875; Slavonic and Russian miscellaneous, parts 1 and 2, 1878–80.

The nucleus of the library at the Hermitage Palace was formed by the empress Catherine II., who purchased the books and MSS. of Voltaire and Diderot. In the year 1861 the collection amounted to 150,000 volumes, of which nearly all not relating to the history of art were then transferred to the Imperial Library.

Moscow. The second largest library in Russia is contained in the public museum at Moscow. The class of history is particularly rich, and Russian early printed books are well represented. The MSS. number 5000, including many ancient Sclavonic codices and historical documents of value. One room is devoted to a collection of Masonic MSS., which comprehend the archives of the lodges in Russia between 1816 and 1821. There is a general alphabetical catalogue in writing; the catalogue of the MSS. has been printed, as well as those of some of the special collections.

For other Russian libraries see the tables.

India, China, and Japan.

India. Of Indian libraries it is sufficient to notice those that have importance for Oriental letters. At Calcutta the Sanskrit college has 1652 printed Sanskrit volumes and 2769 Sanskrit MSS., some as old as the 14th century; there is also a large collection of Jain MSS. A catalogue is now being prepared for publication.—The Arabic library attached to the Arabic department of the Madrasa was founded about 1781, and now includes 731 printed volumes, 143 original MSS. and 151 copies; the English library of the Anglo-Persian department dates from 1854, and extends to 3254 volumes.—The library of the Asiatic Society of Bengal was founded in 1784, and now contains 15,000 printed volumes, chiefly on Eastern and philological subjects, with a valuable collection of 9500 Arabic and Persian MSS. A catalogue is now passing through the press.

At Bombay the library of the Bombay branch of the Royal Asiatic Society, established in 1804 as the Literary Society of Bengal, is now an excellent general and Oriental collection of 40,000 printed volumes and 200 MSS., described in a printed catalogue of 1875. The Moolla Feroze Library was bequeathed for public use by Moolla Feroze, head priest of the Parsís of the Kudmí sect in 1831, and consisted chiefly of MSS. in Arabic and Persian on history, philosophy, and astronomy; some additions of English and Gujaratí works have been made, as well as of European books on Zoroastrianism. A catalogue has been printed.

The library of Tippoo Sahib, consisting of 2000 MSS., fell into the hands of the British, and a descriptive catalogue of them by Charles Stewart was published at Cambridge, in 1809, 4to. A few were presented to public libraries in England, but the majority were placed in the college of Fort William, then recently established. The first volume, containing Persian and Hindustaní poetry, of the *Catalogue of the Libraries of the King of Oudh*, by A. Sprenger, was published at Calcutta in 1854. The compiler shortly afterwards left the Indian service, and no measures were taken to complete the work. On the annexation of the kingdom in 1856 the ex-king is believed to have taken some of the most valuable MSS. to Calcutta, but the largest portion were left behind at Lucknow. During the siege the books were used to block up windows, etc., and those which were not destroyed were abandoned, and plundered by the soldiers. Many were burnt for fuel; a few, however, were rescued and sold by auction, and of these some were purchased for the Asiatic Society of Bengal.

Perhaps the most remarkable library in India is that of the rájá of Tanjore, which dates from the end of the 16th or beginning of the 17th century, when Tanjore was under the rule of the Telugu Náiks, who collected Sanskrit MSS. written in the Telugu character. In the 18th century the Marhattas conquered the country, and since that date the library increased but slowly. By far the greater portion of the store was acquired by Sharabhojí Rájá during a visit to Benares in 1820–30; his successor Sivají added a few, but of inferior value. There are now about 18,000 MSS. written in Devanágarí, Nandinágarí, Telugu, Kanada, Granthí, Malayálam, Bengalí, Panjábí or Kashmirí, and Uriya; 8000 are on palm leaves. Dr. Burnell's printed catalogue describes 12,375 articles.

Thanks to the enlightened policy of the Government of India, we are beginning to know much more respecting native libraries than was possible a few years ago, and since 1868 a yearly sum of 24,000 rupees has been granted to carry on the work of searching for Sanskrit MSS. The first part of a list of those in private hands in southern India has been published by Dr. G. Oppert; it contains a description of 8376 MSS., and another volume is in course of preparation. Dr. Bühler, in his investigation of Santinah's library at Cambay, found 300 MSS. of great antiquity, six dating from the beginning of the 12th century. A pandit has examined the Samghavina Pada Library in Pathan, and a catalogue has been prepared for printing. A copy of the oldest Sanskrit dictionary, the *Sasvata Kosha*, of which only one other copy (at the Bodleian) is known, was found here. Dr. Bühler also purchased 429 volumes for the Government. Inquiries made in Behar have not met with much result. Notices of Sanskrit MSS. in the presidency of Bengal have been prepared under the direction of Dr. Rajendralala Mitra; seven fasciculi (1000 pp.) have been printed, describing 842 articles. The same scholar has also printed a catalogue (755 pp.) of the library of the maharaja of Bikanir, describing 2000 Sanskrit MSS., and his analysis of the Sanskrit Buddhist literature of Nepal will shortly be published. The total number of Sanskrit MSS. acquired in this presidency is now 1612, some of which are new to Europeans. Two catalogues of 180 Sanskrit MSS. discovered in the North-Western provinces and Oudh during 1878–80 have been prepared, and the following libraries (containing many important texts) of the Punjab have been examined:—that of Pandit Rikhikesha, of 500 books; Pandit Jwala Datta Prasada, 2500 MSS., the largest collection in the province; and Pandit Dilaram, 430 MSS. The efforts of Dr. Forchhammer will probably bring to light many valuable Sanskrit MSS., both in Upper and Lower Burmah.

Singapore. The Raffles Library at Singapore was established as a proprietary institution in 1844, taken over by the government in 1874, and given legal status by an ordinance passed in 1878. It now contains 11,000 volumes in general literature, but books relating to the Malayan peninsula and archipelago have been made a special feature, and since the acquisition of the collection of J. R. Logan in 1879 the library has become remarkably rich in this department.

Batavia. The library of the Genootschap van Kunsten en Wetenschappen at Batavia contains books printed in Netherlandish India, works relating to the Indian Archipelago and adjacent countries, and the history of the Dutch in the East. There are now 20,000 printed volumes and 1630 MSS., of which 243 are Arabic, 445 Malay, 303 Javanese, 60 Batak, and 517 on lontar leaves in the ancient Kawi, Javanese, and Bali language, etc. The last edition of the catalogue appeared in 1877; printed catalogues of the Arabic, Malay, Javanese, and Kawi MSS. have also been issued.

China. *China.*—The Great Imperial Library was founded by K'in Lung, 18th century, and from a catalogue which has been issued appears to have contained about 12,000 works, extending to 168,000 volumes. There are many provincial libraries in China, and the chief Buddhist monasteries also possess collections of books.

Japan. *Japan.*—The library of the Tokio Fu (municipality of Tokio) at Leido, in the old Chinese university, contains 63,000 Chinese and Japanese volumes, and 5000 European, principally English and Dutch. The reading-room is supplied with native daily papers, and the chief foreign periodicals. The library is open for purposes of reference, and books may be borrowed by special permission. The Asakusa Library, now occupying the former fireproof rice storehouses of the shogun, is one of the oldest in the country, and is reported to contain 143,000 volumes, including many ancient books and MSS.; an entrance fee of about ½d. is charged here. The Imperial University has a good collection of European and Japanese science and general literature. The libraries of the large temples often contain rare books of value to the philologist, and many of the leading towns throughout the country are provided with free libraries. Lending libraries of native and Chinese literature have existed in Japan from very early times.

British Colonies.

Of such libraries as may be found in the British colonies there are very few that call for particular mention here.

Canada. The largest collection of books in Canada is the library of parliament at Ottawa. Though founded in 1815, it contained very few books until 1841, when the two libraries of Upper and Lower Canada were joined. After being destroyed by fire, the library was re-established in 1855, chiefly for parliamentary use. It now contains 100,000 volumes, and is open to the public except when parliament is sitting. Books are lent out. The main library is a handsome octagonal apartment with beautiful carved work in Canadian white wood.

Cape-town. In the South African Public Library at Cape-town, which was established in 1818, there are 39,000 volumes, including the collection bequeathed by Sir George Grey, comprising, besides MSS. and early printed books, an unrivalled collection of works in the native languages of Africa, Australia, etc. The library is open to any respectable person.

Australia. The largest library in the Australian colonies is the Public Library of Victoria at Melbourne, which was established in 1853. In 1881 it numbered 89,387 volumes with 22,257 pamphlets; it possesses a collection of works on Australasia. The library has a printed catalogue (1880). It is supported by an annual parliamentary vote, which amounted last year to £5495. Readers are admitted without any formality, and have free access to the shelves. Although books are not lent out of the library individually, there is a system by which parcels of from 100 to 400 books are lent to libraries, mechanics' institutes, etc., in the inland towns of Victoria. There are several other not inconsiderable libraries in Melbourne. Next in importance to the Melbourne Library is the Sydney Free Public Library, which is said to contain the largest collection of works on Australasia anywhere to be found. It has a lending as well as a reference department, and is much used.

Particulars of other colonial libraries will be found in the tables.

United States.

United States. The libraries of the United States, as we should expect to find in a country where intelligence and education are so widely diffused, are exceedingly numerous. A great mass of information with regard to them has been published by the Bureau of Education, particularly in the comprehensive *Special Report on Public Libraries* issued in 1876. From this report, and the annual reports of the commissioners of education which have since appeared, we learn that the number of public libraries already registered is 3842, with upwards of 12,569,450 volumes. It is of course true that the great majority of these libraries are not numerically important. On the other hand, many of them are very rapidly growing, and their very youth implies that their shelves are not burdened with much obsolete literature. The recent development of American libraries is indeed very striking. Of the libraries reported in 1875, about 64 appear to have been established before 1800, and 30 of these between 1775 and 1800. Between 1800 and 1825 there were established 179 libraries, between 1825 and 1850 as as many as 551, and finally between 1850 and 1875 no less than 2240, which in the latter year contained as many as 5,481,068 volumes. It will be convenient to deal with these libraries in groups according to the historical order of their development. The earliest libraries formed were in connection with educational institutions, and the oldest is that of Harvard **Harvard.** (1638). It was destroyed by fire in 1764, but active steps were at once taken for its restoration. From that time to the present, private donations have been the great resource of the library. In 1840 the collection was removed to Gore Hall, which was erected for the purpose with a noble bequest from Christopher Gore, formerly governor of Massachusetts. There are also nine special libraries connected with the different departments of the university. The total number of volumes in all these collections is 259,000, exclusive of over 200,000 pamphlets. The annual increase is about 7000 volumes, and the library has an endowment fund of over $200,000. There is a MS. card-catalogue in two parts, by authors and subjects, which is accessible to the readers. The only condition of admission to use the books in Gore Hall is respectability; but only members of the university and privileged persons may borrow books. **Yale.** The library of Yale College, New Haven, was founded in 1700, but grew so slowly that, even with the 1000 volumes received from Bishop Berkeley in 1733, it had only increased to 4000 volumes in 1766, and some of these were lost in the revolutionary war. During the present century the collection has grown more speedily, and now the main library numbers 102,000 volumes, while the special libraries in the control of the college bring up the total to 143,000 volumes. The yearly increase is about 4500 volumes, and the library has a book fund of $100,000. Amongst the other important university libraries are those of the college of New Jersey (Princeton), Dartmouth College (Hanover), Amherst College, Cornell University, and Brown University (Providence, R. I.). In 1875 the number of college libraries (not reckoning academy and school libraries) was 312, besides 299 libraries belonging to college students' societies.

Proprietary libraries. The establishment of proprietary or subscription libraries runs back into the first half of the 18th century, and is connected with the name of Benjamin Franklin. It was at Philadelphia, in the year 1731, that he set on foot what he calls "his first project of a public nature, that for a subscription library. . . . The institution soon manifested its ability, and was imitated by other towns and in other provinces." The Library Company of Philadelphia was soon regularly incorporated, and gradually drew to itself other collections of books, including the Loganian Library, which was vested in the company by the State legislature in 1792 in trust for public use. Hence the collection combines the character of a public and of a proprietary library, being freely opened for reference purposes, while the books circulate only among the subscribing members. It numbers at present 123,000 volumes, of which 11,000 belong to the Loganian Library, and may be freely lent. The printed classed catalogue of the library has been praised by Brunet and Allibone. In 1869 Dr. James Rush left a bequest of over one million dollars for the purpose of erecting a building to be called the Ridgway branch of the library. The building is very handsome, and has been very highly spoken of as a library structure. Philadelphia has another large proprietary library—that of the Mercantile Library Company, which was established in 1821. It possesses 143,135 volumes, and its members have always enjoyed direct access to the shelves. The library of the Boston Athenæum was established in 1807, and numbers 122,000 volumes. It has recently published an admirable dictionary-catalogue. The collection is especially rich in art and in history, and possesses a part of the library of Washington. The Mercantile Library Association of New York, which was founded in 1810, has the largest of all the subscription libraries, counting over 193,000 volumes. New York possesses two other large proprietary libraries, one of which claims to have been formed as early as 1700 as the "public" library of New York. It was organized as the New York Society Library in 1754, and has been especially the library of the old Knickerbocker families and their descendants, its contents bearing witness to its history. It contains about 80,000 volumes. The Apprentices' Library has about 63,000 volumes, and makes a special feature of works on trades and useful arts. It is maintained by the General Society of Mechanics and Tradesmen. Finally, the Brooklyn Library deserves mention, if only for its very useful and admirable catalogue, the printing of which was completed in December, 1880, and which embraces 60,000 volumes.

State libraries. Although the State libraries of Pennsylvania and New Hampshire are known to have been established as early as 1777, it was not until some time after the revolution that any general tendency was shown to form official libraries in connection with the State system. It is especially within the last thirty years that the number of these libraries has so increased that now every State and Territory possesses a collection of books and documents for official and public purposes. These collections depend for their increase upon annual appropriations by the several States, and upon a systematic exchange of the official publications of the general Government and of the several States and Territories. The largest is that of the State of New York at Albany, which contains 116,000 volumes, and is composed of a general and a law library, of which a printed catalogue has been published with full subject-indexes. The State libraries are libraries of reference, and only members of the official classes are allowed to borrow books, although any well-behaved person is admitted to read in the libraries.

In addition to the libraries maintained by the several States, there are the collections belonging to the general Government, most of which are at Washington. The most important of them is of course the Library of Congress, but there are also considerable libraries attached to the house of representatives, the senate, the department of state, the patent office, and the office of the surgeon-general.

Library of Congress. The Library of Congress was first established in 1800 at Washington, and was burned together with the Capitol by the British army in 1814. President Jefferson's books were purchased to form the foundation of a new library, which continued to increase slowly until 1851, when all but 20,000 volumes were destroyed by fire. From this time the collection has grown rapidly, and now consists of 396,000 volumes with 130,000 pamphlets. In 1866 the library of the Smithsonian Institution, consisting of 40,000 volumes, chiefly in natural science, was transferred to the library of congress. The library is specially well provided in history, jurisprudence, the political sciences, and Americana. Since 1832 the law collections have been constituted into a special department. This is the national library. In 1870 the registry of copyrights was transferred to it under the charge of the librarian of congress. As two copies of every publication which claims copyright are required to be deposited in the library, the receipts under this head are nearly 25,000 articles per annum. The sum annually appropriated by congress for the management and increase of the library is $52,840. The present accommodation is inadequate, and a separate building is to be erected of size to contain two million volumes. There is an alphabetical card-catalogue kept constantly up to date, and a printed catalogue of subject-matters. The library is open every day in the year, except on four legal holidays, from 9 A. M. to 4 P. M., and admission is granted to all persons over sixteen years of age without formality or introduction, but books are only lent to members of the official classes.

Since the organization of the government in 1789, no less than one hundred and sixty historical societies have been formed in the United States, most of which still continue to exist. Many of them have formed considerable libraries, and possess extensive and valuable manuscript collections. The oldest of them is the Massachusetts Historical Society, which dates from 1791.

The earliest of the scientific societies owes its origin to Franklin, and dates from 1743. The most extensive collection is that of the Academy of Natural Sciences of Philadelphia, which consists of 35,000 volumes and 40,000 pamphlets. For information as to the numerous professional libraries of the United States—theological, legal, and medical—the reader may be referred to the report already mentioned.

Town libraries. Of all of the libraries of the United States none have achieved a greater fame, and none are more zealously and admirably conducted, than those which are supported from the public funds of some of the great cities. Legislation on the subject of free public libraries was almost synchronous in England and America. Of the free town libraries of America, much the largest and most successful is the Boston Public Library, which was established in 1852. Besides the liberal appropriations made by the city for its support, it has been the object of a long series of splendid gifts in money and books. Among the more conspicuous of its benefactors have been Joshua Bates, Theodore Parker, and George Ticknor. Since the library has been opened to the public there has thus been gathered "the largest collection of books, under one administration, upon this continent." The number of volumes in the library on July 1, 1881, was 395,478, and the annual accessions are over 17,000 volumes. In addition to the income available from trust funds, the annual appropriation by the city is $115,000. Besides the central library, with the Bates Hall and Lower Hall, there are eight branches, and the total circulation is considerably over 1,000,000 volumes per annum. Any inhabitant of Boston over fourteen years of age is admitted to read in the library and to borrow books. The principal catalogue of the library is upon cards, in addition to which there are printed catalogues of special collections, and a perfect multitude of useful class catalogues and bibliographical helps of various kinds. The number of persons engaged in the service of the library is one hundred and forty-three. The library is open to readers from 9 A. M. to 6 P. M. from October to March, and until 7 P. M. during the rest of the year. Books are delivered for home use until 9 in the evening. The periodical room is open from 9 A. M. to 9 P. M. on week days, and on Sundays from 2 to 9 P. M. A new building is in contemplation.

Of the remaining free town libraries, the most important are those of Cincinnati and Chicago. The public library of Cincinnati, which was established on its present footing in 1867, has 122,930 volumes besides pamphlets. Its expenditure last year was $51,465, and its total issues, including those from the two branches, were 768,565. The reading-rooms are open every day in the year from 8 A. M. to 10 P. M. The library buildings were completed in 1873 at a cost of about $400,000, and are "among the handsomest in the world." The Chicago Public Library was established in 1872, and owed its origin to the sympathy felt for Chicago in England after the great fire of 1871. The number of volumes now in the library is 76,120. There is a very full and minute card-catalogue, in one alphabet, of authors and subjects; the contents of collections, volumes of essays, etc., are analyzed under their subjects. The reading-room is open three hundred and sixty-five days in the year from 9 A. M. to 9 P. M., and is not even closed for the purpose of taking stock or cleaning. The library has not yet an appropriate building. Of smaller free town libraries there is a considerable number, especially in Massachusetts. Of the entire number ten only possess over 30,000 volumes each. It is the opinion of the energetic and enlightened managers of these libraries that a free public library is the proper corollary of a free system of public education, and it is their aim as far as possible to direct the taste and to methodize the reading of those who use the collections under their charge.

Astor library. We cannot conclude this brief sketch without mentioning some notable illustrations of that public-spirited munificence which is nowhere perhaps so frequently found as in the United States. The Astor Library in New York was founded by a bequest of John Jacob Astor, whose example was followed successively by his son and grandson. The library was opened to the public in 1854, and at the end of 1880 the collection due to their joint benefaction contained 192,547 volumes. It consists of a careful selection of the most valuable books upon all subjects. It is a library of reference, for which purpose it is freely open, and books are not lent out. It is "a working library for studious persons," and such persons on a proper introduction are allowed to pursue their studies in the alcoves. In 1880 the number of general readers was 45,670, and the number of visits to the alcoves was 7961. The total endowment is over $1,100,000. There is a printed catalogue for about half the library, with a printed index of subjects, and a similar catalogue for the rest is in preparation. **Lenox library.** The Lenox Library was established by Mr. James Lenox in 1870, when a body of trustees was incorporated by an Act of the legislature. In addition to the funds intended for the library building and endowment, amounting to $1,247,000, the private collection of books which Mr. Lenox has long been accumulating is extremely valuable. Though it does not rank high in point of mere numbers, it is exceedingly rich in early books on America, in Bibles, in Shakesperiana, and in Elizabethan poetry. The Peabody Institute at Baltimore was established by Mr. George Peabody in 1857, and contains a reference library open to all comers, numbering about 72,000 volumes. The institute has an endowment of $1,000,000, which, however, has to support, besides the library, a conservatoire of music, an art gallery, and courses of popular lectures. The largest legacy yet made for a public library has recently fallen to the citizens of Chicago in the Newberry bequest of over $2,000,000 for the founding of a free public library in the north division of Chicago

South America and Mexico.

Argentine Republic. The importance of public libraries has been fully recognized by the Argentines, and at present more than two hundred of them are in the country. They are due to benefactions, but the Government in every case adds an equal sum to any endowment. A central commission exists for the purpose of facilitating the acquisition of books, and to promote a uniform excellence of administration. The most considerable is the Biblioteca Nacional at Buenos-Ayres, which contains at present 40,000 volumes, and has been almost doubled since

1872. It is passably rich in MSS., some of great interest, concerning the early history of the Spanish colonies.

Brazil. The chief library of Brazil is the Biblioteca Publica Nacional at Rio de Janeiro, founded in 1807, and now comprising 120,000 printed volumes with 1000 MSS. National literature and works connected with South America are special features of this collection. The Royal Library of Ajuda (including 4000 MSS.) was taken to Brazil by King Joao VI., but was sent to Portugal on the declaration of independence. Since 1873 the annual Government grant has been largely increased. Among other libraries of the capital may be mentioned those of the Faculty of Medicine (18,000 volumes), Marine Library (19,500 volumes), National Museum (9000 volumes), Portuguese Literary Club (53,000 volumes), Bibliotheca Fluminense (43,000 volumes), Benedictine Monastery (9000 volumes), and the Bibliotheca Municipal (15,500 volumes). In the official report on Brazil, submitted at the Philadelphia Exhibition in 1876, it was stated that the aggregate number of volumes in all the libraries of the empire accessible to the public was then 460,272 volumes. In 1875 the libraries were visited by 85,044 persons.

Chili. The Biblioteca Nacional at Santiago is the chief library in Chili. The catalogue is printed, and is kept up by annual supplements.

Mexico. Only sixteen out of the twenty-nine states and territories of the Mexican republic have public libraries, and only a small proportion of the contents consists of modern literature. Many, however, possess rare and valuable books, of interest to the bibliographer and historian, which have come from the libraries of the suppressed religious bodies. It is calculated that books in all the public libraries amount to about 250,000 volumes. There are about seventy-three scientific and literary associations in the republic, each possessing books. The Society of Geography and Statistics, founded in 1851, is the most important of them, and owns a fine museum and excellent library. After the triumph of the Liberal party the cathedral, university, and conventual libraries of the city of Mexico came into the possession of the Government, and steps were taken to form them into one national collection. No definite system was organized, however, until 1867, when the church of San Augustin was taken and fitted up for the purpose. Two copies of every book printed in Mexico must be presented to this library. The only other public library in the city is the Biblioteca Cinco de Mayo, which is under the management of the Lancastrian Society.

Peru. The Biblioteca Nacional at Lima was founded by a decree of the liberator San Martin on August 28, 1821, and placed in the house of the old convent of San Pedro. The nucleus of the library consisted of those of the university of San Marcos and of several monasteries, and a large present of books was also made by San Martin. The library is chiefly interesting from containing so many MSS. and rare books relating to the history of Peru in vice-regal times. The volumes marked "Papeles varios" contain reports on the superstitions of the Indians, abstracts of the ecclesiastical councils of Lima, and memoirs on provincial administration and petitions. It is reported (1881) that the whole library has been seized by the Chilians and transferred to Santiago.

LIBRARY MANAGEMENT.

Buildings. *Library Buildings.*[1]—The conditions of no two libraries being precisely alike, it is impossible to lay down rules to suit all, but certain principles of general application may be stated. In the first place the internal arrangements ought to be devised by a person thoroughly acquainted with the practical working of such a library as the building is intended to accommodate. The reading-rooms, book-rooms, work-rooms, and offices should be made to fall into the most convenient relations one to the other. And as libraries grow with wonderful rapidity the plan ought to admit of easy development. The site should be dry and airy, and permit isolation of the fabric, which should be constructed of fire-proof materials, iron being preferable to stone, and brick to either. Every floor should be laid upon rolled iron beams, supported by lattice girders, the space between the beams being fitted in with porous terra cotta, and the beams covered with concrete. To protect them against fire, girders and pillars must be covered with terra cotta. Iron doors (or, better still, stout wooden doors plated with thin iron) should separate the different rooms.[2] The safety and convenient disposal of the books must never be sacrificed to outside show. The old form of library, the museum-like room with alcoves and a large block of vacant space in the centre, or the series of apartments with books on the walls only, is no longer in favor. The reading-room, commodious, well lighted, and supplied with works of reference, should be away from the main collection, and the lending department should be kept apart from the reference library. It is convenient to have separate rooms for ladies and for readers to whom special facilities may be granted; and that ample provision be made for work-rooms, librarians' offices, cataloguing rooms, and a bindery if necessary. The chief portion of the books (at any rate those in most demand) should be on the ground floor, and more than two stories are to be avoided. Plenty of light and good ventilation are two conditions of great importance. The basement should be vaulted. As the store-room, or that in which the main collection is deposited, is one to which readers have seldom the right of access, the greatest economy as to shelvage and passage way may be effected. Bookcases may be placed against the walls, but not too close to them, and double presses, about 3 feet apart, arranged across the floor. To prevent the objectionable use of high ladders, no shelf should stand more than 8 feet above the ground. If the room be sufficiently lofty it may contain one or more perforated iron floors, sustained by the upright portion of the presses, also of iron. Spiral staircases are to be avoided. Lifts may be introduced with advantage. In many college libraries in America (*e. g.*, at Princeton) the circular form, with cases radiating from the centre, has been adopted successfully. The spacious rotundas of the British Museum and that of the Liverpool Free Public Library are good examples of the circular reading-room.

Mr. Justin Winsor has devised an excellent plan for a library of one million volumes capacity (see "Library Buildings," in *Report on Public Libraries of U. S.*, p. 465), and the same system might be applied to one much less extensive. Another distinguished American librarian, Mr. W. F. Poole of Chicago, has made some novel suggestions on library architecture which have met with considerable approval. He objects to the waste of space in the central portion of most large library rooms, to the difficulty of ventilating and heating them, to shelving books in galleries on the walls, to the destruction of bindings from gas and heat ("books cannot live where man cannot live"), to the excessive labor of procuring books from long distances, the insecurity from fire, the inconvenience of keeping many volumes (other than those of reference) in the public reading-room, and the unnecessary cost of the present system. To remedy these defects a plot of land is required 200 feet square, and surrounded with open spaces. At the middle of the principal side may be placed the main building 60 feet front and 75 feet deep, devoted to administrative and working purposes. The books will be stored, not in one central repository, but in a series of rooms thrown out in wings from the central edifice, and extending round the four sides of the quadrangle with a vacant space in the middle. Each room is 50 feet wide, 15 feet high, and as long as convenient. Ten of these rooms will occupy the ground floor, so that, carrying the same construction four stories high there will be forty different rooms in the whole structure. Each will be devoted to one large, or two or more small, classes of books. Alcoves and galleries are not to be permitted, but the books will be shelved on the walls or on double presses within reach. Every room will receive light on two sides, will be furnished with tables and chairs for readers, and provided with an attendant; no general reading-room will therefore be wanted. As a protection against fire, each room will be cut off by means of brick fire-walls extending to the roof, and access from one room to the other will be by a light iron corridor on the inside of the quadrangle. At the rear of the central building will be a lift for readers, and there will be staircases as well. In this way, on one story there will be about 25,250 square feet in the different wings, which, after deducting sufficient space for readers' tables, etc., will give about 20,200 square feet for books. As each square foot will shelve 25 volumes, each story will hold 505,000 volumes, or on the four stories 2,020,000 volumes. One of the front rooms (to hold 67,500 volumes) might serve as a circulating library. Mr. Poole estimates the cost of such a building in America at $530,000, or complete with shelving and furniture $640,000. (See *Library Journal*, vi. 69 *sq.*) In the same volume, p. 77 *sq.*, is a description of the proposed plan for a new national library building at Washington. In this scheme the architect has in view the centralization towards a circular reading-room, good light, the possible expansion of the library for one hundred years, accessibility to all parts, economical administration, and division into different fire-proof compartments.

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[1] Plans of most of the chief libraries of Europe may be seen in the *Memoirs of Libraries* of Mr. Edwards (2 vols. 1859), and in the *Katechismus der Bibliothekenlehre* of Dr. Petzholdt (1871); the volumes of the *Library Journal* contain representations of many new American libraries.

[2] A recipe to make wood incombustible, and other suggestions, are given by C. Walford in *Manchester Trans. Libr Assoc.*, 1880, p. 65

Heating. Of the various systems for heating libraries open fire-places have the best appearance, are very safe, and best convey heat; close stoves are the cheapest at first hand. Perhaps steam heating is the safest and most economical for large buildings. Unprotected gas jets are very injurious to the books. If gas be used at all, the sun-light system or the Benham light is the best means of conveying away the fumes and heated air. The electric light is used with great success at Liverpool and in the British Museum.

Shelves. *Bookcases and Shelves, Furniture and Appliances.*[1]—For presses and shelves, should wood be preferred, English oak or the cheaper deal (well seasoned) is the best material; or the presses may be made of iron and the shelves of slate or galvanized iron. At the British Museum the presses are all on one scale and all of the same model,—the standards being of galvanized iron, with holes for brass pins, which are so shaped that the space is altered by merely turning them half-way round. The shelves are also of galvanized iron, covered with leather, on wooden frames; movable pads covered with leather protect the books at either end from being rubbed, and there are leather falls to keep the dust out. In the Radcliffe iron bookcase, invented by Dr. Acland, the framework is of iron and the shelves of wood, faced with leather. It is 7 feet high, and stands on any floor-space 48 inches by 18 inches; books are placed on both sides to the number of 500 octavos. Danner's revolving bookcase is useful for reference books; it is square, stands about 5 feet high, occupies no more space than a chair, and holds about 250 volumes. Economy of space is also a feature in Mr. Virgo's bookcase, in the front of which is a door, itself shelved, which, on being swung round, discloses another row of shelves behind. The Eastlake portable bookcase can be taken to pieces, and is made to stand against a wall. In providing for shelf room it is usual to allow about 110 square feet of shelving to 1000 volumes; and in giving directions for presses and shelves it is well to have them planned upon a uniform scale. Perhaps the best supports for the shelves are Tonks's movable shelf-fittings, consisting of two rows of metal strips, with oblong perforations at intervals of ¾ inch, in which are inserted small metal plates. The tops of reading tables, trays and barrows for carrying books, and such shelves as may be intended for heavy or choice books, should be padded. Very large volumes had better be kept flat in sliding trays. There is much diversity of opinion as to whether the fronts of the presses should be glazed or not, or whether they should be protected by wooden doors, curtains, or wire screens; many librarians object to glass doors as harboring dry rot, and to any opaque screen as concealing the books.

Reading-room. The arrangement of the reading-room of the British Museum furnishes a good example of perfect supervision combined with every consideration for the comfort of readers. The tables are here arranged as the spokes of a wheel, with smaller square tables between them for large volumes. Each reader at the radiating tables has a separate place 4 feet 3 inches long, and is screened from his opposite neighbor by a division running along from one end to the other; in front is a hinged desk, with racks, inkstand, and a folding shelf for books. The framework of each table is of iron, forming channels by which air is conveyed through screens at the top of the longitudinal divisions. A tubular foot-rail affords facility for warming the feet in cold weather. The catalogue-stands (with presses of special bibliographies near them) are placed in two concentric circles around the enclosure of the superintendent, who can thus observe every reader in the room.

Supply. A speedy supply of books is ensured by the use of the automatic book-delivery contrived for the Harvard bookstore (of six stories) by Mr. Justin Winsor. At the delivery-desk a keyboard shows the digits which combine the various shelf-marks; and the number of the book wanted being struck upon it, is repeated at the floor on which the work is located, where it is sought for by an attendant and placed in a box attached to an endless belt, which carefully deposits it on a cushioned receptacle close by the delivery-desk.

Indicators. Many English lending libraries find that a great saving of time and trouble both to officials and readers is made by the use of the indicator for public reference. There are many varieties of this invention, but the main principle is a frame containing a series of small pigeon-holes, each numbered and referring by that number to a book; when a volume is lent out, the borrower's card, etc., are placed in the pigeon-hole and signify that it is absent. This roughly describes the Birmingham indicator (Mr. Morgan's); in that of Mr. Elliot, the title of the book is pasted against each pigeon-hole; Mr. W. H. K. Wright uses at Plymouth a system which serves as a catalogue and register of books lent as well; and Mr. A. Cotgreave has improved the original idea by his indicator-book, a sort of ledger of the persons to whom each volume is lent, which is placed in the small pigeon-hole previously spoken of. The card-ledger of Mr. G. Parr, used at the London Institution, is for the use of the librarians alone and not for the readers; it is applied to a borrowing system which permits several volumes to be taken away by the same person, and also acts as a register of borrowers.[2]

Minor appliances. For the purpose of stamping the name of the library on the books, etc., some persons prefer the embossing stamp, and some the ink stamp now very conveniently made in india-rubber. Props, either to screw upon the shelves, or made of thick blocks of wood, or of tin folded at right angles, are useful for preventing books falling about in a slovenly manner. Reading cases are necessary for periodicals and choice bindings; periodical cases are made conveniently of wood with strong leather backs. In order to keep the consecutive numbers of current periodicals and newspapers clean and in perfect order, some kind of temporary binder is required. The contents of the different shelves or recesses may be printed on labels made of leather or cloth. The "Van Everen" printed numbers and letters for the marks on the shelves and the backs of the books are to be purchased at a small cost.

Classification. *Classification and Shelf Arrangement.*—The defect of most classificatory systems, especially of those which profess to be particularly philosophical and logical, is that they are better adapted for a systematic review of human knowledge than for the arrangement of a miscellaneous collection of books. A small library will not require so extensive a scheme as a larger one, and a popular library needs less minute classification than one for reference or for the use of more learned readers. Again, the classes which are best represented in the library, and its special or local collections, deserve more elaborate treatment than the classes in which it possesses but few volumes. The same system cannot invariably be used in all respects both for the shelves and for the catalogue, as a book can have but one position in the presses, but the title may appear under any number of headings in different parts of the catalogue. For these reasons, the natural order should be followed as far as possible. That is to say, the books should suggest their own classification, which should be made to harmonize with the requirements of the library, and the various classes should not be strained to fit some arbitrary method, however logical in theory As the title of a book is often an unsafe guide to its contents, no one should attempt classification by the help of the title alone. In vol. ii. of Edwards's *Memoirs of Libraries*, he gives a number of schemes both on philosophical and on natural or practical principles; and Petzholdt, in his *Bibliotheca Bibliographica* (Leipsic, 1866), has drawn up an account of no less than one hundred and seventeen different methods of classification, a number which could now be largely increased, as the practical ingenuity of American librarians alone has added many to the roll. Some of these schemes have been elaborated with great care, but, however interesting on account of the useful hints they may now and then supply, most of them are useless either for the catalogue or the shelves. All these are systems to classify the whole range of literature, but there are many classified bibliographies and other guides useful for the scientific arrangement of special departments.[3]

Books are usually arranged upon the shelves either in order of (1) their sizes, (2), authors' names, (3) subjects, or sometimes (4) of accession, or by a modification of two or more of these systems. The arrangement by subjects is that which displays most conveniently the richness or poverty of the collection. Although a library may possess the most complete of subject catalogues, it cannot be considered in perfect order without classification on the shelves. In carrying out shelf-arrangement ample space should be left for additions, and in fixing upon the places of the bookcases those containing the works in most demand should be nearest the point of delivery. In some libraries the books are located without any classification, and the shelf marks are all in all. At Munich and many other Continental libraries there are thirty or forty classes, designated by single or double letters, and the books are arranged in sets of octavo, quarto, and folio in the different classes under the names of their authors, so that Macaulay's *History of England* would be found in the octavo alphabet under M of the class "history." Mr. Richard Garnett supplies an interesting description of the system of classifying books on the shelves followed at the British Museum in the *Trans. of Conf. of Libs.* (London, 1878, pp. 108, 188). There are ten classes:—(1) theology, (2) jurisprudence, (3) natural history and medicine, (4) archæology and arts, (5) philosophy, (6) history, (7) geography, (8) biography, (9) belles lettres, (10) philology; and the classes have five hundred and fifteen divisions. Periodicals, academical publications, state papers, the Oriental departments, the Grenville Library, and the reference library are all distinct, but the principle of classification is practically identical. By allowing intervals in the numbering of the presses space is allowed for new ones to contain additions, and as the different presses are alike in size, they may be shifted at will and no alteration of press-marks is wanted. Mr. Edwards (*Mem. of Libs.*, ii. 814) proposes a system for a public free library of upwards of thirty thousand volumes to be arranged under (1) theology, (2) philosophy, (3) history, (4) politics and commerce, (5) sciences and arts, (6) literature and polygraphy. A novel scheme, marked with many practical advantages, is the Amherst or Dewey system,[1] according to which the library is divided into ten classes, the first being a zero or general class, including bibliography, polygraphy, general periodicals, etc., while the others are philosophy, which is numbered 100; theology, 200; sociology, 300; philology, 400; natural science, 500; useful arts, 600; fine arts, 700; literature, 800; and history, 900. These classes are then separated again into nine special divisions of the main subject, preceded by a zero or general division. Each of these divisions again has nine sections (preceded by a zero). Thus 513 is the third section (geometry) of the first division (mathematics) of the fifth class (natural science). This is the classification or class number, and is affixed to every book and pamphlet belonging to the library. The zero in a class number has its normal power, and signifies a general treatise, so that 500 is a book on natural science in general. The system was devised in the first instance for classifying and indexing, but it can also be used for numbering and arranging books and pamphlets on the shelves. For this purpose the absolute location by shelf and bookmarks is wholly abandoned, and the relative location by class and book-number used instead. Accompanying the *class*-number is the *book*-number, which prevents confusion of different books on the same subject. Thus the first geometry catalogued is marked 513·1, the second 513·2, and so on. The books of each section are all together, arranged by book-numbers, and these sections are also arranged in simple numerical order throughout the library. The number 513·11 will therefore mean the eleventh book in subject 513, or the eleventh geometry belonging to the library.—A representative specimen of the philosophical method is that devised by Dr. W. T. Harris for the catalogue of the Public School Library of St. Louis, which is classed in a modified form of the Baconian plan. The main classes are (1) science, including philosophy, theology, social and political sciences, and natural science and the useful arts, (2) art, (3) history, (4) appendix, including polygraphy, cyclopædias, and periodicals. These main classes are again divided into one hundred subclasses, many of which are divided still further. Thus, under natural history, class 50 is zoology; 50*a*, vertebrates; 50*a* i., mammals, etc.—The divisions *Médicine* and *Histoire de France* in the great printed catalogue of the Bibliothèque Nationale are excellent examples of classification.[2]

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[1] Details in the works of Edwards and Petzholdt, the *Library Journal*, the publications of the Library Association, and of the Library Bureau (Boston, U. S.).

[2] See *Oxford Trans. Lib. Assoc.*, 1879, p. 76; *Manchester Trans.*, 1880, p. 71 *sq.*

[3] For instance, in the class of fine arts may be consulted the *Bibliographie des Beaux-Arts* (Paris, 1874–8), which the late M. Ernest Vinet left incomplete; and botany may be classified with the help of Mr. B. D. Jackson's *Guide to the Literature of Botany* (London, 1881). In the *Memoirs of Libraries* (ii. 922) may be found a useful classification for MSS., and further on an account of perhaps the best systems for prints and maps, being those of the Bibliothèque Nationale.

Every volume upon the shelves should have a mark to indicate its position. One system is to designate each press by a number, each shelf by a letter, and if necessary, each volume on the shelf by another consecutive number, so that 13 D 16 is the sixteenth volume on the fourth shelf of the thirteenth press. The principles underlying numbering systems as well as shelf-arrangment are discussed by Mr. Melvil Dewey (see *Library Journal*, iv. 7, 75, 117, 191), and the combined system of numbering and arranging of Mr. J. Schwartz, as well as his mnemonic system of classification (*ib.*, iii. 6; iv. 3), are also well worth attention. The new scheme of classification devised for the use of the Boston Athenæum by Mr. Cutter is also described in the *Library Journal*, iv. 234. A catalogue for the Winchester Library (1879) was prepared by Mr. Cutter on the principles there detailed.

Many authorities strongly recommend that, instead of a fixed mark for the shelves, the location of books should be indicated by a running number or combination of letters and numbers; so that, although the books should not always remain in the same place, their relative position would be unaltered, and, while they could be found just as readily by means of the number, any quantity of additions could be introduced without affecting the whole scheme.

In a circulating library it may be found convenient to designate each press by letter, and to omit to number the shelves from top to bottom, but number each volume consecutively. The shelf-notation may be placed inside each volume or on a label upon the back.

Binding.

Binding.[3]—The best binding is the cheapest in the end, since it lasts longer under all circumstances, and is always better treated by readers. Morocco resists wear and tear and the action of gas and heated air better than any other leather. Vellum is the most durable material, but it is not suitable for all purposes. Then follow in order of merit calf, russia, basil, roan, buckram, and cloth. Morocco should be used as much and russia as little as possible. Buckram, linoleum, crêtonne, leatherette, etc., have met with favor from time to time, but are not recommended. Olive, light brown, and red are said to be the most lasting colors; then come dark blue and green, light blue and green. Black is a lasting color. Some persons assign a particular color to each class of literature, but, as there are more classes than colors to suit them, such an arrangement consistently carried out can only lead to confusion; besides, a want of variety on the shelves destroys at once the individual appearance which it is always desirable to give to each set of books in order to make them easily distinguishable. The council of the Library Association have suggested as a pattern for ordinary library binding that the volumes should be sewn all along, with the first and last sheets overcast, on strong cords, the slips to be drawn in all along, and the backs made close (flexible); half-bound, with corners of same material; smooth cloth sides; edges cut, sprinkled, and burnished, or, if so directed, top edge only cut, etc., the others trimmed and left with proof; end-papers of stout Cobb's paper, with cloth joints in quartos and folios; lettered with author's name, short title, and date; gilt fillets, but no other tooling; two-page plates to be guarded so as to open out flat; all materials of the best quality, and the work to be done carefully.[4] In making contracts some such specification as that suggested by the Library Association should be decided upon. Full instructions should always accompany work sent out, and a copy must be kept in a binding-register. Rare and valuable books demand special treatment and a special binder. The British Museum authorities have adopted a style of binding in half-morocco, with the leather coming only just over the back to act as a hinge, the sides whole cloth, the corners tipped with vellum.

Pamphlets.

How to deal with pamphlets is a troublesome question. At the British Museum each was formerly done up separately in slight binding. This is certainly the best system, but out of the reach of most libraries from its cost. Failing this, the pamphlets can be arranged in solander cases as they come in, and afterwards bound up in volumes according to size and subject, with the contents marked on the fly leaf of each. The rebinding of a MS. is to be avoided; it is better to preserve the old cover and place the book in a case. Drawings and prints are best preserved in sunk mounts, and maps, charts, etc., should be backed with thin linen.

Hints.

Practical Hints.—Collate every volume when it comes in, so as to prevent binder's imperfections; remove plate-paper when the book is quite dry; strings and silk registers are to be avoided, as they tear the leaves; preserve old bindings as far as possible, and do not permit book-plates, the names of former owners, and MS. notes of any kind to be destroyed; be careful with metal clasps and corners; let gilding be used sparingly; do not hurry the binder overmuch, as he may retaliate by returning his work insufficiently dried and pressed; be careful with letterings; index dictionaries and works of reference on the fore edges; bind up paper wrappers; never let a binder exercise his fatal proclivity to cut away full margins.

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[1] See *A Classification and Subject-Index for Cataloguing and Arranging the Books and Pamphlets of a Library*, by Melvil Dewey. Amherst (Mass.), 1876.

[2] A proposal for a new co-ordinative catalogue and subject-index is made by Mr. Hy. Wilson in his contribution, "Classification in Public Libraries," to the *Transactions, etc., of Library Association of Manchester* (London, 1880, pp. 79, 155); and in the same work (p. 85) may be read some remarks on the various classifications used in reporting statistics of issues in the chief public free libraries.

[3] For an account of the history and practice of binding consult the article BOOKBINDING (vol. iv. p. 86 *sq.*); also Marius-Michel, *La Reliure Française artistique* (Paris, 1880); and *La Reliure Française depuis l'invention de l'imprimerie jusqu' à nos jours* (Paris, 1881); *La Reliure, ancienne et moderne*, Paris, 1878; J. W. Zaehnsdorf, *The Art of Bookbinding*, London, 1880.

[4] *Monthly Notes of Lib. Assoc.*, vol. ii. p. 52.

For the removal of grease and ink-spots, and the restoration of old bindings, prints, etc., consult *L'art de restaurer les estampes et les livres* (Paris, 1858), and *La réparation des vieilles reliures* (*ib.*, 1858), both by A. Bonnardot, and Rouveyre, *Connaissances nécessaires à un Bibliophile* (Paris, 1880). To restore calf-bindings which have become impoverished, it has been recommended[1] that they should be lightly washed with a soft sponge dipped in a preparation consisting of ½ oz. of the best glue, dissolved in a pint of warm water, to which add a teaspoonful of glycerin and a little flour paste. Should the state of the leather be very bad, a second dressing may be found necessary. The volumes must be rubbed with chamois leather when dry. Neat's-foot or olive oil has been suggested for the same purpose, but it ought to be used with a sparing hand. Much has been written about the effect of gas and heat upon binding.[2] The question is still undecided, but it seems likely that the deterioration of the leather is caused more directly by the over-heated air, so that thorough ventilation, especially as regards the upper shelves, is most important for the well-being of a library. Morocco, vellum, and buckram resist this action best, and calf, russia, and roan worst. Prof. H. A. Hagen has studied the various kinds of bookworms and other insect pests of librarians.[3] Most libraries of the first class bind on the premises, and M. Hipp. Gariel of the Bibliothèque de Grenoble is persuaded, after a very careful inquiry, that any library which binds as many as nine hundred volumes a year will save largely by keeping up a binding establishment of its own.[4]

Catalogues.

Catalogues and Cataloguing.—A library is useless without a proper equipment of good catalogues, which to be thoroughly efficient should be compiled upon a well-considered plan, carefully kept up to date, and made accessible to every reader. The variety of different catalogues is very great, and no one form can be adopted alike by libraries for study and those for popular reading, nor yet by those which combine the two functions in whatever proportions. As regards the amount of information necessary to be given, the titles of the books may be either short, or not more than a single line to each, as in the *London Library Catalogue* (1875); medium, or several lines to each, as in the *Royal Academy Library Catalogue* (1877); or full, as in the *Catalogue of the Huth Library*, 5 vols. large 8vo (1880), where the title is copied in extenso and a quantity of bibliographical details are added.

The chief questions to be answered by a catalogue are:—1. Has the library a certain work by a certain author? 2. What has it by any given author? 3. Has it a certain book of which the title only is known to the inquirer? 4. Has it a certain book of which the subject only is known to the inquirer? 5. What has it on a given subject? 6. What works in certain classes or languages has it? To supply this information, catalogues are arranged sometimes under the names of authors in alphabetical order (1 and 2); or under the first words of the titles (3); or classified under subjects, whether in alphabetical or systematic order (4 and 5); or by a combination of two or more of these methods. A dictionary-catalogue answers all six questions under the names of authors, the titles of books, the subjects and forms of literature (*i. e.*, essays, or French, German, etc.), which are arranged in one alphabet and connected one with the other by a complete system of cross-references. A modified form of short-title dictionary-catalogue, with the names of authors, titles of books, and subjects in one alphabet, is a useful type for a popular library to adopt. No author-catalogue can be considered complete without an index of subjects,[5] and every classified catalogue requires an index of authors, if alphabetical, and of both authors and classes if systematic. An ideal catalogue would furnish references under each name and subject to every work, part of work, or even magazine article contained in the library which illustrated it. This can rarely be attempted, but a near approach to perfection is shown by the new catalogues of the Boston Athenæum and the Brooklyn Mercantile Library; the last is a model of thoroughness. It is becoming a laudable practice to give the contents of collected works and periodicals in catalogues; and good examples of the value of annotations are the catalogues of the classes of history, biography, travel, and historical fiction in the Boston Public Library.

In making choice of a form of catalogue the way is sufficiently plain should the alphabetical system under authors be adopted, neither can there be much cause for discussion in fixing upon an alphabetical subject-catalogue; but, should it be decided to compile a systematic subject-catalogue, the question becomes a much more serious one. A subject-index of some sort is an indispensable supplement to any catalogue merely arranged under authors. The references had better be strictly alphabetical in form; for instance, a work on ants should be indexed under that word and not under the general heading of insects or entomology; but there is no reason why there should not be cross references under the larger to the smaller headings. In an appendix to Mr. Cutter's article on "Library Catalogues"[6] there is a descriptive list of more than a thousand printed catalogues of American libraries, among which many useful types might be selected. All the printed catalogues of European libraries which were published before 1840 are mentioned in Vogel's *Literatur europ. öff. u. Corporations-Bibliotheken* (Leipsic, 1840).

Librarians should take a share in the compilation of their catalogues at any sacrifice of time and trouble, for by no other means can they obtain so exact an acquaintance with their collections. No cataloguer should be allowed to prepare a title except from the very copy of the book which he is cataloguing.

In order to secure precision and uniformity in the descriptions of the books and in the headings under which they are placed, some well-considered code of rules is absolutely necessary as a guide to the cataloguer. All such rules are founded more or less upon those of the British Museum, printed in 1841,[7] which have been followed with modifications by Professor Jewett (in the *Smithsonian Report on the Construction of Catalogues*, 1852), by Mr. E. Edwards (*Memoirs of Libs.*, 1859, vol. ii.), by Mr. F. B. Perkins (in the *American Publisher*, 1869), with many additions by Mr. C. A. Cutter (in his *Rules for a printed Dictionary-Catalogue*, 1876),[8] by the condensed rules of the American Library Association (*Library Journal*, iii. 12), and by the Library Association of the United Kingdom (as finally agreed upon and printed in their *Monthly Notes*, ii. 81). The authorities of the Cambridge University Library have also printed their rules. In drawing up a set of rules the special wants of the library and the readers should be first considered, and then the most suitable rules chosen from one or other of the schemes mentioned above. But when rules are decided upon, no alteration should be permitted during the compilation of the catalogue, as bad rules uniformly followed are better than good rules without uniformity.

Among disputed questions, that of how best to describe the sizes of books is perhaps the most difficult. What is wanted is a system that can be understood by every one, and which is capable of being applied to old as well as to new books.[9] For books printed before the introduction of machine-made paper about the beginning of the century, the correct bibliographical size may be derived from the fold of the sheet, that is, roughly speaking, a quarto is a sheet folded four times, an octavo eight times, etc. The great variety of modern papers (a different scale of sizes being used in each country) renders this method no longer available, and it seems generally admitted that some system of fixed measurements of heights to denote certain sizes is wanted for library purposes. A report on the subject, giving details of three rival schemes, including that of the American Library Association, an ingenious adaptation of the "demy" scale paper, and one following the ordinary binder's scale, may be found in *Trans., etc., of Manchester Meeting*, 1880 (p. 11), of the Library Association. A committee of the same body subsequently devised a plan which endeavored to embrace the different merits of all three schemes, but it has not yet been generally adopted.[1]

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[1] By Mr. C. P. Russell, *Oxford Meeting of Library Association*, p. 100.

[2] See *Conf. of Lib.*, 1878, p. 232; also *Library Journal*, i. 124; iii. 64, 229; iv. 255, 435; v. 50, 218.

[3] *Ib.*, iv. 251, see also pp. 376, 443.

[4] *La Bibl. de Grenoble*, Paris, 1878, 8vo, pp. 19, 20.

[5] Of such an index a very complete specimen may be seen in the *Catalogue of the Royal Medical and Chirurgical Society's Library*, 1879, 3 vols. 8vo.

[6] See *U. S. Report*, p. 577.

[7] Prefixed to the printed catalogue of letter A. The rules, which were compiled by Sir A. Panizzi, Th. Watts, J. Winter Jones, J. H. Parry, and E. Edwards, have been conveniently arranged by Mr. Nichols in *Handbook for Readers at the British Museum*, 1866, and have been reprinted with additional rules by Mr. Hy. Stevens in his *Catalogue of the American Books in the British Museum.*

[8] Second part of *Report on Public Libraries of U. S.*, Washington, 1876.

[9] See C. Evans, in *Library Journal*, i. 58; and W. Blades, in *Monthly Notes*, i. 2, 9.

Printed catalogues.

Printed catalogues are doubtless costly, and they soon become out of date, but they are much easier to consult than manuscript volumes, and possess the great advantage that they admit of being used away from the library. On the whole the balance of convenience is strongly in their favor, and few libraries of any importance fail to print as soon as they can. For free public libraries printed catalogues are absolutely necessary, and they are extremely useful in those of a more learned or special character.

As regards the form of catalogue most suitable for library reference, card-catalogues are used comparatively little in England, but are found to act satisfactorily in many American libraries. They possess many peculiar advantages, among others being the facility with which titles may be added, withdrawn, or rearranged. Readers do not object to turning over the cards, as the labor is shortened by indexes standing above the rows; and there are many contrivances to prevent the unauthorized removal of the titles.[2]

It is obvious that, if a universal catalogue of printed literature existed, it would be only necessary for each library to mark in a copy the particular works it chanced to possess. Such a plan on a small scale has been adopted in many cathedral and college libraries, where a copy of the Bodleian printed catalogue is used for the purpose. A satisfactory step in the direction of co-operative cataloguing has been made by Mr. Henry Stevens in his proposals for a bibliographical clearing-house,[3] which shall supply exact copies of the title pages of rare (and eventually of more common) books by means of photography. Mr. Stevens has now many thousands of these "photograms" of titles, which are all reduced to a uniform scale, with the full titles and collations added in ordinary type. They are very convenient for card-catalogues.

Thus far the wants of readers have been principally considered; but librarians ought to possess two other kinds of very important catalogues, which they must keep up in their own interest. The first is the accessions-catalogue, or record of every book, part of book, pamphlet, or periodical as it comes in; and the second the shelf-catalogue, or stock-book of the library, a register of the contents of every press and every shelf. These tell the source and date of every addition, and enable all the books to be checked at any time. A novel form of accessions-catalogue is that of the Liverpool Free Public Library, which is a sort of large photographic album to show printed titles of accessions in alphabetical order; loose sheets are laced into the body of the catalogue to provide for any number of additions as quickly as possible. In the same library the titles of new books are also pasted upon blocks arranged in a frame for the information of readers.

Administration.

Administration.—In any library which manages its own financial matters, however small, all accounts should be as carefully kept as those of a trading establishment. In the same way a periodical stock-taking should be made by means of the shelf-catalogue. It is a great convenience to display recent accessions for a short time in some place put apart for the purpose. A recommendation and complaint-book are both useful. The rapid and efficient supply of books is greatly promoted by requiring that all demands should be made in writing and not verbally. The books should be carefully dusted from time to time by experienced persons; and the leaves of all new books, etc., should be cut by the library staff.

In issuing and taking note of books lent, either the ledger or the slip-system may be used, or a combination of the two, something like a shelf-catalogue. Accounts are kept either against the borrower, against the book, or against time; the first, with the ledger system, may be well for small libraries, but in larger institutions the slip-system must be resorted to, and it is better to keep the accounts against the books, with perhaps a ledger-index of borrowers. Where more than one volume is lent at a time a small card is sometimes placed in a pocket in each book; the card, whether marked with borrower's name, etc., or not, being retained as a voucher, as in the "card-ledger" spoken of on p. 537, which is on the slip-system with the account against the borrower. The special feature of the "card-ledger" is that no writing whatever is required. It is necessary to introduce some device for overdrawn or reserved books.

Besides furnishing the materials for reading, it is now recognized that a popular library has also the function of indicating the method of reading and study. A collection of well-chosen books suitable for girls and boys is now a good feature in many English free libraries. At the Providence Public Library, Rhode Island, Mr. W. E. Foster issues daily notes on current topics and events, with detailed references by which the subject may be illustrated by the resources of the library; more complete special lists, *e. g.*, on Herbert Spencer, Irish landlord and tenant, etc., are also issued from time to time. Library lectures are now given at several free libraries in England, but, to make these efforts distinctly useful in adding to the good work of the institution, they should be restricted to lectures on books and courses of reading, so that, by illustrating certain works or departments of the library, these lectures may gradually lead readers to a more careful consideration of literature. Aimless and purposeless reading is the bane of a free public library, and it should be the desire of its authorities to do what can be done to induce people to use with due circumspection books of a higher class and of a more useful and informing character. The admirable catalogue of history, biography, and travel of the Boston Public Library, with its suggestive notes and illustrations, had the effect of lowering the reading of fiction from 74 per cent. to 69 per cent. In the same library even the reading of novels has been elevated by the catalogue of English prose fiction arranged on the same plan.

Experience shows that in all that relates to such questions as preliminary forms, age of readers, days and hours of admission, Sunday-opening, access to catalogues, shelves, and librarians, fines, loans of books, guarantees, number of volumes allowed, time of reading, etc., a liberal tendency is always beneficial both to the library and the public.

Precautions against fire.

In view of an outbreak of fire, some well considered plan should be fixed upon. Extincteurs and hand-pumps should be kept ready for use in central positions. The means for extinguishing fire should be familiar to the members of the staff, who should all be practised in fire-drill, in order that each may know his proper place and duty in case of emergency. Full directions should be suspended in conspicuous places. In the case of fire breaking out after library hours, it should be thoroughly understood where the keys are to be found, what officials should be sent for, and what apparatus is ready for use within the building.

Librarians.

Librarians.—Without insisting upon quite so wide a range of subjects as did F. A. Ebert in his *Bildung des Bibliothekars* (Leipsic, 1820), one may expect the librarian of a great library to be a man of liberal education, and specially endowed with sympathy with books and reading; a practical acquaintance with bibliography, including palæography, and bibliology, is also necessary, as well as with the theory and practice of library management. To be thoroughly qualified, a librarian should have had the practical experience of library-work which it is impossible to obtain from any amount of book reading. Besides this, he ought to be a man of business habits and a good administrator.

These acquirements imply qualifications of a somewhat higher character than may perhaps be necessary in all public libraries; but some knowledge of languages and literatures, bibliography, bibliology, and general library management should be possessed by any person holding the chief position in the administration of any library, however small. As regards the qualifications of the librarian of a popular institution or of library-assistants, it may be useful to give the outline of a plan recently proposed by a committee of the Library Association for their examination (see *Monthly Notes*, vol. ii.). There should be a preliminary examination, chiefly in the subjects of a sound English education, special attention being paid to English literature; proficiency in the elements of one or more classical or modern languages would be specially indorsed upon the certificate, one language to be necessary. The suggested subjects for the preliminary examination are—arithmetic, English grammar and composition, English history, geography, and English literature. After having been engaged in library work for not less than one year, a second-class certificate might be awarded to any librarian or assistant who should pass a satisfactory examination in English literature, especially of the last hundred years, some one other European literature, principles of the classification of the sciences, elements of bibliography, including cataloguing and library management,—a cataloguing knowledge of at least two languages besides the English to be necessary. A first-class certificate would be given, after a satisfactory examination, to a librarian or assistant of at least two years' experience, for an advanced knowledge of the subjects last mentioned, with the addition of general literary history. A cataloguing knowledge of at least three languages would be necessary for the higher certificate,—an acquaintance with any others, as well as proficiency in any subjects (not more than two in number) offered by the candidate, being specially indorsed.

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[1] See *Monthly Notes*, i. 61, 62.

[2] The Bonnange and other systems of card-catalogues are described in *Report on Public Libraries of U. S.*, pp. 555, etc.

[3] *Transactions of Conference of Librarians*, London, 1878, p. 70.

Women are gradually making their way in libraries. At Manchester and elsewhere they are successfully employed as assistants; and in several other places in England the chief charge of the library is maintained in a very efficient manner by a lady. In the United States the majority of the librarians are ladies (at the Boston Public Library no less than two-thirds of the staff), and many of the most accomplished cataloguers are of the same sex.

The first general meeting of librarians took place at New York, September 15 to 17, 1853, upon an invitation signed by Professor C. C. Jewett, Mr. W. F. Poole, and others "for the purpose of conferring together upon the means of advancing the prosperity and usefulness of public libraries, and for the suggestion and discussion of topics of importance to book collectors and readers." About eighty persons attended, many questions were debated, and the suggestion to form a permanent association met with considerable favor. Nothing came of it, however, and twenty-three years had elapsed when, having in view the Centennial Exhibition of 1876, a second meeting was convened on October 4 to 6, at Philadelphia, which was attended by one hundred and two Americans and one English representative. At the Philadelphia conference of 1876, the American Library Association, which has since done so much good work in practical librarianship, was founded. In October, 1877, a conference of librarians was held in London, under the presidency of the late Mr. J. Winter Jones, and attended by two hundred and sixteen librarians and others, including representatives of the French, German, and Greek Governments, all the chief libraries of the United Kingdom, as well as certain of those of the United States, Belgium, Denmark, France, Italy, and Australia. Altogether one hundred and forty different libraries sent representatives, and nearly the whole field of library-science was reviewed at the different sittings. *The Transactions and Proceedings of the Conference of Librarians* (London, 1878) is the title of the official report of the meeting. The chief result of the conference was perhaps the foundation of the Library Association of the United Kingdom, of which the "main object shall be to unite all persons engaged or interested in library work, for the purpose of promoting the best possible administration of libraries; it shall also aim at the encouragement of bibliographical research." Monthly meetings of the association take place at the London Institution, and the members hold an annual conference in some one or other locality, where the different libraries are inspected, various questions of library economy are discussed, and new library appliances are exhibited. Full reports of these meetings have been published; *Monthly Notes* are also issued. Every important British library is now represented in the association, which numbers over 360 members.

Selection.

Guides to Selection of Books.—As it is not only necessary to find out the best treatises on given subjects, but also to decide upon the respective merits of different editions and even of different states or copies of the same edition, an acquaintance with bibliography, or the science dealing with the technical features of books and MSS., and with bibliology, or that which deals more especially with their literary aspect, is to be expected in those forming a library.[1] So necessary is bibliography in library selection that Dr. Cogswell, as a preliminary step to collecting books for the Astor Library, formed a bibliographical apparatus of five thousand volumes to help him in his arduous task. To assist librarians and collectors in their choice, among earlier works may be mentioned that of G. Peignot, *Manuel du Bibliophile ou traité du choix des livres*, Dijon, 1823, still interesting on account of the descriptions of the favorite reading of eminent men. *Catalogue of my English Library* (London, 1853) is the title of a little volume prepared by Mr. Henry Stevens to assist in getting together the best editions of the standard English authors. The idea was followed on a larger scale by M. Hector Bossange in *Ma Bibliothèque Française* (Paris, 1855). The best guide for ordinary purposes, but far from perfect, is *The best Reading: hints on the selection of books, on the formation of libraries, public and private*, by F. B. Perkins (4th ed., New York, 1877). The list is restricted to books now in the market; prices are appended. The titles are very brief, and are arranged in an alphabet of subjects; and a selection is appended of the chief French, German, Italian, and Spanish authors. A new edition of Porter's *Books and Reading* appeared in 1881. Current German literature is well looked after in G. Schwab and K. Klüpfel's *Wegweiser durch die Literatur der Deutschen* (4th ed., Leipsic, 1870), with several supplements. The leading literary reviews, as well as the publishers' trade journals, will guide in the acquisition of the books of the day. The careful cataloguing and excellent descriptive notes in the New York *Publishers' Weekly* are good examples of what book committees are glad to have before them. An examination of the authorities quoted by authors of repute will frequently help in deciding upon the merits of rival treatises, and the printed catalogues of well-chosen libraries are also useful. To his practical little treatise, *Free Libraries and Newsrooms*, Mr. J. D. Mullins appends a list of books he considers desirable for free public libraries, and to form the basis of a collection of high-class fiction, Mr. F. B Perkins has drawn up a list of the best hundred novels procurable in English (*Library Journal*, i. 166). The *Coming Catalogue*, about which we hear now and then from America, will contain selected lists of books, with short notes.

Acquisition.

Acquisition of Books.—Public libraries must look to purchases as their chief means of getting the books they want. The best system is to draw up lists of the desired works and editions, and circulate the lists among the leading booksellers, who will notify the prices and conditions of the copies they may be able to supply; announcements of books wanted can also be inserted in the booksellers' trade organs. Second-hand booksellers will willingly furnish their catalogues, which, if they are not required to purchase from, are always useful for reference. It is usually more convenient to give commissions for books at sales than for the librarian to attend in person; but an occasional visit to the auction rooms will give much information as to current prices of books, a matter which, coupled with frequent visits to the shops of second-hand booksellers and the diligent study of their catalogues, will be carefully attended to by the capable librarian. The works of Brunet, Lowndes, and Graesse may also be consulted for the prices of old books. It is perhaps needless to add that the state of condition and binding makes a great difference in the market value of copies of the same book. Libraries will frequently dispose of their duplicates or surplus copies to other institutions at a low price. For new books, periodicals, newspapers, etc., special terms may always be arranged with local tradesmen.

From time to time the Governments of Great Britain, France, and the United States have had under consideration various schemes for the international exchange of books upon a systematic basis, but the proposals were never carried into effect, and it was left to the public spirit of a French gentleman, M. Alexandre Vattemare, to devise and carry out for some years a large scheme for the interchange of books among the chief public institutions of Europe and America. In 1853 M. Vattemare was able to state that one hundred and thirty such establishments had participated in the benefits of the system, but unfortunately it gradually fell off. Earlier than 1851, however, a similar agency was in full working order at the Smithsonian Institution, and it has been kept up with efficiency to the present time. The institution acts as a medium for the exchange of their publications among the chief learned bodies and other public institutions of Europe and America, and undertakes the cost of receiving and sorting the parcels, and the remuneration of the agents in the chief centres of the Old World to whom they are sent, and by whom they are distributed free of charge. The corresponding societies are only required to deliver their parcels without expense at Washington.

On several occasions the United States Congress has passed special Acts directing the exchange of Government publications with those of other countries, and in 1848 the joint committee on the library was authorized to appoint agents for the exchange of books and public documents. As the scheme did not appear to work satisfactorily, the Act was repealed four years later. But since 1867 it has been ordered that fifty copies of all documents printed by either House of Congress or by any Government department be placed with the joint committee on the library, to be exchanged for foreign works. It is most unfortunate that this enlightened policy is not followed by the English authorities.

Many learned bodies which issue their proceedings willingly present them to libraries, and authors find this a useful means of spreading a knowledge of their works, when they are not of sufficient public interest to ensure a large or rapid sale. Library committees may often secure valuable additions by a discreet application; indeed, privately printed works and local publications (unless given spontaneously) are almost only to be had in this manner.

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[1] The article BIBLIOGRAPHY (vol. iii. p. 563 *sq.*) will afford a general idea of the immense extent of this literature; in addition to the special works there mentioned, reference may be made to Sabin's *Bibliography of Bibliography*, New York, 1877.

Many valuable works are issued at the expense of Governments. It might be naturally expected that these should be sent, free of charge, to all public libraries of any importance. In England, however, this is not done. In countries where the public libraries are subject to the minister of public instruction, as in France and Italy, more is done in this direction, especially as regards expensive volumes. In 1853 a select committee of the House of Commons recommended that parliamentary papers should be sent free of charge to free public libraries, but the recommendation has never been carried out.

In America official publications can be obtained without charge by public institutions from the secretary of the interior upon the order of a senator or representative, but the system is said not to be in a satisfactory condition.

Many valuable English Government publications, notably the state papers and chronicles, and the fine art handbooks of the South Kensington Museum, are easily to be had at less than the cost of production, and parliamentary papers are neither inaccessible nor highly priced. Although there is no fixed rule as to distribution, some of the departments may now and then be induced to present copies of their publications on being applied to in a proper manner.

Copyright Acts.

The privilege of demanding copies of all books, periodicals, newspapers, musical publications, maps, and prints, when published, under the provisions of the various Copyright Acts, is enjoyed by only a very few, generally only by one, of the chief national libraries in each country. This system has grown up under the different enactments of the censorship of the press. The first Act of Parliament passed in England to enjoin printers to present their publications was that of 14 Charles II. c. 33, which directed that *three* copies should be sent, one to his Majesty's library, and one to each of the universities of Oxford and Cambridge. By 8 Queen Anne c. 20 the number was increased to *nine*, and by the 41 George III. c. 107 to *eleven*, viz., to (1) the Royal Library; (2) University Library of Cambridge; (3) Bodleian Library; (4) Edinburgh University Library; (5) Glasgow University Library; (6) King's College Library, Aberdeen; (7) University Library, St. Andrews; (8) Sion College Library, London; (9) Advocates' Library, Edinburgh; (10) Trinity College Library, Dublin; (11) King's Inns Library, Dublin. This was in force till 1835, when by the 6 & 7 William IV. c. 110 the privilege was abolished as regards six of the eleven libraries mentioned, and a yearly grant, estimated at £3028, allowed in compensation. The Act under which five libraries, viz., the British Museum, the Bodleian, the Cambridge University, the Advocates', Edinburgh, and Trinity College, Dublin, now receive the copyright books is 5 & 6 Vict. c. 45. (See COPYRIGHT, vol. vi. p. 318.)[1]

As instances of the variety in practice in different countries, it may be mentioned that in France the Bibliothèque Nationale is entitled to a copy of every book, etc., printed within the dominion of the republic; in Belgium and the Netherlands one copy must be sent to the respective national libraries in order to secure the advantages of copyright; in Spain the Biblioteca Nacional of Madrid enjoys the privilege of one copy; in Portugal two copies are claimed, one by the Bibliotheca Nacional at Lisbon, and one by the Bibliotheca Publica of Oporto; in the United States a copy of every work must be sent to the library of Congress; the Imperial Library at St. Petersburg receives two copies of every book printed in Russia; by the Brazilian law the Biblioteca Nacional of Rio de Janeiro is entitled to a copy of everything published within the municipality; and in Mexico two copies have to be delivered to the National Library.

Authorities.—There have been many books written about library-management; a complete list of those published down to about 1865, with critical notes, is given in Petzholdt's *Bibliotheca Bibliographica* (Leipsic, 1866). Among recent treatises the valuable works of Mr. Edward Edwards—*Memoirs of Libraries* (1859, 2 vols. 8vo), *Free Town Libraries* (1869), *Libraries and Founders of Libraries* (1865), *Lives of the Founders of the British Museum* (1870, 2 vols. 8vo),—should be in the hands of all librarians. Petzholdt's *Katechismus der Bibliothekenlehre* (Leipsic, 1871) is a practical little volume. The report of the Bureau of Education on *Public Libraries of the U. S.* (Washington, 1876, 2 parts 8vo), besides giving an exhaustive account of all the American libraries, also includes a great variety of valuable information on library economy. The six volumes of the *Library Journal* contain much that is useful for practical librarianship; it is a well edited periodical. Petzholdt's *Anzeiger* is of a more bibliographical character. The different publications of the Library Association include a great deal of interesting matter.

TABLES OF THE PRINCIPAL LIBRARIES THROUGHOUT THE WORLD.

In compiling the following tables officials of each of the libraries have been personally applied to, and in most instances the information has been supplied by them. An attempt has been made to give particulars of all libraries of general or special interest in the United Kingdom. As regards those of other countries the list has been usually limited to those of 30,000 vols. and upwards, with a few exceptions. In India and the British Colonies there are few collections of that extent.

The abbreviation L. A. in the United Kingdom signifies that the library is under the Public Libraries' Act; o. b. l. means open by leave.

I. GREAT BRITAIN AND IRELAND.

Name.	Founded.	Special Character and Remarks.	No. of Vols.		To whom accessible.
			Print.	MSS.	
Abbey Tavistock:					
Public Lib.	1799		10,000		Sub.
Aberdeen:					
Free Ch. Coll. L.		Theol., Hist., Rabbin.	20,000		Mem.
Mechanics' Ins.	1824	Gen., Eng. and Fr.	16,000		Mem.
University Lib.		Gen. and Scient.	90,000	400	Mem.
Aberystwith:					
Municipal Free Lib.	1874	L. A.	1,710		Open.
University Col.	1872	Gen., Wales.	3,000		Mem.
Airdrie:					
Free Public L.	1856	L. A.	4,500		Open.
Aldershot:					
Prince Consort's Lib.	1859	Milit. (Privy Purse); also one at Dublin.	4,500		Officers.
Arbroath:					
Public Lib.	1797		13,000		Sub.
Armagh:					
Public Lib.	1771	Foundation L.	17,000	150	Open.
Ashton:					
Mechanics' Ins.	1825		7,500		Sub.
Aston Manor:					
Free Public L.	1877	L. A.	6,258		Open.
Ayr:					
Public Lib.	1870		6,926	8	Sub.
Bangor:					
Free R. Room and Museum.	1873	L. A.	1,500		Open.
Bath:					
Royal Literary and Scientific Inst.	1825	Ref., Sci.; Agriculture.	10,000	30	Sub.
Bebington:					
Mayer Free L.	1866	Polit. and Relig. exc.; maintained by Mr Mayer.	23,000	MSS.	Open.
Bedford:					
Lit. and Scientific Inst.	1832		12,000		Sub.
Belfast:					
Queen's Coll. L.	1849	Gen., Orient.	35,797		Mem. (o. b. l.)
Bilston:					
Free Library.	1873	L. A.; branch reading-room.	3,000		Open.
Birkenhead:					
Free Public L.	1855	L. A.	60,000		Open.
Birmingham:					
Free Library.	18—	Gen., Shakesp., Birmingh.; L. A.; 5 branches.	100,000	200	Open.
Friends' Lib.	1829	Gen.	2,600		Mem.
Lib. (Union St.)	1779	Gen.	45,000		Sub.
Queen's Col. L.	1828	Gen.	2,000		Mem.
Blackburn:					
Fr. L. and M.	1862	L. A.	26,000		Open.
Stonyhurst Col. Library.	1794	Gen.; printed cat. of early Books.	50,000	MSS.	Mem.
Bolton:					
Public Lib.	1853	L. A.; section for subscribers; 2 lending depart's.	46,466		Open.
Bradford:					
Free Public L.	1871	L. A.	32,056		Open.
L. and Lit. Soc.	1774	Gen.	17,500		Mem.
Bridgwater:					
Free Library.	1860	L. A.	2,000		Open.
Brierley Hill:					
Free Library.	1875	L. A.	800		Open.
Brighton:					
Free Library.	1875	Gen., Class., Med., Shakespeare, L.A.	26,000		Open.
Bristol:					
Bristol Baptist College.	1770	Gen., Theol.; incunabula; English Bibles, incl. only known copy of 1st ed. of Tyndale's N. T., and MSS. of Wickliffite translations.	12,000	200	Open.

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[1] In the recent *Report of the Royal Commission on Copyright*, 1878, a recommendation is made that the privilege should in future be granted to the British Museum alone.

Name.	Founded.	Special Character and Remarks.	No. of Vols.		To whom accessible.
			Print.	MSS.	
BRISTOL—*contd.*					
Cathedral Lib.	16th cent	Burnt 1831, except 1000 vols.	1,000		Mem. (o. b. l.).
Free Library.	1613	Gen., Bristol; Acts adopted 1875; 3 branches.	46,000	Few.	Open.
Mus. and Lib.	1772	Gen., Hist., and Top., Chatterton MSS.	50,000	Few.	Sub.
BURSLEM:					
Free Library (Wedgwood Ins.).	1863	Gen., Sci.; L. A.	3,500		Open.
BURY:					
Co-operative Provision Society's Lib.	1860	13 newsrooms; 2 small branch libraries.	11,000		Mem.
CAMBRIDGE:					
Cavendish Coll. Library.	188–	Small.			Mem.
Christ's Coll. L.	1506		18,000	Few.	Mem.
Clare Coll. L.		16th and 17th cent. Lit.	7,500	Few.	Mem.
Corpus Christi College Lib.	14—	Clas., Hist., Theol.; MS. coll. notable.	5,000	484	Mem. (o. b. l.).
Downing College Lib.	1800	Largely Law and Hist.	1,700	30	Mem.
Emmanuel College Lib.		Theol. and Lit.	20,000	250	Mem.
Fitzwilliam Museum Lib.	1816	Art, Archl.; engravings and music.	9,760	159	Mem. of U. (o. b. l.).
Gonville and Caius Coll.	1348	Pr. cat. of the MSS., 1849.	18,500	700	Mem.
Jesus Coll. Lib.			9,500	100	
King's Col. L. *c.*	1441	Gen., Clas., Theol.; 300 Oriental MSS.	17,000	320	Mem. (o. b. l.).
Magdalene Col.		Pepysian Library.			
Newnham Col. Library.	1872	2 branches.	1,240		Mem.
Pembroke Col. Lib.		Pr. cat. in preparation.	14,000	300	
Peterhouse L.	1418	Gen., Theol.	9,000	300	Mem.
Philosophical Library.	1831	Sci. Tran., etc.; based upon Library of Cam. Phil. Soc.	6,000		Mem. and Stud.
Pub. Free Lib.	1853	Gen., Camb., Shakespeare; L. A.; 1 branch.	24,747		Open.
Queen's Col. L. *c.*	1448	Chiefly Clas., Theol.	30,000		Mem.
Ridley Hall Carr. Lib.	1881	Theol.	2,800		Mem.
St. Catherine's College.					
St. John's College Library.	1624	Gen., early prints; pr. cat. of MSS. and rare books.	35,000	500	Mem.
Sidney Sussex College.	1598	Chiefly Theol. and Clas.	5,000	100	Mem.
Taylor Lib.	17—	Math. and Sci.; separately administered.	2,000		Mem.
Trinity College Lib. *c.*	1546	Gen., Theol., Clas.; Hare and Capell collections.	90,000	1,918	Mem.
Trinity Hall Lib. *c.*	1350	Law; orig. desks to which the books were chained.	7,000		Mem.
Union Society.	1816	Gen.	20,000		Mem.
University Lib.	14—	Copyright privil'e.	200,000	5,728	Mem. (o. b. l.).
CANTERBURY:					
Dean and Chapter Library.		Gen., Div., Hist.; Early English Bibles.	9,900	110	Open.
Free Lib. and Museum.	1800	L. A.	4,000		Open.
St. Augustine's College.	1848	Theol., Missions.	15,000	150	Mem.
CARDIFF:					
Free Library.	1862	L. A.; sci. and art school.	14,000		Open by guarantee
CARLISLE:					
Cathedral Lib.			8,500	25	Open; books lent
CHELTENHAM:					
Cheltenham L.	1863	Gen., Sci.	11,265		Sub.
CHESTER:					
Cathedral Lib.		Monastic.	1,100	Few.	Clergy.
Free Public L.	1876	L. A.	10,000		Open.
CHICHESTER:					
Cathedral Lib.	1660	Gen., Clas., Div.; earlier coll. destroyed 1642; cat. pr. 1871.	4,000		Clergy of diocese.
Lib. Society.	1794		6,500		Sub.
CLITHEROE:					
Free Library.	1878	L. A.	3,110		Open.
CORK:					
Queen's Col. L.	1849	Gen., Orient.	25,000		Stud.; lit. inquirers.
Royal Cork Ins.	1807	Gen., Sci., Hist.	14,000		Open to inquirers.
COVENTRY:					
Free Library.	1868	L. A.	22,000		Open.
DARLASTON.					
Free Library.	1876	L. A.	2,269		Residents.
DARWEN:					
Free Public L.	1871	L. A.	8,000	Few.	Open.
DERBY:					
Free Lib. and Mus.	1877	L. A.	13,000		Open.
DEVONPORT:					
Free Public L.	1881	L. A.; mus. in connection.	3,500		Open.
DONCASTER:					
Borough Free L.	1869	L. A.	10,628		Open.
DUBLIN:					
King's Inns L.	1787	Leg., Gen.	58,000	Few.	LawStud., etc.,
King & Queen's Col. of Physns.	1711	Med., Sci.; founded by Sir Patrick Dunn's will.	12,000	Few.	Mem., etc.
Law L., Four Courts.	1816	Law.	9,000		Sub.
Mechanics' Ins.	1838				
National Lib. of Ireland.	1877	Form. by Royal Dub. Soc.; under S. and A. Dep.	85,000		Open by introd.
Pub. L., St. Patrick's.	*t.* W. &M.	Chief. Theol.; little used.	18,000	200	Open by introd.
Royal Coll. of Sci. (Ireland).	1867	Sci.; succeed. Museum of Irish Industry, 1850.	8,500		Open to inquirers.
Royal Coll. of Surg.	1784	Med., Sci.	25,000		Mem.
Royal Dublin Soc.	1731	Trans. and Periodicals; body of L. transf. to Nat. L. of Ireland.	10,000		By introd.
Roy. Irish Acad.	1785	Gen., Ireland.	40,000	1,400	By introd.
Trinity Col. L.	1602	Copyright privilege; cat. print'd.	192,000	1,880	Graduates (o. b. l.).
DUNBLANE:					
Bibl. Leightoniana:	1684 1701	Theology; bequest by Archbishop Leighton.	2,000	MSS.	Clergy; others by payment.
DUNDALK:					
Free Public L.	1858	L. A.	6,000		Open.
DUNDEE:					
Free Lib. and Mus.	1866	Gen.; old Scot. Music; L. A.	35,500		Open.
DURHAM:					
Bishop Cosin's Library.	1669	Chiefly Theol.; little used.	4,456	188	Open; cler. borrow.
Cathedral Lib.		Monastic; pr. cat. of MSS.	15,000	570	(o. b. l.).
University Lib.	1833	Maltby, Routh and Winterbottom bequests.	31,168		Mem. (o. b. l.).
EDINBURGH:					
Advocates' Lib.	1680	Copyright priv.; printed cat.	265,000	3,000	To inquir.
Faculty of Actuaries.	1856	Professional; large col. of pamphlets.	1,200		Mem. and Stud.
Literary Inst.	1872		8,000		Sub.
Mech. Subs. L.	1825		22,500		Sub.
New College Library.	1843	Theological, etc.; cat. pr. 1868.	40,000	200	Stud.
Philosoph. Inst.	1846		30,000		Sub.
Royal Coll. of Physicians.	1681	Medical; cat. pr. 1862.	26,000		Mem.
Royal Medical Society.		Medical; MS. dissertations.	20,000		Mem.
Royal Society Library.	1787	Scientific Trans.; Hume's MSS.	15,300		Mem.
Select Subs. Library.	1800	Gen., Pamph.	31,000		Sub.
Signet Library.	1755	Gen., Law; cat. pr.	65,800		Mem., lit. inquir.
Society of Antiquaries' Lib.		Chiefly Scot. Arch.; Drummond and Riddell MSS.	9,000		Mem.
S. S. C. Library.	1808	Law., Gen. Lit.	12,000		Mem.
Subscription L.	1794		40,000		Sharehol.
United Presby. Coll. Lib.	1847	Main. Theol.; classed cat. pr. 1868.	21,000		Stud. and Ministers.
University Lib.	1580	Drummond, Halliwell-Phillips and Laing coll.	140,000	2,000	Mem.
Watt Inst. and Sch. of Arts.	1825	Chiefly Scientific.	2,500		Stud.
ELY:					
Cathedral Lib.		Monas., Misc.; little used.	6,000		By leave.
EXETER:					
Cathedral Lib.	*ante* 900	Theol. and Hist.	6,000		Clergy only.
Devon. and Ex. Free Lib.	1870	L. A.	12,076		Open.
Devon. and Ex. Institute.	1813		22,000		Sharehol. and Sub.
FORFAR:					
Free Library.	1870	L. A.	4,450		Open.
GALASHIELS:					
Public Library.	1874	L. A.	3,800		Open.

Name.	Founded.	Special Character and Remarks.	No. of Vols.		To whom accessible.
			Print.	MSS.	
GALWAY:					
Queen's College Library.		Gen., coll. course; town council records.	23,000		Mem.; househo. (o. b. l.).
GARTMORE:					
Gartmore Lib.	1871		2,700		Sub.
GLASGOW:					
Anderson's Col.					
(1) Ewing's Mus. Lib.	1878	Music; pr. cat.	5,500		
(2) Manager's Lib.			2,870		
(3) Mechanic. Class Lib.	1808		7,138		Mem.; or by payt.
Coll. of Science and Art.	1823	For use of Stud.	8,000		Stud.; or by payt.
Faculty of Physicians and Surgeons.	1690	Medical, Scientific, Local Arch.; cat. printing.	20,000	50	Med. men; fellows borrow.
Faculty of Procur. (1 br.).	1817	Gen., Law; books lent.	10,861		Mem.
Free Church Coll. Lib.		Theology; N. Test. critic.; Tischendorf's library.	24,000		Mem. and Stud.
Mitchell Lib.	1874	Stephen Mitchell's beq.; Scot. poet.; Glasgow col.	36,000	Few	Fr. pub. ref.
Philosoph. Soc.	1802	Chiefly Scientific.	9,000		Mem.
Stirling's and Glasgow Public Library.	1791	Founded by Stirling's bequest.	50,000		Free ref.; Sub. bor.
University Lib.	15th cent	Also a Divin. Hall Lib. and Hunterian Mus. Lib.	125,000	350	Mem.; lit. inq. by payt.
GLOUCESTER:					
Cathedral Lib.			2,700		
GODALMING:					
Charterhouse School Lib.	1804	Also 11 boarding-house libraries.	10,000		Open to the boys.
GREENOCK:					
Greenock Lib.	1783	Gen.; printed cat.	20,000		Sub.
Mechanics' Ins.	1832		4,000		Sub.
GREENWICH:					
Royal Naval College Lib.	1873	Gen., Sci., Math., etc.	5,000		Staff, Stu.
HADDINGTON:					
Free Library.	1717	Chiefly old books from Gray beq.	3,355		Free.
HALIFAX:					
Mechanics' Ins.	1825		12,000		Sub.
HANLEY:					
Potteries Mech. Institute.	1826	Gen., Local.	7,000		Sub.
HARROW:					
School (Vaughan) Library.	*ante* 1819		8,000	Few.	Open to the boys.
HAWICK:					
Public Library.	1878	L. A.	3,000		Open.
HEREFORD:					
Cathedral L. *c.*	1380	Chiefly Theol. and Hist.; admission difficult.	2,000	230	No rules.
Free Pub. Lib. and Mus.	1872	L. A.	7,018	38	Open.
Permanent L.	1815		7,000		Sub.
HERTFORD:					
Free Library.	1856	L. A.	1,000		
Haileyb'ry College Library.	1868	200 vols. of E. I. Comp.'s lib.	4,000		Upper boys.
HEYWOOD:					
Public Free L.	1874	Lending lib. only; L. A.	6,000		Open.
HIGH WYCOMBE:					
Free Library.	1872	Sup. by J. O. Griffith, Q. C.	2,500		Open.
HORNCASTLE:					
Mechanics' Ins.	1835		3,500		Sub.
HULL:					
Lyceum Lib.	1807		17,000		Sub.
Subscription L.	1775	Cat. printed 1876.	40,000		Sharehol.
INVERNESS:					
Free Public L.		Act adopted 1877.			
IPSWICH:					
Free Library and Museum.	1853	Scientific; ref. lib. only; L. A.	3,000	20	Open.
KEIGHLEY:					
Mechanics' Ins.	1825		7,000		Sub.
KELSO:					
Kelso Library.	1751		3,000		Sub.
KIDDERMINSTER:					
Free Library.	1857	Ref. lib. with news-room.	1,000		Open.
KILMARNOCK:					
Library.	1797		14,000		Sub.
LANGHOLM (Dumfries):	1800	Talfourd bequest.	7,000		Sub.
LEAMINGTON:					
Free Public L.	1857	L. A.	11,249		
LEEDS:					
Leeds Library.	1768		85,000	Few.	Sharehol.
Mechanics' Ins.	1842		20,000		Sub.
Public Library.	1870	L. A.; 21 branches.	109,202		Open.
Yorkshire Coll.	1874	Chiefly Scientific.	2,000		Stud.
LEEK:					
Lit. and Mech. Inst.	1837	Gen., Local.	4,500		Sub.
LEICESTER:					
Free Library.	1869	Gen., Leicest.; L.A.	20,000		Free.
Permanent L.	1779		10,000		Sub.
LEWES:					
Library Soc.	1790	In Fitzroy Memo.	6,000		Sub.
LICHFIELD:					
Cathedral Lib.			6,000	20	Clergy (o. b. l.).
Fr. L. and Mus.	1874	L. A.	5,000		Residents
LINCOLN:					
Cathedral Lib.		Monastic; Theol.; political tracts, Eliz. to Chas. I.	7,400		Clergy of diocese.
LINLITHGOW:					
Mechanics' Ins.	1850		3,000		Sub.
LIVERPOOL:					
Athenæum.	1798		30,000		Propr.
Free Public L.	1852	L. A.; 1 central ref., 2 lend'g branches; printed cat.	R72,406 L43,285		Open.
Lib. (Lyceum).	1758		72,000		Sub.
Medical Inst.	1823	Med., Sci.	8,000		Med. men.
LONDON:					
Admiralty Lib.		Naval and Geog.; cat. pr.	25,000		
Anthropologic. Inst.	1844 -63 1871	Anthropol.; Ethnolog. Soc. 1844, Anthrop. Soc. 1863, united 1871.	4,000		Mem.
Architect. Asso.	1862	Architecture, etc.; lending only.	1,100		Mem.
Athenæum Cl.	1824	Gen. ref., Art, Hist.; pamph.; pr. cat.	48,000		Mem.
Baptist Coll. (Regent's P.)	1810	Theol. and Gen.	10,000		Stud.
Bethnal Green Free Lib.	1875		10,000		Open.
Birkbeck Inst.	1823	Educational.	9,000		Mem.
Brit. and For. Bible Soc.	1805	Chiefly Bibles; cat. pr. 1855.	10,000	280	
British Archæ. Asso.		Archæol., History; many drawings of antiquities.	500		
Brit. Museum.	1753	Universal; many special col.; copyright priv.	1,500,000	50,000 and 45,000 charters.	Free by ticket, over 21.
Charterhouse.					
Chemical Soc.	1841	Chemistry, etc.	8,000		Mem.
Christ's Hosp.					
Colonial Office.		Colonial.	12,000		Officials.
Compositors' L.	1858	Gen., Printing.	8,000		Mem.
Corporation L. (Guildhall).	1824	Gen., Lond.; Dutch library of Austin friars; Clockmaker's Co.	80,000	300	Open.
Dr. William's L.	1716	Mainly Theol.; cat. pr. 1841-78.	30,000	1,000	By introd.
Dulwich Col. L.	1619	Alleyne Papers.	7,000	1,173	Masters and sixth form.
Entomolog. Soc.	1833	Entomology.	2,400		Mem. (o. b. l.).
Foreign Office Lib.		Hist., Dipl., etc.	70,000		Officials.
Geological Soc.	1807	Sci., Geol., Min.; geol. maps; cat. pr. 1880.	17,500		Fell.
Gray's Inn.	*ante* 1555	Law, Gen.; cat. pr. 1872.	13,000	25	Mem.
Guy's Hospital.	1825	Med. and Sci.	5,197		Staff, Stu.
Herald's Col. L.					
Home Office.	1800	Law, Hist.	5,000		Officials.
H. of Commons.	1818	Gen., Law, & Hist.; pr. cat. 1857.	40,000		M. P. s.
House of Lords.		Gen., Law.	30,000		Peers.
Incorpora. Law Society.	1831	Law, Gen. refer.; priv. acts; pamphlets.	30,000	Few.	Mem. and Sub.
India Office.	1801	Mainly Indian and Oriental.	40,000	10,000	Indian Officials (o. b. l.).
Inner Temple.	*ante* 1540	Law, Gen., Petyt, Adolphus, Crawford, and Austin colls.	36,000	600	Mem.
Inns of Court Lending Lib.	1866		1,500		Barrist'rs' clerks.
Inst. of Civil Engineers.	1818	Sci., Engin.; cat. printed.	17,000		Mem. and Stud.
King's College Library.	1830	Marsden, Wheatstone, and Medical Libraries.			Stud.
Lambeth Palace Library.	1610	Theol. and Hist.; books lent by leave.	30,000	14,000	Open.
Lincoln's Inn.	1497	Law, Gen., Lit.; cat. print.; Hale MSS.	45,000	Many	Mem.

Name.	Founded.	Special Character and Remarks.	No. of Vols.		To whom accessible.
			Print.	MSS.	
LONDON—*contd.*					
Linnean Soc.		Linnæus's library apart.			
London Institution.	1805	Hist., Topgr.; cat. print.	70,000	Few.	Sub. (o. b. l.).
London Lib.	1841	Cat. pr. 1875–81.	90,000		Sub.
Medical Soc.	1773	Med. Sci.	11,200	800	Mem.
Meteorol. Office	1855	Meteorology and Magnetism.	6,000		Officials.
Middle Temple.	1641	Law, Miscel.; cat. pr. 1880.	30,000	Few.	Mem.
Mus. of Practical Geology.	1843	Sci., Geol., Min.; cat. pr. 1878.	30,000		By introd.
Notting Hill Fr. Pub. Lib.	1874	Supported by Mr. J. Heywood.	5,000		Open.
Numismat. Soc.	1836	Numismatics.	2,000	Few.	Mem.
Obstetrical Soc.	1859	Obstetrics.	8,000		Med. men.
Oratory, Brompton.	1849	Mainly Theol.	18,000		Mem.
Patent Office L.	1855	Sci.; cat. printing.	80,000		Open.
Pharmaceutic Society.	1841	Phar., Chem., Bot.; branch in Edin. with 700 vols.	8,000	Few.	Mem.
Reform Club.	1841		30,000		Mem.
Royal Acad. of Arts.	1769	Fine Arts; pr. cat. 1877.	5,500		Mem. (o. b. l.).
Royal Acad. of Music.	1822	Music.	850		Mem.
Royal Archæol. Inst.	1845	Antiq., Hist.	8,000	Few.	Mem.
Royal Asiatic Society.	1823	Chiefly Oriental.	12,750	750	Mem.
Royal Astronomical Soc.	1820	Astronomical.	8,000	300	Mem.
Royal Coll. of Physicians.	1525	Medical.	16,000	200	Mem.
Royal Coll. of Surgeons.	1801	Med.; 40,000 pamphlets and dissertations.	42,500		Mem.
Royal Colonial Institute.	1869	Colonial, Indian.	2,000		Fell. (o. b. l.).
Roy. Geographical Society.	1832	Geograph., Maps; cat. pr. 1881.	Over 20,000		Fell. (o. b. l.).
Royal Historical Society.	1875	Hist.	2,000		Fell.
Royal Inst. of Brit. Arch.	1834	Architecture; also a loan coll.	6,700		Mem. (o. b. l.).
Royal Institution.	1803	Ref.; classified pr. cat.	40,000	Few.	Mem.
Royal Med. and Chirur. Soc.	1805	Med., etc.; cat. pr. in 3 vols. 1879.	82,000	Few.	Fell.; on introd.
Royal Society.	1665	Sci.; trans. and periodicals.	40,000		Fell.
Roy. Soc. of Lit.	1820		8,000		Mem.
Roy. Unit. Service Instit.	1831	Milit. and Naval; cat. pr. 1865.	20,000	Few.	Officers of A. and N.
Russell Instit.	1806		17,500		Sub.
Sac. Harmonic Society.		Music; pr. cat.	4,851		By leave.
St. Bartholomew's Hosp.	1667	Med., Gen.; new lib. built 1870.	8,000		Stud.
St. Paul's Cath. Library.		Theol.; pamphlets.	8,700		Cath. body
St. Paul's Sch.	1670	Milton edns. and edns. of Lily's gram.	8,300	Few.	Masters and 8th class.
St. Thomas' Hospital.		Med.	5,000		Stud.
Sion College.	1629	Theol., Hist.; interleaved Bodleian cat. in use.	50,600	Few.	London clergy by sub.
Sir J. Soane's Museum.					
Society of Antiquaries.	1707	Antiq., Topog.	20,000	500	Fell.
So. of Bib. Arch.	1870	Bibl. Archæology.	2,000		Mem.
So. of Telegraph Engineers.	1876	Electric. and Magnetism; form. by Sir F. Ronalds; cat. pr. 1880.	8,000		Open.
So. Kensington Museum.					
(1) Educational Lib.	1857	Education; cat. pr.	42,190		Teachers, Stud., Sub.
(2) Nation. Art Lib.	1852	Art; drawings, etc.	56,000		Do.
(3) Dyce Lib.	1869	Gen.; Eng. Drama; bequest of Rev. A. Dyce.	14,500	MSS.	Do.
(4) Forster L.	1876	Gen., Hist., Antiq., etc.; beq. of John Forster.	19,000	MSS.	Do.
South London Free Lib.	1878	Newsroom.	2,000		Open.
Statistical Soc.	1834	Statist.	10,000	Few.	Mem.
University Col.	1828	Chiefly Clas., Sci., Med.; Chinese, Icelandic, Math., and Dante col.	100,000		Stud.; oth. by introd.
Univ. of Lond.	1837	Grote and De Morgan coll.	11,000		Mem. (o. b. l.).
Victoria Institute.	1855	Theol.	800		Mem.
LONDON—*contd.*					
War Office.		Milit., Topogr.; MS. records.	25,000		Officials.
Westminster—					
Free Pub. L.	1857	L. A.; 1 branch.	13,527		Open.
Dean and Ch. Lib.		Theol., History.	11,000		Chapter.
Working Men's Coll.	1854	Chiefly Scien. and Hist.	4,360		Mem.
Zoological Soc.		Zoological.	9,000	25	Mem.
LYNN:					
Stanley Lib.	1854	Founder 15th Earl Derby.	17,000		Sub.
MACCLESFIELD:					
Free Library.	1876	L. A.	10,000		Open.
MADELEY:					
Free Library.		L. A.			
MAIDSTONE:					
Mus. and Pub. Library.	1858	Gen. ref.; L. A.	10,000		Open.
MANCHESTER:					
Athenæum L.	1835	Lib. partly burnt in 1873.	18,511		Sub.
Cathedral Lib.	1869	Mainly Theol.	500	Few.	Cath. cler.
Chetham's Lib.	1653	Chiefly older Lit.; Popery tracts; Halliwell col.	40,000	800	Open.
Free Pub. Lib.	1852	Central ref. L. and 6 branches; pr. cat.	R65,000 L85,000	Few.	Open.
Grammar Sch.			5,000		Boys.
Lancashire Indep. Coll. L.	1816	Chief. Theol.	11,000	20	Stud. (o. b. l.).
Mech. Inst.			14,500		Mem.
Medical Soc. L.	1834	Medical; at Owens Coll.	24,000		Sub.
Owens Coll. L.	1851	Coll. Course.	81,000	Many	Stud. (o. b. l.).
Portico Lib.	1804	Many pamphlets.	30,000		Sub.
Radford L. (St. Mary's Hos.)	1853	Med., Obstet.; pr. cat. 1877.	3,500		Staff.
MARLBORO' COL.:					
Adderley Lib.	1848		7,400		5th & 6th forms.
MAYNOOTH COL.	1795	Chief. Cath. Theol.	40,000	Few.	Stud. (o. b. l.).
MIDDLESBORO':					
Free Library.	1871	L. A.; one branch reading-room.	9,500		Open.
NEWCASTLE-ON-TYNE:					
Lit. and Philosoph. Soc.	1793	Gen. ref.; pr. cat.	60,000		Sub.
Public Library.	1874	L. A.; new building erecting.	25,000		Burgesses and Resi.
NEWPORT:					
Free Library.	1870	L. A.; also art sch.	6,784		Resi.
NORTHAMPTON:					
Free Library.	1876	L.A.; also mus. and schools of art and science.	11,000		Resi.
NORWICH:					
Cathedral Lib.		Monastic; chiefly Div.	5,700		Dioc. cler.
Free Library.	1854	Gen., Local; L. A.	6,000		Open.
Norfolk and Norwich Lit. Inst.					
Public Library.	1784	Gen., Clas.	45,000		Sub.
NOTTINGHAM:					
Free Pub. Lib.	1867	Gen., Local (Byron); L. A.; two branches.	26,000		Open.
OSCOTT:					
St. Mary's Coll. Lib.	1839	Largely Theol. and Clas.; purchased by Bp. Walsh.	20,238	70	
OXFORD:					
All Souls Lib.	1443	Gen., Law; Codrington bequest, 1710.	40,000	800	Grad, etc.
Balliol Coll. L.	15th cent	Undergrad. merged with Coll. Lib.			
Bodleian Lib.	1602	Copyright priv.	400,000	30,000	Grad. (o. b. l.).
Brasenose Coll. Lib.	*ante* 1520	Undergrad. Lib. of 1000 vols.	12,000		Fell. (o. b. l.).
Christ Church Library.		Div., Clas., Top.; Morris collect.; Wake MSS.	83,000	337	Mem. (o. b. l.).
Corpus Coll. L.					
Exeter Coll. L.	1314	Also an undergrad. lib.	25,000		Fell. (o. b. l.).
Hertford Col. L.					
Jesus Coll. L. c.	1621	Also an undergrad. ("Meyrick") lib.	7,000	141	Fell. (o. b. l.).
Keble Coll. L.	1870	Chiefly Theol.; Keble MSS.	8,600	10	Mem.
Lincoln Coll. L.		Theol.	15,000		
Magdalen Coll. Lib.	1458		22,500	250	Fell. (o. b. l.).
Merton Col. L. c.	1370	Has lately specialized in mod. hist. (foreign).	12,000	350	Mem. (o. b. l.).

Name.	Founded.	Special Character and Remarks.	No. of Vols.		To whom accessible.
			Print.	MSS.	
OXFORD—*contd.*					
New Coll. Lib.	1386	Gen., Clas., Theol.	17,000	350	Mem.
Oriel Coll. Lib.		Compar. Phil. and Myth.		82	
Pembroke Coll. Lib.			8,000		
Public Library.	1854	L. A.	7,000		By guar.
Queen's Coll. L.	1400	Gen. Theol. Hist.; undergrad. reading-room.	50,000	400	Fell. (o. b. l.).
Radcliffe Lib.	1749	Sci. and Med.; now at Mus.	80,000		M. of Univ
St. Edmund Hall.		Patristic Lit.	Small.		Mem.
St. John's Coll. Lib.			20,000	210	Fell. (o. b. l.).
Taylor Inst. L.	1848	Mod. Europ. Lit.; Dante Lit.; Masarinades; Luther pamphlets.	80,000	110	M. of Univ (o. b. l.)
Trinity Coll. L.	1554	Also an undergrad. lib.			Fell., etc. (o. b. l.).
Unattached Stud. Lib.	1872	Stud. Lib.	2,000		Stud. by fee.
Union Society.	1836		17,000		Mem.
Univ. Coll. Lib.					
Wadham Coll. Lib.	1613	Coll. on Bot. and Spanish Reformers (Wiffen).	16,000		
Worcester Coll. Lib.	1714	Chiefly Clas. and Theol.; specialties in classical archæology.	23,000		Resident M. A.'s.
PAISLEY:					
Free Public L.	1870	L.A.; mus., art galleries, and observatory.	19,000	160	Open.
PEEBLES:					
Chambers' Ins.	1859	Founder Dr. W. Chambers.	15,000		Sub. only.
PENZANCE:					
Public Library.	1818		15,400		Sub.
PERTH:					
Mechanics' L.	1823	Gen., Local; burnt 1869.	7,000		Sub.
Perth Library.					
PETERBOROUGH:					
Cathedral Lib.		Monastic; mainly Theol.	4,000		By introd.
PLYMOUTH:					
Free Public L.	1876	Gen., Dev. and Corn. Coll.; L. A. (1871).	15,000		Open.
Proprietar. and Cottonian L.	1820	Cottonian Mus. and Lib. annex. 1853.	16,084		Proprie. and Sub.
PORT-GLASGOW:					
Public Library.	1798	Closed 1868; reop. 1872.	2,500		Sub.
PRESTON:					
Free Public L.	1879	Harris beq.; L. A.	10,000		Open.
Dr. Shepherd's Library.	1762	Ref.; bequeathed by Dr. Shepherd to town.	11,622	54	Ord. from alderman.
READING:					
Free Library.	1875	Not under L. A.; A. recently adopted, however.	6,000		Open.
RICHMOND:					
Free Public L.	1881	L. A.	7,000		Resi.
Wesleyan Theological Ins.	1843	Chief Theol.	14,000		Staff and Stud.
RIPON:					
Minster Lib.	1624	Misc.	5,840		Clergy (o. b. l.).
ROCHDALE:					
Equitable Pioneers' Society.	1849	Central Lending L. and 17 newsrooms, each with small ref. lib.	14,475		Mem.
Free Public L.	1872	Gen., Local Lit.; L. A.	30,175		Open.
ROCHESTER:					
Cathedral Library.		Misc.; printed cat.	1,100		Dioc. Cler.
ROSSALL:					
School Library.					
ROTHERHAM:					
Free Library.	1880	L. A.	3,200		Inhabit.
RUGBY:					
School Library.	*ante* 1818	Temple reading-room, 1879.	5,000	Few.	Masters & Boys.
ST. ANDREWS:					
University Lib.	1612	Includes the three college lib. (1455, 1512, 1537).	90,000	200	Mem. (o. b. l.).
ST. HELEN'S:					
Free Library.	1854 1877	Gen., Local; L. A.	6,000	Few.	Open.
SALFORD:					
Royal Mus. and Library.	1849	L. A.; 4 branches.	70,000	150	Open.
SALISBURY:					
Cathedral Lib.	11th cent	Chiefly Theol.; pr. cat.	4,877	187	Open.
SHEFFIELD:					
Free Lib. and Mus.	1855	L. A.; 3 branches.	66,000		Resi.
SHREWSBURY:					
School Library.		Older Lit.	5,000	Few.	Masters (o. b. l.).
SMETHWICK:					
Free Library.	1876	L. A.	4,036		Open.
SOUTHAMPTON:					
Hartley Inst.	1862	Ref.; coll. of old French lit., med., clas.	18,000	Few.	Sub.; pub. in eveng.
SOUTHPORT:					
Atkinson Free Library.	1875	L. A.; 1 branch.	10,850		By guar.
SOUTH SHIELDS:					
Public Library.	1871	L. A.; 1 br. newsroom.	18,250		Open.
STAFFORD:					
William Salt L.	1872	Gen. ref. Archæol.; Staffordshire coll.	7,500	Numerous.	Open.
STOCKPORT:					
Free Public L.	1875	L. A.	16,400		Open.
STOKE-UPON-TRENT:					
Free Library.	1878	L. A.; also a Mus.	6,186		Open.
SUNDERLAND:					
Public Free L.	1862	L. A.	10,000		By guar.
SWANSEA:					
Public Library.	1874	Gen. ref., Welsh Lit.; L. A.; 3 br.; Rowland Williams beq.	26,500	20	Open.
Royal Inst. of South Wales.	1835	Gen., Wales; printed cat.	13,000	Few.	Sub.
THURSO:					
Free Library.	1875	L. A.; Robert Dick's coll.	2,500		Resi.
TRURO:					
Bishop Phillpott's Lib.		Theol.	5,000		Dioc. Cler. or Sub.
Cornwall Lib.	1792		7,000		Sub.
Royal Institute of Cornwall.	1818	Sci. and Archæol.; also Mus.	1,750		Mem.
TYNEMOUTH:					
Free Library.	1868	L. A.	19,083		By guar.
WALSALL:					
Free Library.	1859	L. A.; 1 branch.	10,850		Open.
WARE:					
St. Edmund's College Lib.	1794	Gen., Theol.; in 1869 many books removed to St. Thomas's Seminary, Hammersmith.	20,000		Mem.
WARRINGTON:					
Museum.	1848	Gen., Local; L. A.	18,000	100	Sub. for lend. lib.
WARWICK:					
Free Library.	1866	L. A.	8,000		Open.
WEDNESBURY:					
Free Library.	1878	L. A.	7,000		Open.
WELLS:					
Cathedral L. *c.*	1660	Chiefly Theol.	4,000	Few.	Open by L.
WESTBROMWICH:					
Free Library.	1874	L. A.	12,000		Open.
WIGAN:					
Free Public L.	1877	Gen., Mining; L. A.	27,000	1	Open.
WILLENHALL:					
Public Library.	1875	L. A.; lending library only.	3,200		By guar.
WINCHESTER:					
Cathedral Lib.	1684	Chiefly Theol.	4,500	15	Dioc. Cler.
College, Moberley Library.	1867		3,750		Boys.
Public Library.	1877	L. A.; old lib. existed in Guildhall before.	2,170		Resi. by guarant.
WINDSOR:					
Eton College L.	15th cent	Chiefly Clas. and Theol.	23,000	100	Masters; Par. Cler.
Eton School L.	1821		8,000		Boys.
Royal Library.	By Wil. IV.	Prints, etc., coll. by Geo. III., and Raphael coll. of Prince Consort.	70,000		
WOLVERHAMPTON:					
Free Library.	1869	L. A.; Field Club and Winter Lectures.	24,500		
WORCESTER:					
Cathedral Lib.	1640	Chiefly Theol.	4,065	251	Dioc. Cler. (o. b. l.).
Public Library.	1880	Gen., Sci.; Worcester; L. A.; Hastings Mus.	12,000		Non-resi. by sub.
WREXHAM:					
Free Library.	1879	L.A.; reading-room and ref. lib.	525		Open.
YORK:					
Minster Lib.		Monastic; pr. cat.	11,000	300	Open by L.
Subscription L.	1794	Gen., Local.	40,000		Mem.

II. FRANCE.

Name.	Founded.	Special Character and Remarks.	No. of Vols.		To whom accessible.
			Print.	MSS.	
Abbeville:					
Bibliothèque de la Ville.	1685	Pr. cat. preparing.	40,000	Few.	Open; bks. lent.
Agen:					
Bibliothèque.		Largely monastic; cat. to be printed.	30,000	Few.	Open.
Aix:					
Bibliothèque Méjames.	1786 1810	Méjames bequest of 80,000 vols.	150,000	1,100	Open; bks. l. to prof.
Ajaccio (Corsica):					
Bibliothèque.	1800	Founded by Lucien Bonaparte.	30,000	200	Open; bks. lent by l.
Amiens:					
B. Communale.	1791	Printed cat.	70,000	300	Do.
Angers:					
B. Communale.	1791	Gen., Anjou; two popular libraries in connection.	44,000	1,500	Open.
Arras:					
Bibliothèque.			40,000	1,200	
Auch:					
B. Communale.	1793		15,000		Open.
Auxerre:					
Bibliothèque.		Gen., Local.	40,000	224	Open; bks. lent by l.
Avignon:					
Bibliothèque.	1791		93,000?	1,200	
Beaune:					
B. de la Ville.	1794		33,000	500	Do.
Besançon:					
B. de la Ville.	1694		130,000	1,800	Open; b. l.
Blois:					
B. Communale.	1792 1812		30,000	Few.	Open; bks. lent by l.
Bordeaux:					
Bibliothèque.	18—	Succeeded lib. of Acad. estab. in first half of 18th cent.; cat. partly prepared.	190,000	1,500	Open.
Boulogne:					
B. Communale.	1798		50,600	90	Open.
Bourg:					
B. Communale.	1790	Gen., Theol., Hist.	30,000	60	Op.; bks. l.
Bourges:					
B. Publique.	1792	Largely older lit.	25,000	327	Op.; bks. l.
Brest:					
B. de l'École de Médecine Navale.	1802	Med., Sci.	15,200		Med. staff.
Caen:					
Bibliothèque.	1809	Succeeded the Univer. L. founded 1431.	80,000	524	Open.
Cambrai:					
Bibliothèque.	1791	Rich in monastic coll.	40,000	1,300	
Carpentras:					
Bibliothèque.		Gen., Local; Peiresc MSS.	25,000	1,000	Open.
Chalons-sur-Marne:					
Bibliothèque.	1800		30,000	30	
Chartres:					
B. Communale.	1794	Rich in early MSS. and books.	65,000	1,673	Op.; bks. l.
Chaumont:					
Bibliothèque Publ.	1790	Gen., Local; rich in incun.	32,000	300	Open.
Clermont-Ferrand:					
Bibliothèque.			40,000	400	
Dijon:					
B. Publique.	1708	Rich in Hist.	79,427	1,106	Open.
Dole (Jura):					
Bibliothèque.	*ante* 1786	Printed cat.	27,353		Open.
Douai:					
B. Publique.	1789	Rich in theology and law.	100,000	1,297	Open.
Épinal:					
Bibliothèque.			30,000	220	
Grenoble:					
Bibliothèque.	1772	Gen., Local.	170,000	7,000	Op.; bks. l.
Havre:					
B. Municipale.	1790		36,121	59	Do.
La Rochelle:					
B. de la Ville.	1604 1797	Gen., Hist., Local.	30,646	569	Do.
Laval:					
B. Municipale.	1822		23,000		Open.
Le Mans:					
Bibliothèque.			30,000?	700	
Lille:					
B. Municipale.	1790	Gen., Local; pr. cat.	75,000	300	Op.; bks. l.
Lyons:					
B. de la Ville.	1530		120,000	1,500	
B. du Pal. des Arts.	1806	Sci. and Art; printed cat.	65,600	46	Open.
Marseilles:					
Bibliothèque.	1796	Gen., Provence.	96,000	1,530	Open.
Montpellier:					
B. de la Ville.	179–	Printed cat.	30,000		Open.
École de Médecine.			40,000	600	By leave.
Nancy:					
Bibliothèque.	1790	In old univ. buildings.	62,221	717	Open.
Nantes:					
Bibliothèque.	1588	Gen., Local.	150,300	200	Open.
Nice:					
B. Municipale.	1790		46,000	Few.	Op.; bks. l.
Nîmes:					
Bibliothèque.	Aft. 1792	Printed cat.	75,000	200	Open.
Orléans:					
B. Communale.	1714	Gen., Orléans.	50,480	649	Op.; bks. l.
Paris:					
B. de l'Arsenal.	1790		200,000	6,000	Open
B. du Corps Législ.	1793	Law, etc.	50,000		
B. de la Cour de Cassation.		Law and History; partly burnt, 1871.	30,000	Many	Judges (o. b. l.).
B. du Dépôt de la Guerre.		Military.	30,000	Many	Open by l.
B. du Dépôt de la Marine.		Mainly Sci.	36,000	258	Open by l.
B. de l'Éc. Nat. de Beaux Arts.	1648	Fine Arts, Archæol.; pr. cat.	15,000		Stud. (o. b. l.).
B. de la Faculté de Médecine.	1733	Commentaries of deans of fac. 1324–1786.	55,000		Open.
B. de l'Institut.	1759	Gen. Sc. and Lit.	100,000		Open by l.
B. Mazarine.	1643	Public since 1688.	150,000	6,000	Open.
B. du Muséum d'Hist Nat.		Zool.; over 7000 draw. on vellum.	30,000		
B. Nationale.	1595 1737		2,290,000	80,000	Open.
B. Polonaise.	1838	Poland, etc.	50,000		Open.
B. Ste. Geneviève.	1624	Public since 1790.	120,000	2,392	Open.
B. de l'Univer. (Sorbonne).		Class., Theol., Sci., Hist.	125,000	1,000	
B. de la Ville.	18th cent	Paris; entirely burnt in 1871.	60,000		Open.
Poitiers:					
Bibliothèque.			30,000	420	
Quimper:					
Bibliothèque.	1794		30,380	120	Op.; bks. l.
Rennes:					
B. de la Ville.	1733 1803	Cat. printed 1830.	48,289	221	Open.
Rheims:					
B. de la Ville.	1809	Cat. partly printed.	60,000	1,300	Op.; bks. l.
Rouen:					
B. Publique.	1792 1809	Printed cat.; card cat.	122,500	2,500	Open; bks. lent.
Soissons:					
B. Publique.	1794	Much older lit.	30,000	300	
Toulouse:					
B. Publique.	1804	Gen., Local.	70,000		Open.
Tours:					
Bibliothèque.	1791	Gen., Touraine; pr. cat. of MSS.	50,000	2,000	Open.
Troyes:					
B. Communale.	1651	Jansenist coll.	100,000	3,000	Open.
Verdun:					
B. Municipale.			30,000	436	Op.; bks. l.
Versailles:					
B. Municipale.	1799	Rich in fine bindings; cat. partly pr.	80,000		Open.

III. GERMAN EMPIRE.

Name.	Founded.	Special Character and Remarks.	No. of Vols.		To whom accessible.
			Print.	MSS.	
Aix-la-Chapelle:					
Stadt-Bibliothek.	1656	Cat. pr. 1834.	30,000	120	Strangers by guar.
Altenburg:					
Herzogl. Landes-B.	1686	Cat. pr. 1872.	50,000		Open.
Amberg:					
Oberpfälz. Provinzial-B.	1805	Formed from Monastic coll.	31,000	200	Open.
Arolsen:					
Fürstl. Hof-Bibl.			30,000		By leave.
Augsburg:					
K. Kreis-u. stadt-B.	1537	Largely fr. Monastic colls.; accessions almost entirely in history.	150,000	300	Students.
Bamberg:					
Königliche B.	1611		185,000	3,200	Strangers by guar.
Berlin:					
Königliche B.	1661	Copy privilege.	750,000?	16,000	Op.; bks. l.
Kö. Kriegsakad.	1765	Milit., Hist., Geogr.	65,000	52	
Kö. Obertribunal.			35,000		
Kö. Pr. Generalstabs-b.		Military; pr. cat.	52,000		Staff and Officers.
Kö. Statistisches Bureau.	1810	Cat. printed, 2 vols. 4to, 1874–79.	32,500	400	

Name.	Founded.	Special Character and Remarks.	No. of Vols.		To whom accessible.
			Print.	MSS.	
BERLIN—*contd.*					
Universitäts-B.	1831	Copy privilege.	200,000	358	Stud. by guar.
BONN:					
Universitäts-B.	1818	Printed cat. of MSS.	250,000	974	Non-priv. persons by guar.
BREMEN:					
Stadt-B.	1660	Gen., Local.	100,000		Citizens; others by guar.
BRESLAU:					
Kö. u. Universitäts-B.	1811	Strongest in Hist. and Theo.; 250,000 pamphlets, etc.	350,000	4,000	Students; others by guar.
Schles. Gesellsch. f. Vaterl. Cultur.	1810	Nat. Sci., Med.	50,000		Members; others by guar.
Stadt-B.	1865	Formed from several libs. of 16th and 17th cent.	200,000	2,400	Open.
CARLSRUHE:					
Grossh. Hof-u. Landes-B.		Accessible to the public since 1766.	134,400	3,000	Open; bks. lent.
CASSEL:					
Landes-B.	1580	Gen., Hesse.	165,000	1,500	Open.
COBURG:					
Herzogl.-B.	Aft. 1699		50,000	350	All educa. persons.
COLOGNE:					
Gymnasium am Marzellan.	1804		37,500	300	Open.
Stadt-B.	Re-est. 1880	Sci. and Pop.; existed earlier with the town archives.	36,000	500	Open; books lent out.
COLMAR:					
Stadt-B.	1791		75,331		Open.
CONSTANCE:					
Wessenberg'sche Stadt-B.	1800		40,000		Open.
DANTZIG:					
Stadt-B.	1580	Formerly learned; now general.	88,000	Many	Open.
DARMSTADT:					
Grossh. Hof-B.	1817	Med. and Jur. Diss.; music.	500,000	3,000	Open; bks. lent.
DESSAU:					
Herzogl. B.	1820		70,000	Some.	
DETMOLD:					
Fürstl. Landes-B.	1824	Formed out of earlier colls.	50,000	100	All educa. persons.
DILLINGEN:					
K. Kreis-u. Studien-B.	1554	Earlier library of a university; strong in Jesuit lit.	75,000	200	Open by guar.
DONAUESCHINGEN.					
Fürstl. Hof-B.	1752	Gen., Hist., Old German Lit.; formed fr. earlier colls.; pr. cat. of MSS.	90,000	1,000	Open.
DRESDEN:					
Kö. Oeffentliche-B.	End 16th cent		350,000	6,500	Open; books lent.
Prinzl. Secundogenitur-B.	1767	Saxonica; Dante (pr. cat.).	50,000	300	By introd.
DUSSELDORF:					
Kö. Landes-B.	1770	Gen., Theol., Hist.	85,000	400	Op.; bks. l.
ERFURT:					
Königl. B.	c. 1400	Formerly the Univer. L.	60,000	1,000	Open.
ERLANGEN:					
Universitäts-B.	1743		147,000	1,900	Op.; bks. l.
FRANKFORT:					
Senckenbergische B.	1763 1840	Sci., Med.; growing fast.	40,000		Open.
Stadt-B.	1484		150,000	300	Op.; bks. l.
FREIBURG IN BREISGAU:					
Universitäts-B.		Earlier coll. soon after 1460.	270,000	500	Open.
GIESSEN:					
Universitäts-B.	1612	Pr. cat. of MSS., 1840–62.	160,000	1,370	Open.
GOTHA:					
Herzogliche-B.	1647		245,000	6,000	Open.
GOTTINGEN:					
Kö. Universitäts-B.	1737	Also the Lib. of the Göttinger Ges. d. Wissen.	400,000	4,800	Open by guar.
GREIFSWALD:					
Kö. Universitäts-B.	1456		120,000	812	Open.
HALLE (Wittenberg):					
Universitäts B.	1699	History predominates; also L. of D. Morgenl. Gesells.	220,000	Few.	
HAMBURG:					
Commerz-B.	1735	Commercial; Hamburg coll. 10,000 vols.; pr. cat.	70,000		Op.; bks. l. by introd.

Name.	Founded.	Special Character and Remarks.	No. of Vols.		To whom accessible.
			Print.	MSS.	
HAMBURG—*contd.*					
Stadt-B.	1610		350,000	5,500	
HANOVER:					
Königl. Oeffentl. B.	1649	Brunswick and Leibnitz MSS.; pr. cat. of MSS.	170,000	4,000	Books lent by guar.
Societäts-B.	1789		45,000		Members.
Stadt-B.	15th cent	Exclusive of Fiction; rich in Reformation theol.	80,000	250	Open.
HEIDELBERG:					
Universitäts-B.	1386	130,000 pamphlets.	300,000	4,700	Op.; bks. l.
HILDESHEIM:					
Beverinsche B.	1678	Belles Lettres excl.	83,000	88	Open.
JENA:					
Universitäts-B.	1502	Removed 1548 from Wittenberg.	180,000		Op.; bks. l.
KIEL:					
Universitäts B.	1665		180,000	2,000	Op.; bks. l.
KÖNIGSBERG:					
Königl.-und Universitäts-B.	1534 1544	25 books lent at one time.	184,000		Stud.; oth. by guar.
KÖRNIK (Posen):					
B. Kórnicka.	c. 1828	Polish Lit.; founded by Graf Dzia-tynski.	50,000	1,200	Open by leave.
LEIPSIC:					
Stadt-B.	1677	Politz Lib. (pr. cat.).	100,000	1,500	Op.; bks. l.
Universitäts-B.	1409	Books lent.	500,000	4,000	Mem.
LÜBECK:					
Stadt-B.	1620	Largely Hist.	100,000	250	Op.; bks. l.
LÜNEBERG:					
Stadt-B.	1555		32,000	350	Open.
LUXEMBURG:					
Bibliothèque.	1798	Reference.	80,000		Students.
MAIHINGEN:					
Oettingen-Wallersteinsche B.	1812		100,000	1,507	Books lent.
MAINZ:					
Stadt-B.	1477 1804	Over 4000 incunabula; several libs. combined.	150,000	1,200	Open; bks. lent.
MANNHEIM:					
Oeffentliche B.	1870	Based upon Kurpfälz. Hofb., est. 1761.	40,000		Open.
MARBURG:					
Universitäts-B.	1558	Rich in dissertations.	140,000	109	Mem. of un.
MEININGEN:					
Herzogl. Oeff. B.	1680	Includes engravings, etc.	160,000		Books lent.
METTEN:					
Benediktiner Kloster-B.	1830	Existed earlier with the convent.	60,000	250	Mem. (o. h. l.).
METZ:					
B. Municipale.	1811	Theol., Sci., Local; pr. cat. of MSS. and incunabula.	80,000	1,664	Open; bks. lent.
MUNICH:					
Benedikt. Stift. S. Bonifaz.	1850		80,000	150	Open to scholars.
Kö. Hof-u. Staats-B.	16th cent	Besides over 3600 music MSS.	1,000,000	26,000	Open.
Universitäts-B.	1472		322,800	1,744	Mem. (o. h. l.).
MÜNSTER:					
Kö. Paulinische B.	1588	Bibliotheca Fürstenbergica separate.	122,175	808	Stud., etc. (o. h. l.).
NUREMBERG:					
Germanisches Nat.-Mus.	1852	Hist. of Germ. to 1650, Art.	90,000		Books lent.
Stadt-B.	1445	Gen., Norica.	50,000	1,012	Op.; bks. l.
OLDENBURG:					
Grosherzogs. Oeff. B.	1792		100,000		Open.
PADERBORN:					
Theodorianische B.	1618	Earlier Univer. Lib.	80,000	Some.	Teachers and Stud.
PASSAU:					
Kö. Kreis-u. Studien-B.	1612	Theol., Hist.; formerly a Jesuit L.	33,276	121	Open to Stud.
RATISBON:					
Fürstl. Thurn-u. Taxissche-B.	1775		40,000		Open by leave.
Kö. Kreis-B.	1430 1877	Ratisbon coll.; Reformation Lit.	35,253		Open.
ROSTOCK:					
Universitäts-B.	Aft. 1419	Gen., Mecklenburg	140,000	800	Open by guarant.
RUDOLSTADT:					
Oeff. B.		Gen., Local.	63,000	Few.	
SCHWEIDNITZ:					
Gräfl. v. Hochbergsche B.	17—		40,000	1,300	Open.
SCHWERIN:					
Regierungs-B.	17—		30,000		Open.
STRALSUND:					
Raths-B.	1709	Pr. cat.; chief access. Hist.	60,000	400	Open.

Name.	Founded.	Special Character and Remarks.	No. of Vols.		To whom accessible.
			Print.	MSS.	
Strasburg:					
Kath. Seminar.		Theol.	80,000		
Stadt-B.	1872	Gen., Local; lib. burnt 1870.	56,000	250	Open.
Universitäts-u. Landes-B.	1871	Lib. burnt 1870.	518,000		Open.
Stuttgart:					
Centralstelle für Gewerbe u. Handel.		Also an art lib. of 2700 vols.	50,000		Open; bks. lent.
K. Oeffentl. B.	1765	Bible coll. (7200 v.).	425,000 Nos.	3,800	Open.
Treves:					
Stadt-B.	1815		80,000	2,800	Open.
Tübingen:					
Kö. Universitäts-B.	1547	Classed cat. print'g.	285,000	3,800	Mem. (o. b. l.).
Ulm:					
Stadt-B.	1448 1576	Ulm coll.	49,624 works	Incl. MSS.	Open.
Warmbrunn:					
V. Schaffgotsch Freistandesherrl. B.		Gen., Siles.; founded by Graf v. Schaffgotsch.	50,000	Some.	Open.
Weimar:					
Grossherzogliche B.	17th cent	Has large dramatic coll.	180,000	2,000	Open; bks. l.
Wernigerode:					
Stolberg-W. B.	1870	Largely Theol.; public since 1746.	87,163	1,100	Open by introd.
Wiesbaden:					
Kö. Landes-B.	1814	Gen., Nassau.	Over 100,000		Open.
Wolfenbüttel:					
Herzogliche B.	Bef. 1589	MSS. and early books of Reform times.	300,000	9,000	Open.
Würzburg:					
Universitäts-B.	c. 1582		300,090	2,000	Op.; bks. l.

IV. AUSTRIA-HUNGARY.

Name.	Founded.	Special Character and Remarks.	No. of Vols.		To whom accessible.
			Print.	MSS.	
Admont:					
B. der Abtei.	1074	Theol., Hist.	80,000	966	Students.
Brünn:					
Franzens Mus.-B.	1818		31,000	1,176	Students.
Buda-Pest:					
Széchényi'sche Landes-B.	1802	Hungarian; founded by Graf F. Széchényi.	400,000	63,000	Open.
Ungar. Akad. d. Wissenschaften.	1826	Founded by the Grafen Teleki.	90,000		Mem. (o. b. l.).
Universitäts-B.	1635 1780	60,000 dissertations	186,000	1,000	Open; books lent
Cracow:					
Universitäts-B.	1364	Re-est. in 1400.	201,881	4,781	Open.
Göttweih:					
Benediktiner-Stifts-B.	11th cent	Many incunabula; val. MSS.	43,887	1,100	Mem.
Graz:					
Landesreg-B.	1811		68,594		
Universitäts-B.	1776	Formed of monastic libs.	120,000	2,005	Op.; bks. l.
Hermannstadt:					
National-B.		Founded by Graf Kemeny.	60,000	700	
Hohenfurth:					
Cisterc.Stifts-B.	1756	Many incun.; val. MSS.	39,010	600	Op. by l.
Innsbruck:					
Universitäts-B.	1745	Gen., Tirolensia.	92,000	1,027	Op.; bks. l.
Klagenfurt:					
Studien-B.	1563 1784		40,000	250	Open.
Klosterneuburg:					
Chorherren-Stifts-B.	1107		55,000	1,400	
Königswart:					
F. Metternich-Winneberg'sche-B.		Attached to the Mus.; formerly in Vienna.	35,000		Open.
Kremsmünster:					
Benedikt-Stifts-B.	1012	Also a scien. lib. of 9000 vols.	50,000	1,800	Mem. (o. b. l.).
Laibach:					
Studien-B.	1791	Gen., Slavica; formed from convent lib.; now scholastic.	47,423	419	Open to Stud.
Lemberg:					
Ossolinski'sches National-Institut.	1817	Founded by Graf Ossolinski.	78,000	2,897	Open.
Universitäts-B.	1784	Formed from convent lib.; 42,000 volumes burnt 1848.	80,000		Open.
Linz:					
Oeff. Studien-B.	1774	Manag. by Kremsmünster Benedikt.-Stift.	36,000	200	Open.
Maros-Vásárhelly:					
Oeff. Teleki'sche-B.	1812	Founded and endowed by Graf Teleki v. Szék.	90,000		
Martinsberg:					
Benediktiner-Erzabtei.		Formed at restitution of the order in Hungary.	96,000	800	Mem.
Melk:					
Bened.-Stifts-B.	1189		50,000	1,000	Private.
Olmütz:					
Oeff. Studien-B.	1774	From monastic, etc., libs.	62,000	1,000	Open.
Ossegg:					
Cisterz.-Stifts-B.	1726		30,000	100	By leave.
Prague:					
F. v. Kinky'sche B.			40,000		Open.
F.Lobkowitz.B.		Does not grow.	30,000	600	Bks. lent.
K. K. u. Universitäts-B.	1366 1777	Formed out of pre-existing libs.	74,122	3,818	Open.
Prämonstrat.-Stift am Strahow.	1565		Over 60,000	500	
Vaterl. Museum.	1818	Exact Sci., Bohemica.	125,000	3,000	Open.
Pressburg:					
Appony'sche B.		Given to the town by Graf G. Appony, 1825.	60,000		Open.
Ungar.Gelehrte Gesellschaft.	1844		60,000		Mem.
Raudnitz:					
Fürst. Lobkowitz'scheB.	1510	Rich in old Classics; val. MSS. and incun.	51,410	600	
St. Florian:					
Chorherren-Stift B.	11th cent	Many incunabula.	63,545	869	Mem.
Salzburg:					
Benedikt.-Stift St. Peter.	6th cent	In 3 divisions—(1) older bks., (2) mod., (3) theol., ascet.	65,000	900	Mem. (o. b. l.).
Landes-u. Studien-B.	1617	Till 1810 Univ. lib.	82,000	1,400	Open.
Seitenstetten:					
Benedikt.-Stifts-B.			35,000		Mem.
Tepl:					
Chorherren-Stifts-B.	1197	Many incunabula.	42,075	189	Mem.
Trent:					
B. Civica.	1841	Hist., and Lit.; public since 1846; mus.	40,500	1,548	Open.
Trieste:					
Stadt-B.	1796	Gen., Loc., Marine; 2 divs.—(1) town, (2) public.	30,000		Open.
Troppau:					
Museums-B.	1814	Schol.; is also gymn. lib.	35,249		Open.
Vienna:					
Benediktin-Stift Schotten	1158	Many incunabula; rich in Austr., hist.	60,000	600	By leave of the Abbot.
Erzherzogl. Albrecht'sche B.	1795	Chiefly Hist. and Milit. Sci.	40,000		Open.
F. Esterházy-B.	1791		40,000		
Fürstl. Liechtenstein'sche B.	Bef. 1780	Old Classics, Med., Art., History, Milit. Sci.	50,000		(o. b. l.).
K. K. Familien-u. Privat-B.	1792	Founder Francis II.; partly priv. pr. of emper.	30,000		By special leave.
K. K. Finanzminis.			35,000	550	Op.; bks. l.
K. K. Kriegsministerium.	1801	Milit. Sci. and Hist.	40,000		Officers. (o. b. l.).
K. K. Ministerium des Innern.	1849		50,000		Easily accessible.
K. K. Obergymnasium der Theresianischen Akad.	1726		33,000	180	Open to strangers; books lent.
K.K.Oeffentl. B.	1495	Copy priv.; 6461 incunabula.	440,000	20,000	Op.; bks. l.
K. K. Technische Hochschule.	1816		40,000		Open.
K. K. Universitäts-B.	1777	Much used; copy-privilege.	271,970	190	Open; bks. lent.
K. K. Zoologisches Cabinet.	1780	Sci., espec. Zoology.	30,000	Few.	Bks. lent.
Mechitaristen-B.	1778	Armenian congreg. lib.	38,243	78	Mem.

Name.	Founded.	Special Character and Remarks.	No. of Vols.		To whom accessible.
			Print.	MSS.	
Weisskirchen:					
Militär-Schulen-B.	1869	Military Sci.	46,000		Staff & Off.

V. SWITZERLAND.

Name.	Founded.	Special Character and Remarks.	Print.	MSS.	To whom accessible.
Aarau:					
Aargauische Kantons-Bibliothek.	1808		60,000	1,200	Open.
Basel:					
Allg. Lesegesellschaft.	1787	Gen., Local.	40,000		Sub.
Oeffentl. B. (Univ.).	1460	Belles-lettres excluded.	120,000	4,000	Open; bks. lent.
Bern:					
Lesegesellsch.	1791		42,000		Sub.
Stadt-B.	1528	Also the university lib.; Prof. and Stud. free.	50,000	3,000	Sub.
Einsiedeln:					
Stifts-B.	946	Chiefly Theol. and Hist.; 500 incunabula.	40,000	1,200	Mem. (o. b. l.).
Frauenfeld:					
Thurgauische Kantons-B.	1807	Printed cat.	85,000		By buying cat.
Freiburg:					
Cantonale B.	1848		38,000		Open.
Geneva:					
B. Publique.	16th cent	Nucleus Bonnivard's bks.; pr. cat.	110,000	1,800	Open.
Lausanne:					
B. Cantonale.	1536	Largely Theol.	62,000		Op.; bks. l.
Lucerne:					
Cantons-B.	1832	Based on lib. of Jesuit col.	83,000		Op.; bks. l.
Neuchâtel:					
B. de la Ville.	1793	Gen., Neuchâtel.	80,000		Op. by gu.
St. Gall:					
Stadt-B.	1536	Many incunabula.	60,400	500	Open.
Stifts-B.	830	Pr. cat. of MSS. and the 1700 incunabula.	41,700	1,800	Adults.
Schaffhausen:					
Stadt-B.	1636		30,000	450	Small sub.
Solothurn:					
Stadt-B.	1761		37,500	200	Open.
Zurich:					
Kantonale Lehranstalten.	1835		55,000	800	Open.
Stadt-B.	1629	Manag. by a Soci.	97,000	3,000	Small sub.

VI. ITALY.

Name.	Founded.	Special Character and Remarks.	Print.	MSS.	To whom accessible.
Bologna:					
Biblioteca della Università.	1712	Sci., lately; MSS. of Aldrovandi and Marsigli; MS. chron.	160,000	6,000	Open; stud. only in winter evenings.
B. Comunale.	1801 1839		120,000		Open.
Cagliari:					
B. Universitaria.	1793		30,000	MSS.	Open.
Catania:					
B. dell' Università.	1755	Gen., Catania.	42,000		Open.
B. Ventimiliana.	1783		20,000		Open.
Cava dei Tirreni:					
B. della SS. Trinità.	11th cent	Gen., Theol., etc.; now under min. of public instr.	10,000		Open.
Cremona:					
B. Governativa.	1774		40,000		Open.
Ferrara:					
B. Comunale.	1753	Gen., Ferrara; Ferrarese MSS. and incunabula.	100,000	Incl.	Open.
Florence:					
B. Marucelliana.	1752	Gen., Fine Arts; bequest of Mgr. F. Marucelli; 30,000 prints and drawings.	136,500	8,000	Open.
B. Nazionale.	1714 1861	Union of B. Magliabechiana and B. Palatina.	400,000	15,000	Open (over 18).
B. della R. Accad. delle Arte.	1801	Fine Arts.	15,000		Open to Stud.
B. Riccardiana.	1815	Valuable MSS.	28,000	3,500	Open.
Libreria Medi.-Laurenziana.	15th cent	Remarkable MSS.	8,000	7,000	Open.
Genoa:					
B. della Cong. della Missione Urbana.	1727	Gen., Fine Arts.	50,000	300	Open.
B. Franzoniana.	1778	Theology; first lib. open at night.	16,000	82	
B. della Università.	1773	Lit., Sci.; Archæol. mus. attached.	116,492	1,363	Op. (over 18); Stud.
Lucca:					
B. Pubblica.	1791		50,000	1,268	Open.
Macerata:					
B. Comunale Mozzi Borgetti.	1773 1855	Found. by B. Mozzi, 1773, T. Borgetti, 1835, united in 1855.	50,000	680	Open.
Mantua:					
B. Governativa.			30,000		Open.
Messina:					
B. dell' Università degli Studii.	1783	University Course; Greek MSS. from Mon. del. SS. Salvadore.	40,000	700	Open (over 18).
Milan:					
B. Ambrosiana.	1609	Milan incunabula; found. by F. Borromeo.	164,000	8,100	Open.
B. Nazionale de Brera.	1770	Collec. of Classics.	162,123	3,646	Open (over 18).
Modena:					
B. Estense.	1598		90,000	3,000	Open.
B. Universitaria.	1844		20,000		Open.
Monte Cassino:					
B. del. Monast.	10th cent	Theol.; early MSS. and archives.	40,000	1,000; 30,000 charts.	By leave.
Naples:					
B. Brancacciana.	1673		150,000	3,900	Open.
B. dei Girolamini.	1690		30,000		Open.
B. Nazionale.	1804 1863	Gen.; Vesuvius and volcanoes.	275,000	8,000	Open. (over 18).
B. di S. Giacomo.	1863	Chiefly mod.; br. of B. Nazionale.	85,000		Open (over 18).
B. dell' Oratorio	16th cent	Theology.	26,420	855	Open.
B. dell' Università.	1812 1827	Gen., Natural Sci.; Dante lit.	150,000	25	Open.
Novara:					
B. Civica.	1847		30,000		Open.
Padua:					
B. Universitaria.	1629	Univ. course.	158,240	2,458	Open (over 18).
Palermo:					
B. Comunale.	1775	Gen., Sicily; Arabico-Sicilian coins; portraits, etc., of Sicilians.	140,941	2,640	Open.
B. Nazionale.	1804		110,000	12,000	Open.
Parma:					
Regia B.	1779	De Rossi's Orient. MSS.	213,995	Incl.	Open (over 18).
Pavia:					
B. dell' Università.	1772	Gen., Medical, and Nat. Sci.; publications of societies.	185,000	791	Open (over 18).
Perugia:					
B. Civita.	1852	Founded by P. Podiani.	30,000	915	Open.
Pisa:					
B. della R. Università.	1742	Univ. course.	120,000		Open (over 18).
Ravenna:					
B. Classense.	1710	Gen., Hist., and Ascetic Theol.; founded at expense of P. Canneti.	65,000	1,200; 7,000 deeds.	Open.
Rimini:					
B. Gambalunga.	1619	Theology, Math., Jurisp., Hist. of Rimini.	36,000	Incl.	Open.
Rome:					
B. della R. Accademia dei Lincei.	1867	Soc. publications; founded on lib. of N. Cavalieri.	12,500		Mem.
B. Alessandrina dell' Università (or B. della Sapienza).	1667	University course; pr. books of lib. of dukes of Urbino.	80,000	225	Open (over 18).
B. Angelica.	1605	Theology; founder Mgr. Ang. Rocca.	65,696	2,453	Stud.
B. Barberina.		Private lib.	70,000	7,000	By leave.
B. della Camera dei Deputati.	1848 1871	Laws and acts of parl. of all countries.	34,000		Deputies.
B. Casanatense.	1700	Joined to B. Vit. Em.	130,000	2,500	Open (over 18).
B. Chigiana.	1660	Private lib., founded by Alex. VII.	30,000	3,036	Leave of Pr. Chigi.
B. Corsini.		Engravings; priv. lib.; founder Clement XII.	60,000	1,300	By leave.
B. della Propag.	1626	Theology, Orient. MSS.	47,000	3,000	Mem.
B. del Senato.	1872	Gen., Law; Statutes of Italian cities; Munic. Hist.	25,000		Senators.
B. Vaticana.	5th cent 1455	MSS. and rarities; priv. lib. of pope.	220,000	25,600	By leave.

Name.	Founded.	Special Character and Remarks.	No. of Vols.		To whom accessible.
			Print.	MSS.	
ROME—*contd.*					
B. Vit. Emanuele.	1876	Gen., Theol.; national lib.	360,000	5,000	Open.
SASSARI:					
B. Universitaria.	1556	Univ. course.	25,000		Open.
SIENA:					
B. Comunale.	1757	Gen., Hist.; Fine Arts; founded by S. Bandini.	55,750	4,250	Open.
SUBIACO:					
Monastero di S. Scolastica.	1350	Gen., Theol.; incunabula pr. in the monastery.	6,000	400	Open.
TURIN:					
B. dell' Università.	1723	Founder, Vit. Amedeo II.	240,000	3,300	Open.
B. Nazionale.	1720	Gen., Sci.; Aldines.	170,000	Incl.	Open (over 18).
URBINO:					
B. dell' Università.	1826		10,000	6	Open.
VENICE:					
B. Marciana. Museo Civico.	1362 1468	Incunab.; Venetian documents.	260,000	9,086	Open (over 18).
VERCELLI:					
B. Agnesiana.	1746	Found. G. B. Morosini.	35,000	40	Open.
VERONA:					
B. ed Archivi Comunali.	1792		124,308		Open (over 18).
B. Capitolare.	1723	Gen., Theol.; early MSS.; property of chapter.	20,000	1,080	Open.
VICENZA:					
B. Bertoliana Comunale.	1706 1710	Gen., Vicenza; archives of religious corporations.	105,000	2,000	Open.
VII. BELGIUM.					
ANTWERP:					
B. Publique de la Ville.	1609	Books lent; includes B. Populaire, 4435 vols.	42,218		Open (over 16).
BRUGES:					
B. Publique de la Ville.	1798	Books lent.	100,000	MSS.	Open.
BRUSSELS:					
B. Royale.	1837	MSS. and incunabula.	350,000	30,000	Open.
GHENT:					
B. de l'Université.	1797	Gen., Juris., Hist., Phil., Med.; bks. l.; one branch.	250,000	1,600	Open (over 18).
LIÉGE:					
B. de l'Université.	1817	Gen., Liége; periodicals and publications of soc.	105,746	1,544	Open (over 17).
LOUVAIN:					
B. de l'Université.	1636	Theol.; university course.	250,000		Open.
MAESTRICHT:					
B. de la Ville.	1662		12,000		Open.
MONS:					
B. Communale.	1802		30,000	393	Open.
NAMUR:					
B. de la Ville.	1797		20,000	100	Open.
TOURNAI:					
B. Publique.	1755		40,000	275	Open.
VIII. HOLLAND.					
AMSTERDAM:					
Univ. Bibliotheek.	15th cent	Gen., Med.; Libs. of Dutch Geogr. and other Soc.	100,000	500	Open.
HAARLEM:					
B. Communale.	1596	Lit. and Hist.; incunabula.	25,000	150	Open.
HAGUE (THE):					
De Koninklijke Bibliotheek.	1798	Hist., Polit., Law; books lent; Dut. incunabula.	200,000	4,000	Open (over 14).
LEYDEN:					
Bibliotheca Acad.	1575	University course; books lent.	160,000	4,950	Open.
ROTTERDAM:					
Bibl. der Stad.	1870	Netherlands.	40,000	Few.	Open.
UTRECHT:					
Univ. Bibliotheek.	1582	Gen.; incunabula.	150,000	950	Open.
IX. DENMARK.					
COPENHAGEN:					
Athenæum.			50,000		Mem.
Det Store Kongelige Bibliothek.	1670 1793	Gen. ref., Danish; national library; books lent.	482,000	18,000	Open by voucher.
Kong. Haandbibliothek.	18—	Gen., Modern; personal property of king.	40,000		King's perm.
COPENHAGEN—*contd.*					
Universitets-bibliothek.	1482 1728	Gen., Nat. Hist.; books lent; Bib. Classense; Scand. MSS.	250,000	4,000	Open.
X. ICELAND.					
REYKJAVIK:					
College L.		Hist., Phil.	9,000		Mem.
Stiptisbókasafn		Sci., Iceland.	30,000		Open.
XI. NORWAY.					
CHRISTIANIA:					
Deichmannske Bibliothek.	1780	Gen., Pop.; found. by C. Deichmann.	15,200	300	By vouch.
Universitets-bibliothek.	1811	Univ. course; Sci.; books lent; early Scand. lit.	230,000	1,170	By vouch.
THRONDHJEM:					
K. nörske Videnskab. Selskab. B.	1767	Science.	50,000	1,000	Resid.
XII. SWEDEN.					
LUND:					
Universitets-bibliothek.	1688	Univ. course; Sci.; books lent; Delagardie MSS.	120,000	3,000	Mem. (o. b. l.).
STOCKHOLM:					
Kongliga or Riks B.	1585	Gen., Swed., Nat. Hist.	250,000	8,000	Open.
UPSALA:					
Universitetsb.	1620	University course; books lent.	220,000	10,000	Open.
XIII. SPAIN.					
BARCELONA:					
Archivo de la Corona de Aragon.			50,000	MSS.	By leave.
Museo y Biblioteca Provin.			50,000	MSS.	By leave.
CADIZ:					
B. Provincial.			30,000		Open.
ESCORIAL:					
Biblioteca.	1575	Gen., incunabula; val. MSS.	32,143	4,611	By leave.
MADRID:					
B. Nacional.	1711	Gen., Span.	400,000	10,000	Open.
B. del Pal. Real.		Property of king.	100,000		By leave.
B. de San Isidro.		Found. by Jesuits.	65,000		Open.
B. de la Univ.		Univ. course.	80,000		Open.
SALAMANCA:					
B. de la Univ.	1254	Incunabula.	70,514	870	Open.
SANTIAGO:					
B. Publica Univ. y Provincial.	1532	Gen., Theol.; Span. lit. and books of chivalry.	37,000	271	Open.
SEVILLE:					
B. Columbina.	1560	Founder, Fernando, son of C. Columbus.	18,000	MSS.	Open.
B. Universitaria	1767	Founded on Jesuit libs.	60,000		Open.
TOLEDO:					
B. de la Catedral	1598	Theology.	30,000	100	By leave.
VALENCIA:					
B. del Arzobispado.		Theology.	10,500	MSS.	Open.
B. Universitaria	1785	Incunabula; destroyed in 1812.	42,000		
VALLADOLID:					
B. de la Universidad.	1480	Gen., Theol., Law; includes lib. of Santa Cruz (1480) and that of the univ. (1767).	27,180	308	Open.
XIV. PORTUGAL.					
COIMBRA:					
B. da Universidade.	1591	Gen., Univ. course; academ. diss.	84,000		Mem. (o. b. l.).
EVORA:					
B. Archiepiscopal.		Theology.	30,500	MSS.	By leave.
LISBON:					
B. da Academia	1780	Science.	60,000	MSS.	Open.
B. Nacional.	1796	Gen., Portug.	200,000	9,415	Open.
MAFRA:					
Bibliotheca.	1730		30,000		By leave.
OPORTO:					
B. Pub. Municipal.	1833	General; books not lent; libraries of suppr. convents.	100,000	1,300	Open.

Name.	Founded.	Special Character and Remarks.	No. of Vols.		To whom accessible.
			Print.	MSS.	
XV. GREECE.					
ATHENS:					
University Lib.	1837	National Lit.	150,000	600	Open.
CORFU:					
Public Library.	1800	Univ. course.[1]	40,000		Open.
XVI. RUSSIA.					
DORPAT:					
University Lib.	1801	Univ. course.	143,500	780	Mem.
HELSINGFORS:					
University Lib.	1828	Univ. course; Finland; separate Russian lib.	140,000		Resid.
KAZAN:					
University Lib.	1804	Univ. course; lib. of Prince Potemkin	80,000		Mem.
KHARKOFF:					
University Lib.	1805	Science.	56,000		Mem.
KIEFF:					
University Lib.	1833	Formerly at Wilna.	110,000		Mem.
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[1] [Corfu University was disestablished in 1864. See Vol. VI. p. 352.—AM. ED.]

[2] [This library is at Singapore. See p. 533.—AM. ED.]

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B. Nacional.	1867	Gen., Mexico.	100,000	MSS.	Open.
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B. Publica.			26,211	Few.	Open.
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(H. R. T.—E. C. T.)

LIBURNIANS were a people who at different times were prominent on the Adriatic coasts. They were originally, one cannot doubt, one of the homogeneous Illyrian tribes (see Illyria). Living in a barren rocky country along the north-eastern coast of the Adriatic, they devoted themselves to the sea, and were the chief navigators of the Adriatic in the early period. They settled on the coast of Picenum, where the town of Truentum was always counted Liburnian; and the Greek colonists found them at Corcyra and other places. They were pressed on all sides by other races, but were still a powerful people in the time of Scylax (Scyl., p. 7). The islands that lay along the coast were peopled by them and called by their name. They were a race of pirates who used swift boats with a large sail. These Liburnian ships became famous when the Romans adopted them in several of their naval wars. The heavy and lofty ships that had been developed by the later Greek states proved unequal to the light and swift Liburnian boats. The country was incorporated by the Romans in the province of Dalmatia.

LIBYA was a geographical name by which the Greeks usually designated Africa, with the exception of Egypt, although sometimes the continent was thought to be divided between Libya and Ethiopia. Libya enters into the sphere of ancient history only in so far as it came into contact with the civilized races of antiquity, and the present article will touch this point only; the natural features and the ethnology will be found under other headings (see Africa). The native tribes came several times into collision with the kings of ancient Egypt. In the reign of Rameses the Great and his successor they invaded the Delta, and various expeditions were made by the Pharaohs into the outlying country, on the south particularly (see Egypt). Herodotus mentions one important expedition sent out by Pharaoh Necho (610–594 B. C.), which started from the Red Sea, circumnavigated the continent, and reached the mouth of the Nile after three years' absence. The truth of the tale has often been doubted, but one circumstance in which Herodotus himself expresses his disbelief, viz., that as they sailed west they had the sun on their right hand, has in modern times been generally accepted as proving that the voyage was actually made.

The Phœnician colonies on the north coast, Utica, Carthage, etc., beginning between 1000 and 800 B. C., established a powerful and civilized empire in a hitherto unknown part of Libya. Their trading expeditions gave them a wide acquaintance with the geography of the country, even with the Atlantic coast as far almost as the equator; but the contempt with which the Roman conquerors treated the literature of the Carthaginians allowed much valuable material to disappear. The historian Sallust, when prætor of Numidia, was still able to use the Punic records which he got interpreters to translate for him (Sall., *Jug.*, 17); and fortunately one record of an exploring voyage along the west coast, preserved in a temple in Carthage, was translated by some Greek traveller and is still available (see Hanno). For all that is known of the Carthaginian rule in Libya see Carthage.

Greek mariners must have visited Libya at a very early period, for the edible lotus of the northern coast is mentioned in the *Odyssey*.

In the latter part of the 7th century B. C. the Greeks began to colonize the north coast. Between the Carthaginian territory and the borders of Egypt they planted a number of cities, and the Pentapolis of which Cyrene was the chief was among the richest and most flourishing of all the Greek states (see Cyrene). When the Persians invaded Egypt they made some attempt to extend their empire over Libya; but the expedition of Cambyses (about 525 B. C.) was too unfortunate to encourage them to further efforts. The camel was introduced into Egypt under the Persian rule, and from this time it became easier to make long journeys over the Libyan deserts. Herodotus shows much knowledge of the Sahara, and it is clear that his account must be founded on the reports of traders and caravan guides well acquainted with the desert route. Under the Macedonian kings knowledge of Libya was much extended; they sent exploring expeditions for scientific purposes into Abyssinia, while growing wealth and luxury caused a continually increasing demand for the ivory, spices, and other produce of Libya. In the period 500–200 B. C. it seems certain that commerce was maintained with the countries beyond the Sahara in at least two ways—by the Carthaginian ships trading along the Atlantic coast, and by the overland route across the desert to the Nile. The Roman conquest of Carthage closed the former route. Polybius indeed was commissioned by Scipio to explore the country, and sailed a long way down the west coast; but the Romans themselves had not the maritime enterprise required for such voyages. The record which Polybius wrote for his friend Scipio is quoted by Pliny and Stephanus. Sallust also collected information about the country, and under the emperor Nero an exploring expedition was sent into Abyssinia. The Romans added more to the knowledge of Libya in other ways—by a better organization of the province and increased facilities of travel and trade, by the frontier wars against surrounding tribes, and finally by the expeditions sent directly into the heart of the country to procure wild animals for the amphitheatre. The passion of the Roman populace for seeing strange animals slaughtered in the public games was gratified by the emperors and magistrates. Enormous numbers of Libyan wild beasts were exhibited in the amphitheatre: even hippopotami and alligators are mentioned. One Roman officer, Maternus, penetrated at least as far as Lake Chad. The *Periplus* of Arrian preserves a record of the trade along the east coast of Libya in the 1st century. In these ways a fairly accurate knowledge of northern Libya was obtained, and Ptolemy could, in the 2d century, construct a good map of Africa as far south as 11° N., though his idea of the shape of the continent further to the south is less accurate than that of Herodotus.

See Ritter, *Erdkunde*, i.; Heeren, *Historical Researches*, or in the German *Ideen*, vol. ii.; and the geographical works of Forbiger, Kiepert, Bunbury, etc.

LICATA. See ALICATA, vol. i. p. 506.

LICHENS (*Lichenes*) may briefly be defined as cellular perennial plants, furnished with a vegetative system containing gonidia, and with a reproductive system consisting of female thecasporous fruits and male spermogonous organs. They constitute a distinct class of cellular cryptogams, intermediate between algæ and fungi, to both of which in some respects they present certain affinities. By the earlier authors they were regarded as being *Aerophycæ* or terrestrial algæ, while of recent years they have been viewed by some writers as being *Ascomycetous* fungi. From both of these, however, they are sufficiently distinguished and separated by the special structure of their thallus, by the presence of certain immediate principles proper to their tissues, and by their mode of life and nutrition. Their relations to these neighboring classes, and their true systematic place, will be best elucidated on considering their structure and its bearings upon some recent speculations.

Structure of Lichens.

A complete lichen consists of a nutritive and vegetative system termed the thallus, and of reproductive bodies borne upon it in the form of *apothecia* and *spermogones*. Occasionally, however, there is no thallus present (*e. g.*, *Sphinctrina*, various *Lecideæ*, *Endococcus*), in which case the fructification is parasitical on the thalli of other lichens.

1. *Vegetative System.*—The thallus is very variable in external form and color, as also in internal structure.

I. In external form it presents the following modifications. (*a*) The *foliaceous* thallus, which may be either peltate, *i. e.*, rounded and entire, as in *Umbilicaria*, etc., or variously lobed and laciniated, as in *Sticta*, *Parmelia*, etc. This is the highest type of its development, and is sometimes very considerably expanded. (*b*) The *fruticulose* thallus, which sometimes is filamentose, as in *Ephebe*, and may be either erect, becoming pendulous, as in *Usnea*, *Ramalina*, etc., or prostrate, as in *Alectoria jubata*, var. *chalybeiformis*. It is usually divided into branches and branchlets, bearing some resemblance to a miniature shrub amongst the *Phanerogamia*. An erect cylindrical thallus terminated by the fruit is termed a *podetium*, as in *Cladonia*. (*c*) The *crustaceous* thallus, which is the most common of all, forms a mere crust on the substratum, varying in thickness, and may be squamose (in *Squamaria*), radiate (in *Placodium*), areolate, granulose, or pulverulent (in various *Lecanoræ* and *Lecideæ*). In its pulverulent state it is either the rudimentary or the abortive condition of many species. (*d*) The *hypophlœodal* thallus is often concealed beneath the bark of trees (as in some *Verrucariæ* and *Arthoniæ*) or enters into the fibres of wood (as in *Xylographa* and *Agyrium*), being indicated externally only by a very thin film or macula. To this may also be referred the evanescent thallus which is denoted solely by gonidia sparingly scattered on the stone or wood (as in some *Caliciei* and *Lecideæ*). This is the simplest form under which lichenose vegetation occurs. These two latter forms of thalli may be either *determinate*, *i. e.*, of a definite shape with a distinct margin or boundary, or *effuse*, *i. e.*, spreading extensively over the substratum with no visible limits. The differences in these forms are no doubt connected with differences in the chemical composition of the thallus. In color also the thallus externally is very variable. In the dry and more typical state it is most frequently white or whitish, and almost as often grayish or grayish glaucous, Less commonly it is of different shades of brown, red, yellow, and black. These various colors do not originate from any coloring matters contained in the cells themselves, but, according to investigations made by Nylander (see *Flora*, 1879, p. 558), they depend upon such as are deposited in the granulations and cellular walls, whence they appear on the epithallus. In the moist state of the thallus these colors are much less apparent, as the textures then become more or less translucent, and the epithallus usually presents the greenish color of the gonidia (*e. g.*, *Parmelia Borreri*, *Peltidea aphthosa*, *Umbilicaria pustulata*, and pulverulent *Lecideæ*).

2. The internal structure of the thallus presents two principal modifications, viz., the *stratified* thallus, having its different elements (hyphæ and gonidia) arranged in layers, and the *unstratified* thallus, in which these different elements are confused in a homogeneous tissue.

A. *The stratified thallus.*—On making a vertical section this is seen in a foliaceous lichen to consist of three layers, constituting a *cortical*, a *gonidial*, and a *medullary* system, to which in the case of many crustaceous lichens is to be added a fourth, viz., a *hypothalline* stratum.

(*a*) The *cortical* stratum occupies the whole of the external surface of filamentose and fruticulose lichens, both the upper and under surfaces of some foliaceous and squamulose species, while it is found only on the upper surface of crustaceous lichens. It usually consists of a colorless cellular tissue, in which the cellules are closely compacted and form a pseudo-parenchyma. Its most superficial portion, termed by Nylander the *epithallus*, a sort of cuticle, is amorphous, often more indurated and colored. In some lichens (*e. g.*, *Collema*) it is the only portion of the cortex present, while in pulverulent crustaceous thalli it is entirely wanting. (*b*) The *gonidial* stratum is situated immediately beneath the cortical stratum, and consists usually of greenish spherical cellules, or of granules destitute of a cellular membrane. It is not always continuous, but is often interrupted, the gonidia occurring in dissociated masses. Sometimes it is situated on the upper part of the medullary stratum, in which case the gonidia are arranged either between or amongst its exterior elements. In general its limits may readily be distinguished from the others by its peculiar color. Various important matters relating to the gonidia will more appropriately be afterwards discussed at length. (*c*) The *medullary* stratum is more variable in its constituent elements, but, being always colorless, is easily recognized. It presents the three following principal modifications. (*a*) The *woolly* medulla consists of simple or branched filaments, which in foliaceous species are loosely intersected and entangled, and in fruticulose species are more or less conglutinated, assuming a longitudinal direction, and constituting, as in *Usnea*, a kind of solid axis for the support of the thallus. (β) The *cretaceous* medulla occurs only in crustaceous lichens, and is generally characterized by its tartareous appearance. It is more compact than the preceding, and consists for the most part of molecular granulations often intermixed with octahedral crystals of lime, and presenting but few traces of filamentose elements. (γ) The *cellulose* medulla consists of a tissue of angular, rounded, or oblong cellules containing gonidia in their interior or in their interstices (*e. g.*, *Pannaria Endocarpon*). In some species (*e. g.*, *Verrucaria fuscula*) the cellules have a tendency to reunite into filaments and then to separate again into rows of cellules. (*d*) The *hypothalline* stratum is the inferior one of the thallus and that upon which the other strata are developed, though it is not always visible, and is sometimes entirely wanting. It usually presents itself under a twofold aspect, viz., the *hypothallus* and *rhizinæ*. (α) The *hypothallus* proper, which is immediately developed upon the prothallus (*i. e.*, the filaments of the germinating spore), is a horizontal stratum consisting of interlacing filaments or of elongated, short, or rounded cellules, and is sometimes of a white or whitish color, but usually dark or blackish. In many crustaceous lichens it is represented only by a black or dark-colored border limiting the thallus (*e. g.*, *Lecidea geographica*, etc.). (β) The *rhizinæ* consist of vertical rhizoid fibrillæ, usually branching and tufted at their extremities, blackish or grayish in color, rarely white, which occur on the lower surface of foliaceous lichens. They consist of several filamentose elements which are most frequently articulated and agglutinated (*e.g.*, *Parmelia*, *Physcia*), or sometimes simple and then always articulated (*e. g.*, *Sticta*). It is to be observed that the hypothallus and the rhizinæ serve merely as bases of attachment for the lichens to the substratum, and do not in any way aid in its nutrition.

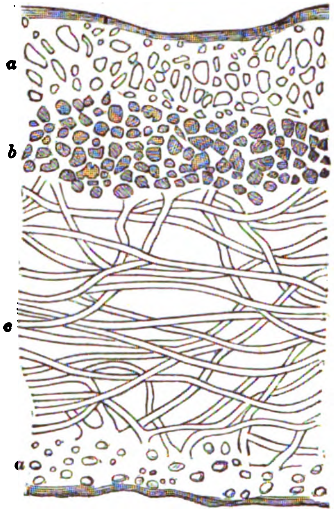

FIG. 1.—Section of Stratified Thallus of *Ricasolia herbacea*. *a*, cortical stratum; *b*, gonidial stratum; *c*, medullary stratum.

B. *The unstratified thallus.*—This occurs amongst the *Lichenacei* (which, however, are most frequently stratified as above), and in various species belonging to the inferior genera, which have a pulverulent or hypophlœodal thallus. In these the constituent elements are more or less mixed together, though the gonidial stratum generally remains distinct, and is often visible when the others are absent. It is, however, the families of the *Byssacei* and *Collemacei* that are more especially characterized by an unstratified thallus. Here the cortical stratum is chiefly represented by a greenish (in *Collema*), rarely brown (in *Synalissa*, etc.), non-cellular epithallus, or in others (*Leptogium*) by a thin stratum of angulose cellules distinct from the other elements of the thallus. The gonidial granules are also disposed in a different manner to those of the *Lichenacei*. In the majority of the *Collemacei* they are strung together moniliformly, and distributed without order in a gelatinous pellucid substance; while sometimes they are agglomerated into small groups, and situated for the most part next to the epithallus. In *Ephebacei* they are not moniliformly arranged, but are tunicated or involved in a gelatinous cellulose stratum. The rest of the thallus consists of the medullary system (except in *Ephebacei*, in which there is no medulla), and is composed of tubular or hollow filaments, with roundish cavities containing the gonidial granules, and imbedded in the gelatinous substance, which very readily imbibes water. There are a few lichens in which there is no trace whatever of stratification, as the genus *Cœnogonium*, in which the entire thallus is composed of filamentose membranous elements, and the peculiar family of the *Myriangiacei* (doubtfully, however, referable to lichens), in which it is equally cellulose throughout.

In addition to the hyphal and gonidial anatomical elements which thus enter into the structure of the thallus, there is another to be noticed, which, however, is to be regarded rather as an immediate principle. This is the *molecular granulations*, which are extremely small and (in form) irregular corpuscles, 0·001–0·002 millim. in diameter, and visible only when very highly magnified (300–400 diameters). They occur in all parts of the thallus, especially in the younger cellules, from the epithallus to the hypothallus, being especially abundant in the medulla of crustaceous species. In the epithallus they are variously colored according to the colors which it presents, but in all other parts they are colorless. They occur also in the apotheca, in the epithecium, the thecæ, and the spores, and constitute the famous "microgonidia" of Dr. Minks. By the application of sulphuric acid many of them are transformed into small acicular crystals, and in the spores they are frequently agitated by a Brownian movement.

We may here also, in connection with the vegetative system of lichens, refer to certain peculiar *excrescences* which are sometimes presented by the upper or under surface of the thallus. Of these the principal are the following. (1) *Soredia* are pulverulent eruptions on the cortical stratum, varying in form, being rounded or diffuse, and either are scattered upon the upper surface of the thallus or border its margins. They are of a lighter color than the thallus, and consist of a mass of gonidia and of molecular granulations intermingled with filamentose elements. They occur in many fruticulose, foliaceous, and crustaceous lichens, and their protrusion through the cortical stratum is owing most probably to an excessive development of the gonidial element. Occasionally also they appear on the disk of apothecia (in *Pertusaria*), which they render abortive, and in this case constitute the pseudo-genus *Variolaria* of older authors. When detached from the thallus they are capable under certain favorable circumstances of giving rise to new plants, and thus act the part of bulbils in the *Phanerogamia*. It is no doubt by their means that many species which are never found in a fertile state (*e. g.*, *Thamnolia vermicularis*) are propagated. (2) *Cyphellæ* are small, urceolate, pale excavations which occur abundantly on the under surface of many species of *Sticta*. They are generally naked, but are often also pulverulent

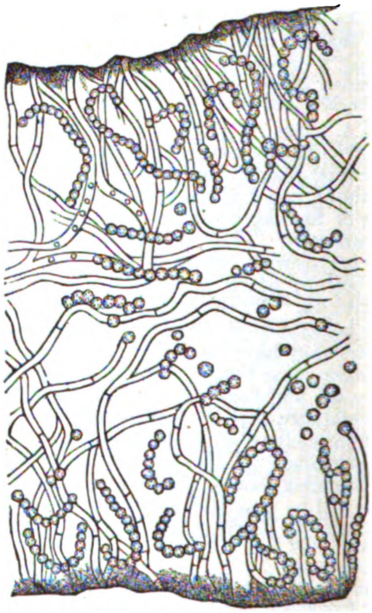

FIG. 2.—Section of Unstratified Thallus of *Collema conglomeratum*, with Moniliform Gonimia scattered amongst the Hyphal Filaments.

sorediiferous, in which latter case they are called *pseudo-phellæ*. Their physiological function is not definitely iown, but they are most likely connected with the nutri-on of the plants. (3) *Isidia* constitute an exuberant con-tion of some foliaceous and crustaceous thalli. They nsist of elevated, coralloid, stipitate excrescences, which e sometimes branched, and which are always of the same lor and texture as the thallus itself. This isidioid con-tion in crustaceous thalli is the basis of the old pseudo-nus *Isidium*, which is merely an anomalous state of some ecies of *Pertusaria*. Isidia have the same functions as e soredia, and serve as propagula. (4) *Cephalodia* are bicular and flattened or globular tubercles of a peculiar xture which occur on the thallus of many species belong-g to different genera. They are usually epigenous, as in *ereocaulon*, *Usnea*, *Lecanora gelida*, *Lecidea panæola*, etc. a few species, however, they are hypogenous, as in *Pel-dea venosa* and *Psoroma euphyllum*, while in various *Stictei*, *ephroma expallidum*, etc., they are endogenous, forming renoid protuberances on the lower surface. Recently ylander has detected both epigenous and hypogenous phalodia on *Psoroma arenarium* and *Lecanora allorhiza*. hey are of a paler color than the rest of the thallus, from hich they differ also in structure, being confusedly cellu-se, and containing gonidial granules. According to Th. . Fries (in *Flora*, 1866, p. 19) they are only morbid excres-nces caused by algals intruding themselves under the rtex; but this is at once refuted by the fact of their rming constant characters of so many different species curring in various situations. In these they evidently nstitute normal organs, the use of which, however, is nknown.

II. *Reproductive System.*—This consists of *apothecia* r the female organs, of *spermogones* or the presumed ale organs, and probably also of *pycnides* or a second-ry kind of fructification.

1. The apothecia, like the thallus, are very variable in xternal form and color, as also in their internal struc-ure. In external form they present three principal odifications, viz., (1) *disciform* (or gymnocarpous), in hich the shape is that of a disc (as in all the higher enera); (2) *nucleiform* (or angiocarpous), in which the hape is that of a rounded tubercle with an apical osti-le (as in *Endocarpon*, *Verrucaria*); and (3) *peri-iform*, similar in shape to the preceding, but closed, ith no ostiole (as in *Thelocarpon*, *Endococcus*). The st two are but little variable in figure, and consequent- do not in this respect admit of different designations. he disciform apothecia, however, present various hapes, of which the following are the principal:—a) *peltate*, which are large, rounded, without any dis-inct thalline margin (*e. g.*, *Usnea*, *Peltigera*); (*b*) *leca-orine*, or scutelliform, which are obicular and sur-ounded by a distinct, more or less prominent thalline argin (*e. g.*, *Parmelia*, *Lecanora*), having sometimes lso in addition a proper one (*e. g.*, *Thelotrema*, *Urceo-ria*); (*c*) *lecideine*, or patelliform, which are typically rbicular, with only a proper margin (*e. g.*, *Lecidea*), ometimes obsolete, and which are occasionally irreg-lar in shape, angular or flexuose (*e. g.*, *Lecidea jurana*, *. myrmecina*), or complicated and gyrose (*e. g.*, *Gy-ophora*), and even stipitate (*e. g.*, *Bæomyces*); (*d*) *irelliform*, which are of very irregular figure, elongated, ranched or flexuose, with only a proper margin (*e. g.*, *Xylographia*, *Graphis*, etc.) or none (*e. g.*, some *Ar-honiæ*), and are often very variable even in the same pecies. It may be here observed that young disciform pothecia are more or less nucleiform. In color the pothecia are extremely variable, and it is but rarely hat they are concolorous or subconcolorous with the hallus (*e. g.*, *Usnea*, *Ramalina*). Usually they are iscolorous, and may be black, brown, yellowish, or also ess frequently rose-colored, rusty-red, orange-reddish, affron, or of various intermediate shades. Occasion-lly in the same species their color is very variable (*e. g.*, *Lecanora metaboloides*, *Lecidea decolorans*), while some-imes they are white or glaucous, rarely greenish, pru-nose. Lecideine apothecia, which are not black, but therwise variously colored, are termed *biatorine*.

The two principal parts of which an apothecium consists are the *hypothecium* and the *thecium*.

(1) The hypothecium, which corresponds to the hypothallus, is the conceptacle of the apothecia. It is composed of cellular tissue, generally very dense, and often presenting an indistinct stratification. This tissue may in general be distinguished from that of the neighboring parts of the thallus by its cellules being smaller, more compact, and differently colored, though in some instances (as in certain *Pannariæ*) the limits are not determinable. In the apothecia of such genera as *Calicium*, *Bæomyces*, etc., the hypothecium is composed of hollow cemented filaments arranged longitudinally and constricted into a stipe for the support of the fruit. The hypothecium in disciform apothecia is usually termed the *excipulum* proper, while in nucleiform apothecia it is termed the *pyrenium*, and in peridiiform apothecia the *peridium*. When the pyrenium quite covers the nucleus it is said to be *entire*, *dimidiate* when it covers only the upper portion. The hypothecium is either colorless or dark, or reddish or yellowish, according as its cellules are tinged.

(2) The thecium, or as it is more frequently termed the *hymenium*, is that part of the apothecium which contains the organs of the fruit, viz., the *thalamium* and the *thecæ*, which are placed perpendicularly to the hypothecium. It is penetrated by an amyloid substance, colorless, and very greedy of water, termed the *hymenial gelatine*, formed of the lichenine, which becomes bluish or wine-reddish when tinged with iodine. The thecium itself corresponds to the gonidial-medullary stratum, while its superficial portion, termed the *epithecium*, corresponds to the epithallus. (*a*) The thalamium generally consists of paraphyses which are erect colorless filaments arising from the hypothecium, and whose function is to aid in the expulsion of the spores by the pressure which they exercise upon the thecæ. They are of nearly equal height, closely placed together, usually very slender, though slightly variable in thickness, frequently articulated, and rarely branched or anastomosing. Internally they are hollow and filled with protoplasm, which sometimes is separated into little globules. Their apices are generally colored, in most instances dilated, sometimes clavate, and are cemented together by gelatin. They are frequently confused together; occasionally they are but little evolute; while in many of the *Pyrenocarpei* they are entirely wanting, though in these the ostiolar filaments of the hypothecium have sometimes been mistaken for them. (*b*) The thecæ are large, oblong, cylindrical or ovoid cellules or vesicles containing the spores, and are usually more or less attenuated towards the base. In size and shape they vary considerably in the different genera and species according to the size, number, form, and arrangement of their spores. They differ also in the same species, within certain limits, according to age, the young theca being more slender than those which are older. In some genera which have very large spores (*e. g.*, *Varicellaria*, *Pertusaria*) the thecæ are distended in proportion, and generally present a saccate or oblongo-ventricose form. The theca itself is a thin membranous cellule, the walls of which are at first of an equal thickness throughout, but in process of development they become gradually thinner, except at the summit, where they retain their original thickness. In some species the wall is remarkably thick at the apex (*e. g.*, *Arthonia*), and in others it is invested throughout with a kind of external cuticle (*e. g.*, *Pertusaria*). The thecæ are resorbed after the expulsion of the spores; though where their walls are extremely thin (as in *Calicium*) they are ruptured and disappear at a very early

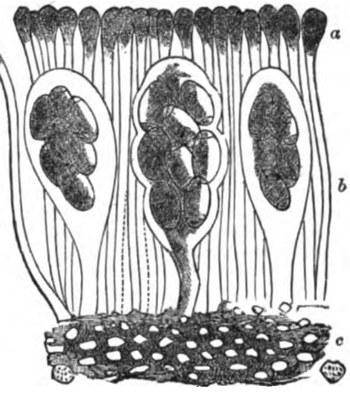

Fig. 3.—Vertical Section of Apothecium of *Physcia parietina*. *a*, paraphyses; *b*, thecæ with bilocular spores; *c*, hypothecium.

stage. The *spores* are the special reproductive organs of lichens, and are produced in the thecæ by free cell-formation, *i. e.*, by the separation and subsequent condensation of the protoplasm of the fully developed theca around certain points in its interior, corresponding in number to that of the spores to be formed. After the formation of the external spore-wall has taken place, the spores have a definite outline, and may consist of only one cellule or loculus (*simple* spores), or may be divided by one or more transverse partitional membranes (*septate* spores). Sometimes the loculi are restricted to the two ends or poles of the spore (one in each), and are said to be *polari-bilocular*, the two loculi being occasionally united by a longitudinal tube. At other times the transverse partitions are further divided by several longitudinal partitions, in which case the spore is said to be *murali-divided*, from the resemblance it then bears to the stones in a wall. The contents of the spores are a homogeneous protoplasm, molecular granulations (often abundant), and a pale-yellow oily substance, which in the fully developed spore often becomes condensated into one or more globules, visible generally near its ends or in the middle. The number of the spores in each theca varies very much in different species, being in most lichens 8, occasionally 6, 4 or 2, or rarely only 1. In some species, however, they are 20–100, when the thecæ are said to be *polyspored*. In form they are also very variable, the principal shapes assumed by them in order of frequency being *ellipsoid*, *fusiform*, *oblongo-cylindrical*, *sphæroid*, and *acicular*, with several intermediate forms. They are still more variable as to size, being smallest in polyspored (*e. g.*, *Lecanora fuscata*, etc.), and largest in monospored species (*e. g.*, *Pertusaria communis*, etc.). The largest spores of all are found in *Varicellaria amicrosticta*, where they are 0·225–0·030 millimetre long, and 0·095–0·115 millim. thick. As to color, they are either *colorless* (white, nearly hyaline or pale yellow under the microscope), or *colored* (brownish, or brown, or blackish), while in *Sphærophoron* there is also a bluish-black superficial pigment. The spore-wall varies in thickness, and is typically composed of two strata, the outer of which is termed the *epispore* and is colored, while the inner is termed the *endospore* and is colorless, gelatinous, and generally less distinct. Notwithstanding that in these respects the spores are so variable in different species, they are, when mature remarkably constant in the same species, so that their characters afford valuable specific diagnoses. Apparently it is only those lichens which germinate from spores that occur in a fertile condition.

2. The spermogones, which are the presumed male organs of reproduction, at once differ in appearance from the apothecia in being very minute corpuscles. In many cases their outline is invisible to the naked eye, unless the thallus has been previously moistened, when they appear as minute points or papillæ. When magnified they externally bear a resemblance to the apothecia of the *Pyrenocarpei*, but internally, on microscopical examination, they are seen to differ essentially from these. In form they are nucleiform, round, or oblong, and are either sessile on the surface of the thallus, or more or less immersed in its substance, or sometimes enclosed in prominent thalline verrucæ. Usually they are simple, though occasionally two or several become confluent or aggregated into little groups. They almost always occur on the same thallus as the apothecia, or rarely on different thalli (*e. g.*, *Ephebe pubescens*), so that lichens are consequently monœcious and diœcious. In color the spermogones are black or brown, or concolorous with the thallus itself. They are composed of two parts, viz., a shell or *conceptacle* and a *nucleus*.

(1) The conceptacle, which is analogous to the hypothecium of the apothecium, is composed of a tissue formed of very small cellules, which are cemented together and have thick walls. The *ostiole* at its summit is generally similar to that of nucleiform apothecia, and in the case of entirely immersed spermogones is the only portion visible.

(2) The nucleus consists of the *sterigmata* and *spermatia*, and of a mucilaginous substance (the spermatic gelatin) in the cavity between them, which very greedily imbibes water and aids in the expulsion of the spermatia. Sometimes also there are present in the nucleus a few elongated, articulated, and occasionally branching filaments intermixed with the sterigmata which are comparable with the paraphyses of the apothecia (*e. g.*, *Ramalina*). (*a*) The sterigmata are elongated cellules filled with a colorless fluid, and are attached to the interior face of the conceptacle, growing from it convergently towards the centre, and often nearly filling its entire cavity. They present two important modifications, viz., *simple* sterigmata and *articulated* sterigmata or *arthrosterigmata*, both of which may become somewhat branched. When arrived at maturity they possess the faculty of producing from their apices or also from the articuli the spermatia, one at a time, though many in succession, as may be inferred from the immense number of them lying in the cavity of the nucleus. (*b*) The spermatia are very small, slender, colorless corpuscles, which at first appear as minute protrusions on the apices of the sterigmatic cells. They subsequently become gradually elongated, and, on reaching maturity, detach themselves from the sterigmata and lie free in the cavity of the nucleus, till in wet weather they are expelled through the ostiole of the spermogones. In form they present two principal modifications, viz., *acicular* and *ellipsoid*, of which the former, the more frequent, is rather variable. They may be slightly fusiform-incrassate at one apex (*e. g.*, *Usnea*), or at both apices (*e. g.*, *Parmelia*), or they may be cylindrical and straight, the most common shape, or cylindrical and arcuate (*e. g.*, *Roccella*). The spermatia of arthrosterigmata are cylindrical and straight, but slightly thickened and obtuse at the apices. In size they also vary, though more in length than in thickness, the arcuate spermatia being sometimes very long (0·040 millimetre). These differences in form and size are often very useful in the discrimination of species, just as the two types of the sterigmata are sometimes of great service in the distinction of genera. The spermatia frequently exhibit a Brownian movement, but they possess no faculty of germination, their functions, as generally acknowledged, being the fertilization or fecundation of the spores. That the spermogones are rightly presumed to be the male organs of reproduction may legitimately be inferred alike from their relation to and their antagonism with the apothecia. In the former respect their position on the thallus relatively to the apothecia is similar to that of the sexual organs in other classes of plants; while in the latter respect spermogones are plentiful on thalli destitute of apothecia, and on those with apothecia are much more sparingly present. The manner, however, in which the spermatia impregnate the spores has not yet been definitely ascertained. Most probably, as suggested by Nylander (in *Syn.*, p. 40, note 1), the spermatia do not exercise any direct influence on the female organ in the hymenium, but their fecundating influence is rather exercised on the prothalline elements of the growing thallus. M. Stahl indeed has recorded and illustrated (*Beitr. sur Entwick. der Flechten*, 1877) the result of certain researches on *Collema microphyllum*, in which he supposed that he had detected sexual organs in the shape of an *ascogonium* and a *trichogyne*, regarded by him as a kind of *carpogonium*. These observations, however, have not been confirmed by subsequent researches on the same or any other species of *Collema*,

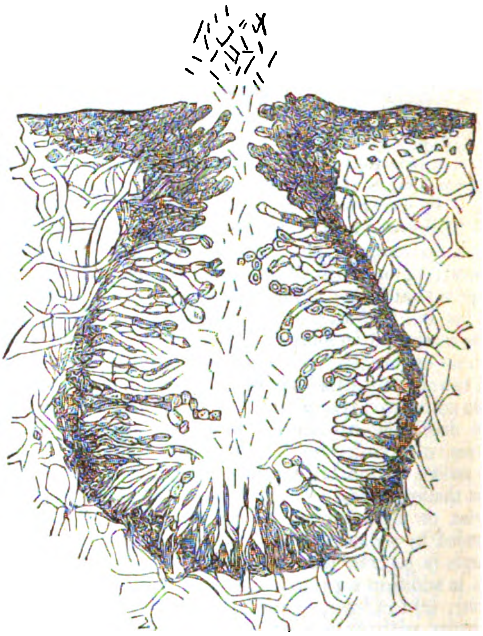

FIG. 4.—Vertical Section of a Spermogone of *Parmelia physodes*, showing the Sterigmata and Spermatia.

while his attributing to the hyphæ a faculty of "contortion" or spirally coiling themselves, which from their nature they do not and cannot possess, is calculated to invalidate all that he otherwise observed and depicted.

3. The pycnides are minute, dark-colored pyrenodean conceptacles which occur on the thalli of various lichens, especially such as are crustaceous. In external appearance they resemble to some extent the spermogones, from which, however, they at once differ in their internal organization. They consist of simple filaments composed of narrow (often short) cellules, termed *basidia*, bearing on their apices bodies called *stylospores*, which are colorless, usually oblong, but variable in form and size, and filled with organic matter (in part at least oily) similar to the spores. Each basidium produces only a single stylospore, which, unlike the spermatia, has a germinative property. Their occurrence in lichens was first pointed out by Tulasne, who showed their affinity to certain analogous fruits (*Diplodia*, *Phoma*, *Septoria*, etc.) in various thecaspored fungi, and regarded them as supplementary or secondary sporiferous reproductive organs. Considering the number of parasitic *fungilli* which frequently occur on lichens, it might be supposed that the pycnides in reality belonged to the same category. From their constant occurrence, however, on the same species, and the evident correlation between them and the accompanying fructifications, as also from the resemblance of their stylospores to the spores of the apothecia, there are good grounds for adopting the conclusion come to by Tulasne. They are very common on the margin of the thallus of isidiiferous states of *Peltigera canina* and *P. rufescens*, where they have often been mistaken for spermogones, which in this genus have not yet been detected. Pycnides occur also in *Lecidea vermifera*, and abundantly in *L. tantilla*, in *Habrothallus*, in several species of *Strigula*, in *Spilonema revertens*, and will probably be yet observed in other lichens.

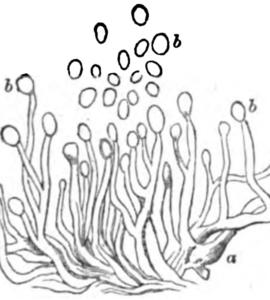

FIG. 5.—Pycnides of *Peltigera rufescens*. *a*, basidia; *b*, stylospores.

The Gonidia of Lichens.

In view of the important place occupied by the gonidia in the structure of lichens, and of the discussions that have recently taken place concerning them, they require to be considered somewhat in detail in order that their real nature and relation to the hyphæ, or the thalline filaments, may become apparent. The gonidia are spherical, ellipsoid, or variously rounded cellules, with thin, colorless walls, composed of cellulose, containing chlorophyll (or a subsimilar coloring matter), homogeneous or granulose, with generally a solid nucleus in the centre. As to the origin of the chlorophyll, it may be observed in passing that this is the same in lichens as in other cryptogamic plants, *e. g.*, mosses and *Hepaticæ*, in which it occurs, the only visible difference being that gonidia often occur as discrete cellules. The gonidia increase by binary (very rarely by ternary or quarternary) division, the nucleus also dividing into two portions, each of which forms the centre of a secondary gonidial cellule. In the gonidial stratum, where they are arranged between the radicles of the hyphæ, their division necessarily proceeds only slowly, but in ecorticated thalli, leprose and others, in which they are free, they are readily multiplied by repeated division. In gonidia isolated from the thallus of some species belonging to *Cladonia*, *Evernia*, and *Physcia*, zoospores have been detected by M. Famintzin and M. Boranetzky (see *Ann. Sc. Nat.*, 1868, p. 137), and, although Nylander failed to perceive such in subsequent experiments (*Flora*, 1877, No. 23), he adds that it is possible they may be generated in free gonidia (*i. e.*, in unstratified thalli), which could not be the case in gonidia closely surrounded by thalline filaments. The subject will well repay further investigation. Other matters relating to the character and relations of the gonidia will be best elucidated by considering the forms which they present, and their origin in the thallus.

I. *The Forms of the Gonidia.*—These have been fully treated by Nylander in the *Flora loc. cit.*, where also the first scientific exposition and classification of them have been given. According to the views there propounded, gonidia in their wider acceptation include three very distinct types:—(1) *Eugonidia* (or gonidia proper), which are involved in a distinct cellular membrane, and are usually bright green: (2) *Gonimia* (or the gonidial granules already mentioned), which are naked, pale greenish, glaucous greenish or bluish; and (3) *Gonidimia* (or *Leptogonidia*), which are intermediate between the two preceding, smaller and of an oblong form. Of these the distinction between eugonidia and gonimia is fundamental, and of "so great weight that lichens seem to present a twofold parallel series" according to the presence of the one or the other in their texture. These two different anatomical elements, as observed by Nylander, have a certain biological analogy with the blood globules in animals, and similarly afford absolute characters. The principal forms presented by these three kinds of gonidia are the following. 1. Eugonidia consist of (*a*) *Haplogonidia*, the most frequent, simple, of a protococcoid form, or sometimes glomerulose (as in granuloso-leprose thalli); (*b*) *Platygonidia*, being depressed and variously membraneously connated gonidia (*Syngonidia*), as in some foliicolous species (*e. g.*, *Platygramma phyllosema*); (*c*) *Chroolepogonidia* (or *Chrysogonidia*), containing chlorophyll and orange grains (endochrome) in the same cellule, more or less similar to *Chroolepa* (as in *Gyalecta chlorobæa*, *Arthonia pruiosa*, *Platygrapha periclea*, *Verrucaria insiliens*, and the genus *Thelopsis*); (*d*) *Confervogonidia*, somewhat resembling *Confervæ*, and forming the chief element of the thallus of *Cœnogonium*. 2. Gonidimia are smaller than gonidia proper, with the wall of the cellules less distinct. They occur in *Peltidea*, *Solorina*, and *Nephroma expallidum*. To these belong also *hymenial gonidia*, which are often very minute, and are present in the thalamium (destitute of paraphyses) of various *Pyrenocarpei* (*e. g.*, *Verrucaria pallida*, *V. umbrina*, and *V. hymenogonia*), rarely of *Arthoniæ* as in *A. chroolepida*. 3. Gonimia (including the gonimia of *Cephalodia*) consist of—(*a*) *Haplogonimia*, which are somewhat large (very large in *Phylliscum*), and either simple, or two or several aggregated; (*b*) *Sirogonimia*, which are scytonemoid or sirosiphoid gonimia, distinguished by the gonimia being tunicated, and are characteristic of the family *Ephebacei*; (*c*) *Hormogonimia*, the most common form, smaller, moniliformly arranged, and contained in syngonimia, especially characteristic of the family *Collemacei*, whence *Collema* (or *Nostoc*) itself, according to Nylander, is to be considered but as a single syngonimium; (*d*) *Speirogonimia*, which are similar to the preceding, but are not moniliform, with the syngonimia subglobose, smaller and more scattered, as in *Omphalaria* and *Synalissa*. It will be perceived from the above that many of these forms are more or less similar to "gonidioid" algæ, though, as we shall presently see, they are not identical with these.

II. *The Origin of the Gonidia.*—By pre-microscopic authors this was a subject necessarily ignored, and indeed it is only within the last thirty years that it has been investigated by lichenists. The earliest theory as to their origin was that propounded by Bayrhoffer (*Einiges üb. d. Lichenen und deren Befruchtung*, 1851), confirmed by observations of Speerschneider (*Bot. Zeit.*, 1853, etc.), and supported by Schwendener (*Untersuch. üb. d. Flechtenhallus*, 1868). This was to the effect that the gonidia derived their origin from the hyphæ (*i. e.*, the thalline filaments), in the way succinctly detailed by M. Fries (in *Scand.*, 187', p. 7, where it is fully endorsed). "The hyphæ," he says, "are not only elongated into filaments, but also put forth short branchlets, the terminal cell of which is gradually dilated, becomes subglobose, and is at length filled with chlorophyll (or a subsimilar matter); in a few that (terminal cell) is changed into a gonidium, and then by varied division germinates other gonidia." For several years this theory was accepted at second-hand by most authors who referred to the subject, though a different origin of the gonidia, presently to be noticed, was indicated by the celebrated Tulasne so early as 1852, in his "Mémoire sur les lichens" (*Ann. Sc. Nat.*). The erroneous nature of this theory was well pointed out by Schwendener, who (*Die Algentypen d. Flechtengonidien*, 1869) very correctly affirmed that the actual development of a gonidium from the terminal cell of a hypha had not been observed, though, strange to say, he had previously himself observed this phenomenon. Not being able otherwise to account for the origin of the gonidia, and following up one of two alternatives put forward by De Bary (*Morpholog. und Physiolog. der Pilze, Flechten*, etc., 1865, p. 291), he promulgated the hypothesis now familiarly known as Schwendenerism. The conclusion to which De Bary came on noticing the resemblance between the gonidia of *Collemaceæ* and certain algæ was as follows:—"Either the lichens in question," he says, "are the perfectly developed states of plants, whose imperfect forms have hitherto stood amongst the algæ, as *Nostocaceæ* and *Chroococcaceæ*, or these latter are typical algæ which assume the forms of *Collema*, *Ephebe*, etc., through certain parasitic *Ascomycetes* penetrating into them, spreading their mycelium into the continuously growing thallus, and frequently attached to their phycochrome-bearing cells." Taking this latter suggestion as his starting point, and assuming the identity of certain algal types with the gonidia of lichens, and the identity of the mycelium of fungi with their hyphæ, Schwendener extends the said alternative to various other groups of lichens than the *Collemaceæ*, and comes to the conclusion that a lichen is composed of a parasitic fungus (the hyphæ) and a number of low algæ (*Chlorophyllaceæ* and *Phycochromaceæ*), the former of which produces the reproductive bodies and is nourished by the latter. This theory was subsequently expanded and illustrated at length by Bornet (*Recherches sur les Gonidies des Lichens*, 1873), who affirms, as the result of numerous investigations, "that the connection of the hyphæ with the gonidia is of such a nature as to exclude all possibility of the one organ being produced by the other," and that the theory of parasitism can alone explain it satisfactorily. To give any detailed account of the investigations of these authors, and the arguments by which they endeavor to support the hypothesis, would exceed the limits of the present article, even were all other matters relating to lichens to be excluded. Suffice it to state briefly that, according to Schwendenerism, a lichen is not an individual plant, but rather a community made up of two different kinds of individuals belonging to two distinct classes of cryptogams, viz., a master-fungus and colonies of algal slaves, which it has sought out, caught hold of, and retains in perpetual captivity in order to provide it with nourishment. To such a singular theory, which from its plausibility has met with considerable support in certain quarters, various *a priori* objections of great validity may be taken. Amongst others which have been adduced two may especially be noticed, having reference to the nature of this alleged parasitism, and the situations in which lichens are found. (1) The parasitism described is of a kind unknown in the vegetable kingdom, inasmuch as the host (the *Algæ*), instead of suffering any injury, only flourishes the more vigorously. Moreover, the algal slaves being entirely enclosed in the master-fungus, can evidently supply no nourishment to it whatever, while direct observation shows that it is through the surface of the thallus of the lichen that nourishment is conveyed to the gonidial stratum, where the active life chiefly has its seat. (2) As is well known, lichens shun such habitats as are most frequented by algæ and fungi, and occur in situations where neither of these are seen. Where then are the algal colonies which, according to the hypothesis, the fungus goes forth in quest of, and "presses into its service"? Either of these arguments is sufficient to throw more than doubt upon Schwendenerism. At the same time, as will be perceived, the origin of the gonidia in the thallus remains to be accounted for, in order that the hypothesis may be utterly subverted. It might at first sight be supposed that this was a matter of no very great difficulty, since by cultivating lichens from the spores it would readily become apparent. All attempts, however, in this direction (and many such have recently been made) have, owing to the peculiar character and conditions of lichen-growth, confessedly proved futile, and the experiments instituted have been productive of no definite results. This is not altogether to be regretted, since in nature itself, when lichens occur on certain substrata, we have in various instances the whole process of the evolution of their vegetative system placed before our eyes, from the first germinations of the spores to the formation of the perfect thallus. It is to Nylander, whose services here as elsewhere in lichenological science—structural, physiological, and systematic—are so valuable, that we owe the first clear enunciation as to the origin of the gonidia in the lichen-thallus. This, though previously indicated by him, as we shall presently see, was at greater length and still more definitely stated in several important papers in the *Flora*, viz., "De gonidiis et eorum formis animadversiones" (1877, No. 23), "Circa lichenes vitricolas notula" (1879, No. 19), and "De hypothallo notula" (1879, No. 36). In these he incontrovertibly demonstrates that the gonidia originate, not from the filaments themselves, but in the cellules of the first cortical glomerules which are produced upon the young hypothallus. This may very easily be studied in the earlier stages of development of crustaceous lichens growing on pure quartz rocks (*e.g.*, *Lecidea geographica*), on the smooth bark of young trees (*e. g.*, *Lecanora subfusca*), and more especially on the surface of old glass (*e. g.*, *Lecanora galactina* and *Lecidea alboatra*). In the case of the young thalli of *Lecanora cinerea* this was sufficiently well delineated by the celebrated Tulasne in 1852, the year subsequent to the promulgation of the Bayrhofferian theory, in his elaborate "Mémoire sur les Lichens," pl. iii. f. 3. Afterwards, as the evolution of the cortical stratum advances, its lower portion is resorbed, and the gonidia there become free, giving rise to the gonidial stratum, to the hyphæ in which they are not *adnate*, as has been represented, but only adherent by means of the gelatin which penetrates all the elements of the lichen. Often also growing gonidia, young and adult, may be observed in the pseudo-parenchymatous cortical cellules in lichens which in this respect are best adapted for examination, such as *Umbilicaria* (*vide* Nylander in *Flora*, 1875, p. 303), *Physcia pulverulenta*, *Psoroma hypnorum*, etc. Similarly, with respect to the origin of the gonimia, Nylander observes (*Flora*, 1868, p. 353) that the isidia in the *Collemacei* (more especially in *Collema*) "show very clearly under the microscope the entire history of the evolution of the thallus from its first origin from a cellule containing a single gonimium to a minute true nostoc, and ultimately to the perfect texture of a *Collema*." With these facts before us, to which various others might be added, such as the entire absence of any algals on pure substrata, where lichen growth presents itself in all its stages, we are compelled to come to the conclusion that the gonidia constitute a true organic system in lichens, and in nature are nowhere seen outside the thallus. Consequently those free algal forms, such as *Protococcus*, etc., regarded as the free gonidia of lichens, are true algæ, there being indeed a parallelism between them but no identity. On the other hand, as to the alleged identity of the lichen-hypha with a fungus-mycelium, it is to be observed that the two are totally different in their nature. The hyphæ of lichens

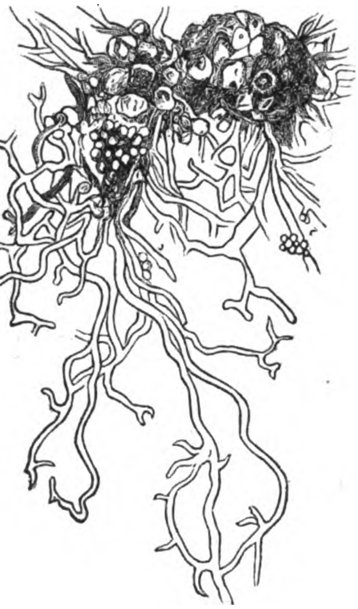

Fig. 6.—Hypothalline condition of *Lecanora cinerea*, showing the origin of the first Cortical Gonidiogenous Cellules. (After Tulasne.)

(*mycelohyphæ* of Nylander) are rigid, elastic, containing lichenine, not becoming putrid by maceration, with no faculty of penetrating or involving, while the hyphæ of fungi are caducous, soft, flexile, with thin walls, etc. Hence, as there is no algal in the lichen, so neither is there any fungus, though there is a parallelism between the fructification of lichens and the asciferous section of fungi (Crombie in *Pop. Sc. Rev.*, 1874).

Nutrition and Life of Lichens.

As already intimated, lichens derive their nourishment directly from the atmosphere, in the shape of rain (or dew) with the materials contained in it. Here, as elsewhere, water is the condition of life, and through its medium is conveyed to them the nutrient substances requisite for their existence and growth, from the clouds, from rivers, and, in the case of maritime species, even from the sea. Where, however, the atmosphere is impregnated with smoke, soot, or other deleterious ingredients, lichens will not grow nor flourish. Hence in our larger cities, or even in smaller manufacturing towns, scarcely any lichen vegetation, or none whatever, is seen. Even in their more immediate suburban districts they occur only in a gonidial or rudimentary state, constituting the pseudo-genus *Lepraria* of the older botanists, and increasing through long periods by bisection, but never developing into perfect plants. Indeed, it is now a well-known fact that their fully developed condition is a sure indication of the purity of the air and the salubrity of the districts in which they occur. It has sometimes been stated that they draw some portion at least of their nutriment from the substratum to which they are affixed. For this, however, their structure is by no means well adapted, and such inorganic substances as iron and lime, which enter into their composition, are only as if mechanically derived in solution from the substratum. This in very many instances, *e. g.*, bare quartzose rocks, dead sapless wood, and pure naked glass, can evidently supply no nutriment whatever. Moreover, in the case of crustaceous species, such as *Lecanora tartarea*, etc., and also of terricole fruticulose species, such as *Cetraria islandica*, etc., the portion of the thallus next to the substratum is dead, so that no nutrient substances can be conveyed through it to the upper layers of the thallus. A very simple, but at the same time convincing, illustration of this is adduced by Nylander. "By immersing," he says, "any fruticulose thallus, such as *Usnea*, by the base in water, it remains entirely dry (with the exception of the part submersed), but if water be poured over the other portions, it quickly absorbs it, softens, and revives." The same thing may be seen in nature itself, in the case of such species as *Cladina rangiferina*, *Alectoria ochroleuca*, *Platysma nivale*, etc., growing on temporarily wet substrata, when the base of their thalli is soft and moist, and all the rest dry and rigid. It cannot therefore be doubted that the nutritive elements contained in the rain or other water are conveyed to the lichen through the surface of the thallus. It is in the superficial parts also, as Nylander has well observed (in *Flora*, 1874, No. 4), that "the active life has its seat, chiefly around the gonidia, manifesting itself in the putting forth of young parts (lobes, laciniæ, branches, isidia), and in the functions of the apothecia and the spermogones, so that the nourishing humors necessary for all the actions of life are especially and directly poured upon these." The vital activities, however, in lichens thus nourished are, as might be expected from the nature of the source whence their nutriment is derived, very intermittent, and in dry weather cease to operate, and become entirely dormant. Hence their life, unlike that of all other plants, is twofold, viz., one *active*, in which when moistened all the vegetative and reproductive functions are at work, and the other *passive*, in which when dry these functions are completely in abeyance. For such a peculiar duplex existence, at one time vegetating, at another lethargic, their organization in all its parts, gonidial and otherwise, is admirably adapted. More especially is this the case with respect to the lichenine found in their textures, which, being readily dried and as readily moistened, enables them to resist with impunity the greatest extremes of temperature, alternate periods of drought and wet, the scorching heat of the sun, the vehemence of stormy winds, and the nipping frosts of winter.

In this fitful and abnormal life of lichens we have the explanation in a great measure of their almost indefinite duration of existence. It is well known that they are perennial plants in the widest sense of the term, and that, though in the earlier stages of their existence their growth is comparatively rapid, yet this becomes extremely slow when they arrive at a certain age. The time required for the development of even the most rapidly growing species may be calculated by the appearance of such of these as are met with on gravestones, mortar of houses, stone walls, wooden palings, and such like, the date of whose erection is known. Amongst other instances which have come under the present writer's own observation may be adduced the case of *Physcia parietina*, growing in fair quantity on the stones of a granite wall built in 1836 in a maritime district where the plant is extremely abundant, and where atmospherical and other conditions are well suited for its growth. In a recent visit to the spot it was found that, although the thallus is now well developed, no fructification whatever is visible, though traces of spermogones are beginning to appear, so that in the space of forty-five years this plant has not yet attained full maturity. But slow as is the growth of lichens after a certain stage of their development, their tenacity of life is very remarkable, as might *a priori* be inferred from their capacity of enduring without injury the greatest extremes of temperature and of hygrometrical conditions. It is on record that, after the lapse of nearly half a century, the same specimen on the same spot of the same tree has been observed without any change in its condition. On this point also E. Fries (in *L. E.*, p. xlv.) notices that certain species such as *Physcia ciliaris*, kept in houses for upwards of a year, revive when again exposed to the influences of the atmosphere,—an observation which in the case of *Cladina rangiferina* similarly kept for a still longer period the present writer can fully corroborate. Endowed then with this singular intermittent vitality, we can easily understand how many individuals which occur on hard mountainous rocks or on the trunks of aged trees in ancient forests are in all probability many hundreds of years old. Nor does age seem in any way to weaken their fecundity, even when the thallus has apparently ceased to grow. This, as observed by Nylander (in *Syn.*, p. 5), is shown from the circumstance that were it otherwise "the already old fruits would be destitute of spores, which is never the case," unless in plants of some lower tribes, *e. g.*, *Graphidei* and *Verrucariæ*, in which the thallus is but sparingly gonidiose, and the life consequently is shorter. In other instances the central portion of the thallus sometimes normally perishes in old plants, as in *Pterygium centrifugum*, *Collema melænum*, *Parmelia centrifuga*, and *P. saxatilis*, leaving only peripheral circles, in which, however, the life of the individual still continues for ages. In fact, "the life of lichens bears in itself no cause of death, and is only to be ended by external injuries" (E. Fries, *L. E.*, *loc. cit.*), or by the alteration of climatic and atmospherical conditions. Hence the assumption is not unwarrantable that individuals of such confessedly long-lived species as *Lecidea geographica*, growing on rocks upon the summits of lofty mountains, date from more than "fabulous epochs," and probably outrival in longevity the ages assigned to the oldest trees on the surface of the globe.

Chemistry of Lichens, and Chemical Reactions.

Chemistry of Lichens.—This is still but little understood, notwithstanding that the subject has been more or less investigated by authors. Their examinations, however, have been too limited and desultory to enable us to give any detailed account of the different principles which enter into the composition of the lichen tissues. Moreover, with respect to those species which have been more particularly analyzed, they have sometimes employed not only the same terms in different senses, but also different terms to denote the same substance. There can, however, be no doubt that the chemical composition of lichens not only produces great modifications in their form, but also considerable diversities in their properties.

The principal substance which occurs in lichens, especially in such as are foliaceous and fruticulose, is *lichenine*—a special kind of gelatin peculiar to them. It is intermediate in character between dextrin and starch, and very eagerly imbibes water, though if boiled in water it is dissolved and lost. *Starch* also very rarely occurs in large lenticular grains scattered in the tissues. In crustaceous lichens *oxalate of lime* predominates, and forms a large proportion of the thallus, *e. g.*, 65 per cent. in *Lecanora esculenta* according to Gœbel. *Chlorophyll* and its modification *phycochrome* are found in lichens only in relatively small quantities, as is also the case with most of the other principles they present. These are enumerated by Nylander (in *Syn.*, p. 51) according to the affinities they bear, as follows:—(1) phosphate of lime, sea-salt, manganese, iron; (2) picrolichenine, variolarine, orceine, cetrarine, inuline, erythrine, roccelline, picroerythrine; (3) gyrophoric acid, parellic acid, usneic acid, orceic acid, erythrinic acid; (4) sugar not crystallizable, oil, waxy matter, resinous matter. Several others, especially phosphates and acids, have been enumerated by authors, which in some instances have not been corroborated, and in others are doubtfully distinct. In illustration of the manner in which several of these principles enter into the composition of lichens, we may adduce the analyses given in one or two species which have been more fully subjected to experiment. In *Cetraria islandica* there have been detected *starch*, including lichenine and inuline, to the extent of 80 per cent.; *gummy* and *waxy* matters; a bitter principle, *cetraric acid; a* fatty principle, *lichestearic acid; fumaric acid*, which exists also in *Fumaria officinalis; gallic acid*, the astringent principle of galls; uncrystallizable *sugar;* various salts, such as *bitartrate of potash*, and *tartrate* and *phosphate of lime*. Again, in *Physcia parietina* there have been found several alimentary principles, as *gliadine, starch, sugar, gum;* several medicinal substances, as *resin, bitter matter, gallic acid*, and a peculiar ethereal *oil;* a yellow coloring matter called *chrysophanic acid;* also *wax, stearine*, and some salts, as *carbonate of lime*. The *ash* of lichens is said to constitute from 8 to 10 per cent. of their bulk, and consists of various earthy bases, such as potash, soda, lime, magnesia, alumina, silica, manganese, and peroxide of iron, in combination with various acids, such as carbonic, phosphoric, sulphuric, and hydrochloric. The whole subject, however, of the chemistry of lichens requires to be investigated in a more extensive and methodical manner than has hitherto been done either by chemists or lichenists.

Chemical Reactions in Lichens.—These have reference to the thallus and the apothecia, and in both respects afford valuable assistance in the systematic study of lichens. (*a*) *Thalline* reactions depend upon the presence in the thallus of certain colorable materials in the form of acids, and are manifested on the application of hydrate of potash and the hypochlorite of lime either on the cortical stratum or the medulla. Of these reagents, hydrate of potash (K), composed of equal weights of caustic potash and water, and hypochlorite of lime (CaCl), composed of chloride of lime and water of any strength, may give certain reactions or none, according to the presence or absence of particular acids in the thallus. If no reaction takes place, this is denoted by K−, CaCl−, and similarly if there is reaction by K+, CaCl+. A very convenient mode of symbolizing the positive and negative reactions of the cortical layer and the medulla of the same species is to place the reaction of the former above the latter, *e.g.*, K±, CaCl∓, denoting that with K the cortical stratum shows reaction and the medulla none, while with CaCl the cortical stratum gives none, but the medulla a distinct reaction. Again, there is often no reaction produced by K alone, but if CaCl be added to it while still moist, a decided reaction appears, for which K(CaCl)+ is the symbol; or, on the other hand, the reaction given by K may be neutralized by the immediate application of CaCl, in which case it is expressed by K+(CaCl)−. The positive reactions are due to the presence of particular acids in the thallus, such as *erythrinic* acid giving a crimson reaction with CaCl, *chrysophanic* acid giving a purple reaction with K, *glaucinic* acid giving a yellow reaction with CaCl, and *lecanoric* acid giving a citrine reaction with K. In most cases where the natural color of the thallus (often also of the medulla) is yellow or orange, chrysophanic acid is present, and with K gives a purple reaction (*e. g. Physcia lychnea*), but in others externally similar in color and general appearance, where only *lecithophanic* acid is present (*e. g.*, *Lecanora laciniosa*), K gives no reaction whatever. Sometimes K produces at first a yellow color which immediately changes into a red or purple, as in *Lecanora cinerea*, which at once enables us to distinguish it from the closely allied species *L. gibbosa* and *L. calcarea*. A solution of iodine (I) is also in certain cases useful as a test on the medulla, and in the discrimination of some species of *Collema*. The value of these chemical tests in lichens was first pointed out by Nylander in *Flora*, 1866, pp. 223, 224, was subsequently illustrated by him in *Flora*, 1869, *passim*, in the case of species belonging to various genera, and has since been generally acknowledged by lichenists and employed by them in all specific diagnoses. They are unquestionably most important, not only in the discrimination of many difficult and closely allied species, but also in enabling us to refer with certainty varieties to the species to which they properly belong. Nay, even a small fragment of the thallus, whether sterile or fertile, may by their aid be readily determined, while otherwise it would be either quite indeterminable or doubtful. Generally they may be obtained on any portion of the thallus, but they are frequently more vivid, as might be expected, in the growing or circumferential portions. It is, however, only immediate reactions which depend on the coloring matter contained in the cortical stratum and the medulla that are to be attended to, and not secondary or tardy reactions which may otherwise originate, *e. g.*, from the dissolution of the chlorophyll of the gonidia. At the same time it is to be observed, in order to prevent a misconception which has occasionally been entertained, that they do not *per se* constitute a special *specific* character, but only an additional and confirmatory specific character. As such their value is clearly apparent in cases where the external characters are similar or approximate, and doubt necessarily exists as to their specific value. (*b*) *Apothecial* reactions for the most part take place either externally on the epithecium or internally on the hymenial gelatin. The reactions of the epithecium are generally produced by K on species which have yellow or orange apothecia (*e. g.*, *Lecanora aurantiaca, Lecidea leucoxantha*), while others with concolorous apothecia (*e. g.*, *Lecanora epanora*, *Lecidea lucida*) give no reaction whatever, owing to the presence or absence of chrysophanic acid. In certain cases also the reaction with CaCl is very useful in enabling us to separate closely allied species with similar apothecia, *e. g.*, *Lecanora subcarnea* (epithecium CaCl−) from *L. glaucoma* (epithecium CaCl+ yellow). Again, with respect to the reaction of the hymenial gelatin, this, as already observed, depends on the application of a solution of iodine. The formula by which the solution is to be prepared is iodine, gr. j.; iodide of potash, gr. iij; distilled water, ½ ounce. In most lichens, where the spores are mature, this solution will tinge the hymenial gelatin in some cases only blue, in others at first blue and then wine-red, and in others wine-red or tawny wine-colored only, without any preceding blue tinge. In such instances the reaction obtained is often very useful as a confirmatory specific character. Sometimes, however, the blue reaction takes place only on the thecæ (*e. g.*, *Pertusaria, Cladonia*, etc.), and at other times only on the epispore (*e. g.*, *Graphis, Thelotrema*, etc.). In the case of some species belonging to the inferior genera the reaction with I is especially valuable for the assistance it lends in distinguishing them from certain pyrenomycetous fungi, to which otherwise they might be supposed to belong. True, in some fungi (*e. g.*, *Peziza*) we obtain a reaction with I, and in some lichens we have no reaction visible; but otherwise in such exceptional instances their respective anatomical characters readily show to which class they belong.

Economic Uses of Lichens.

These are intimately connected with their chemical constituents, and are in some respects very important. In the arts, as food and as medicine, many of them have been highly esteemed, though others are not now employed for the same purposes as formerly.

1. *Lichens Used in the Arts.*—Of these the most important are such as yield, by maceration in ammonia, the valuable dyes known in commerce as archil, cudbear, and litmus. These, however, may with propriety be regarded as but different names for the same pigmentary substance, the variations in the character of which are attributable to the different modes in which the pigments are manufactured. Archil proper is de-

rived from several species of *Roccella* (*e. g.*, *R. Montaguei*, *R. tinctoria*), which yield a rich purple dye and fetch a high price in the market. Of considerable value is the "perelle" prepared from *Lecanora parella*, and much used in the preparation of a red or crimson dye. Inferior to this is "cudbear," derived from *Lecanora tartarea*, which was formerly very extensively employed by the peasantry of north Europe for giving a scarlet or purple color to woollen cloths. By adding certain alkalies to the other ingredients used in the preparation of these pigments, the color becomes indigo-blue, in which case it is the litmus of the Dutch manufacturers. Amongst other lichens affording red, purple, or brown dyes may be mentioned *Ramalina scopulorum*, *Parmelia saxatilis* and *P. omphalodes*, *Umbilicaria pustulata* and several species of *Gyrophora*, *Urceolaria scruposa*, all of which are more or less employed as domestic dyes. Yellow dyes, again, are derived from *Chlorea vulpina*, *Platysma juniperinum*, *Parmelia caperata* and *P. conspersa*, *Physcia flavicans*, *Ph. parietina*, and *Ph. lychnea*, though like the preceding they do not form articles of commerce, being merely used locally by the natives of the regions in which they occur most plentifully. In addition to these, many exotic lichens, belonging especially to *Parmelia* and *Sticta* (*e. g.*, *Parmelia tinctorum*, *Sticta argyracea*), are rich in colorific matter, and, if obtained in sufficient quantity, would yield a dye in every way equal to archil. These pigments primarily depend upon special acids contained in the thalli of lichens, and their presence may readily be detected by means of the reagents already noticed. In the process of manufacture, however, they undergo various changes, of which the chemistry is still but little understood. At one time also some species were used in the arts for supplying a gum as a substitute for gum-arabic. These were chiefly *Ramalina fraxinea*, *Evernia prunastri*, and *Parmelia physodes*, all of which contain a considerable proportion of gummy matter (of a much inferior quality, however, to gum-arabic), and were employed in the process of calico-printing and in the making of parchment and cardboard. In the 17th century some filamentose and fruticulose lichens, viz., species of *Usnea* and *Ramalina*, also *Evernia furfuracea* and *Cladina rangiferina*, were used in the art of perfumery. From their supposed aptitude to imbibe and retain odors, their powder was the basis of various perfumes, such as the celebrated "Poudre de Cypre" of the hairdressers, but their employment in this respect has long since been abandoned.

2. *Nutritive Lichens.*—Of still greater importance is the capacity of many species for supplying food for man and beast. This results from their containing amylaceous substances, and in some cases a small quantity of saccharine matter of the nature of mannite. One of the most useful nutritious species is *Cetraria islandica*, "Iceland moss," which, after being deprived of its bitterness by boiling in water, is reduced to a powder and made into cakes, or is boiled and eaten with milk by the poor Icelander, whose sole food it often constitutes. Similarly *Cladina rangiferina* and *Cl. Sylvatica*, the familiar "reindeer moss," are frequently eaten by man in times of scarcity, after being powdered and mixed with flour. Their chief importance, however, is that in Lapland and other northern countries they supply the winter food of the reindeer and other animals, who scrape away the snow and eagerly feed upon them. Another nutritious lichen is the "Tripe de Roche" of the Arctic regions, consisting of several species of the *Gyrophorei*, which when boiled is often eaten by the Canadian hunters and Red Indians when pressed by hunger. But the most singular esculent lichen of all is the "manna lichen," which in times of drought and famine has served as food for large numbers of men and cattle in the arid steppes of various countries stretching from Algiers to Tartary. This is derived chiefly from *Lecanora esculenta*, which grows unattached on the ground in layers from 3 to 6 inches thick over large tracts of country in the form of small irregular lumps of a grayish or white color. Speaking of the distribution of these nutritive lichens, whose qualities depend on the presence of amylaceous matter, Dr. Lindsay (in *Pop. Hist. Brit. Lich.*, p. 82) very appropriately remarks that, "by a beautiful provision of nature, they occur precisely under the circumstances where they are most wanted—in northern or arctic countries, or on arid steppes, where grain stuffs are unknown, and food of a better kind is often scarce or deficient." In connection with their use as food we may observe that of recent years in Scandinavia and Russia an alcoholic spirit has been distilled from *Cladina rangiferina* and extensively consumed, especially in seasons when potatoes were scarce and dear. Formerly also *Sticta pulmonaria* was much employed in brewing instead of hops, and it is said that a Siberian monastery was much celebrated for its beer which was flavored with the bitter principle of this species.

3. *Medicinal Lichens.*—During the Middle Ages, and even in some quarters to a much later period, lichens were extensively used in medicine in various European countries. Many species had a great repute as demulcents, febrifuges, astringents, tonics, purgatives, and anthelmintics. The chief of those employed for one or other, and in some cases for several, of these purposes were *Cladonia pyxidata*, *Usnea barbata*, *Ramalina farinacea*, *Evernia prunastri*, *Cetraria islandica*, *Sticta pulmonaria*, *Parmelia saxatilis*, *Physcia parietina*, and *Pertusaria amara*. Others again were believed to be endowed with specific virtues, *e. g.*, *Peltigera-canina*, which formed the basis of the celebrated "pulvis antilyssus" of Dr. Mead, long regarded as a sovereign cure for hydrophobia; *Platysma juniperinum*, lauded as a specific in jaundice, no doubt on the *similia similibus* principle from a resemblance between its yellow color and that of the jaundiced skin; *Peltidea aphthosa*, which on the same principle was regarded, by the Swedes, when boiled in milk, as an effectual remedy for the *aphthæ* or rash on their children. Almost all of these virtues, general or specific, were imaginary; and at the present day, except perhaps in some remoter districts of northern Europe, only one of them is employed as a remedial agent. This is the "Iceland moss" of the druggists' shops, which is undoubtedly an excellent demulcent in various dyspeptic and chest complaints. Probably also *Pertusaria amara*, from the intensely bitter principle which it contains, might still with propriety be employed as a febrifuge. No lichen is known to be possessed of any poisonous properties, although *Chlorea vulpina* is believed by the Swedes to be destructive to wolves when powdered and "mixed with pounded glass." Nor are lichens, as has sometimes been alleged, injurious to the trees upon which they grow, except to a very limited extent. Not being parasites properly so called, the only injury they can inflict upon them is by slightly interfering with the functions of respiration, or, when growing very crowdedly upon the branches of orchard trees, by checking the development of buds.

Classification of Lichens.

From the time of Acharius, the father of lichenological science, different authors have proposed different classifications of lichens, according to the degree of importance attached by them to one or other of their vegetative and reproductive organs. Most of these classifications, however, whether proposed by microscopical or pre-microscopical lichenists, have been too artificial and arbitrary, and indeed less natural in various ways than that originally propounded by Acharius. Of recent years they have been entirely superseded by other two systems, viz., that of the Massalongo-Koerberian and that of the Nylanderian school. With respect to the former of these, its characteristic feature is the prominence which it assigns to the form and structure of the spores not only in the differentiation of species but also in the foundation of genera. Though it has been adopted, with various modifications, by many Continental lichenists, yet essentially it also proceeds on an artificial principle, and necessitates the adoption of far too many genera, distinguished from each other merely by slight differences in the spores. The other system—that of Nylander, which was first proposed by him in his *Essai d'une Nouvelle Classification des Lichens* (1854–55),—has since then commended itself more and more to the acceptation of lichenists, so that even the disciples of the opposite school (the sporologists) have in many respects gradually approximated towards it in their most recent writings. Not only is it the only complete system of classification yet wrought out; it is also the most natural and philosophical of any hitherto propounded. In its main outline it proceeds upon the principle of showing the near relation of certain lichens to some genera of algæ on the one hand, and of certain other lichens to some genera of fungi on the other hand, and connects these three great classes of cryptogams together by a sort of twofold chain, commencing with those genera of lichens nearest allied to the algæ, working up to those genera best developed (*Sticte*i), and thence retrograding and terminating with those nearest allied to the fungi. His genera also are principally founded, not upon a single special character, but upon the combined anatomical characters presented by the thallus, the apothecia, and the spermogones. It may here be further observed that we are indebted to the same accomplished lichenist for the succinct but comprehensive diagnoses, generic and specific, of the different parts of a lichen, which have tended so much to facilitate their systematic study. The following is a conspectus of the Nylanderian classification of lichens, with the leading characters of the different families and tribes, and an enumeration of all the principal genera of which these are composed.

Family I.—*Ephebacei*, Nyl.

Thallus but little turgid when moist, gonidial stratum consisting of gonimia which are tunicated; medullary filaments none.

Tribe 1. *Sirosiphei*, Nyl.—Thallus filamentoso-fruticulose, gonimia variously connate. Apothecia biatorine or lecideine. Spermogones with sterigmata or arthrosterigmata.

Genera: *Sirosiphon*, Ktz.; *Gonionema*, Nyl.; *Spilonema*, Born.

Tribe 2. *Pyrenopsei*, Nyl.—Thallus thinly granulose, rubricose within, gonimia simple or connate. Apothecia lecanorine or pyrenocarpous. Spermogones with simplish sterigmata.

Genera: *Euopsis*, Nyl.; *Prenopsis*, Nyl.

Tribe 3. *Homopsidei*, Nyl.—Thallus either fruticulose with the gonimia seriated, or squamuliform or granulose with the gonimia subsolitary. Apothecia pyrenocarpous with or without paraphyses. Spermogones with simple sterigmata.

Genera: *Ephebe*, Fr.; *Ephebeia*, Nyl.; *Phylliscum*, Nyl.; *Phylliscodium*, Nyl.; *Collemopsidium*, Nyl.

Tribe 4. *Magmopsei*, Nyl.—Thallus pyrenopsidian, containing syngonimia, the gonimia arranged without order. Apothecia peridieine.

Genus: *Magmopsis*, Nyl.

Family II.—*Collemacei*, Nyl.

Thallus turgid when moist, gonidial stratum consisting of gonimia moniliformly arranged; medulla not discrete.

Tribe 1. *Lichinei*, Nyl.—Thallus fruticulose or radiately laciniated, gonimia elongato-seriately moniliform, subconnate. Apothecia lecanorine or lecideine. Spermogones with sterigmata or arthrosterigmata.

Genera: *Lichina*, Ag.; *Pterygium*, Nyl.; *Leptogidium*, Nyl.; *Lichinodium*, Nyl.

Tribe 2. *Collemei*, Nyl.—Thallus membranaceous, lobate, rarely fruticulose, granulose or subsquamulose, gonimia moniliformly arranged, cortical stratum none or distinct. Apothecia lecanorine or rarely pyrenocarpous. Spermogones with simplish sterigmata or arthrosterigmata.

Genera: *Leciophysma*, Fr. fil.; *Synalissa*, DR.; *Omphalaria*, DR.; *Anema*, Nyl.; *Paulia*, Fée; *Schizoma*, Nyl.; *Collema*, Ach.; *Leptogium*, Ach.; *Ramalodium*, Nyl.; *Kichinella*, Nyl.; *Amphidium*, Nyl.; *Collemopsis*, Nyl.; *Hydrothyria*, Russ.

Tribe 3. *Pyrenidiei*, Nyl.—Thallus fibrillose, gonimia moniliformly coherent, cortical stratum distinct. Apothecia pyrenoid.

Genus: *Pyrenidium*, Nyl.

Family III.—*Lichenacei*, Nyl.

Thallus not gelatinous, with a gonidial, rarely gonimic stratum; medullary stratum more or less distinct.

Series I.—*Epiconiodei*, Nyl.

Apothecia with the spores usually naked and pulverulent on the surface of the fructification.

Tribe 1. *Caliciei*, Nyl.—Thallus horizontally expanded, sometimes none. Apothecia stipitate, capituliform or sessile. Spermogones with simple sterigmata.

Genera: *Sphinctrina*, Fr.; *Calicium*, Pers.; *Stenocybe*, Nyl.; *Coniocybe*, Ach.; *Pyrgidium*, Nyl.; *Trachylia*, Fr.; *Pyrgillus*, Nyl.

Tribe 2. *Tylophorei*, Nyl.—Thallus thinly crustaceous. Apothecia at first pyrenodean and then lecanorine with sporal mass. Spermogones with somewhat branched sterigmata.

Genus: *Tylophoron*, Nyl.

Tribe 3. *Sphærophorei*, Nyl.—Thallus fruticulose, branched. Apothecia at first nucleiform, becoming variously dehiscent, with sporal mass. Spermogones with simplish sterigmata or arthrosterigmata.

Genera: *Sphærophoron*, Pers.; *Acroscyphus*, Lev.; *Thelurna*, Norm.

Series II.—*Cladodei*, Nyl.

Apothecia terminal on podetia, rarely sessile, biatorine or rarely lecanorine.

Tribe 4. *Bæomycetei*, Nyl.—Thallus horizontally expanded. Apothecia substipitate. Spermogones with sterigmata or arthrosterigmata.

Genera: *Gomphillus*, Nyl.; *Bæomyces*, Pers.; *Glossodium*, Nyl.; *Thysanothecium*, Berk.; *Stereocauliscum*, Nyl.

Tribe 5. *Pilophorei*, Nyl.—Thallus granulose, cephalodiiferous, with rigid podetia. Apothecia cephalodine, on the podetia, with the paraphyses prolongated into the hypothecium. Spermogones with simplish sterigmata.

Genus: *Pilophoron*, Tuck.

Tribe 6: *Stereocaulei*, Nyl.—Thallus cæspitose, podetiiform, solid. Apothecia terminal or lateral, lecideine or rarely lecanorine. Spermogones with simple sterigmata.

Genera: *Stereocaulon*, Schreb.; *Stereocladium*, Nyl.; *Argopsis*, Fr. fil.; *Oxocladium*, Mnt.

Tribe 7. *Cladoniei*, Nyl.—Thallus foliaceous or fruticulose, with fistulose podetia. Apothecia biatorine on the podetia, rarely sessile on the leaflets. Spermogones with simplish sterigmata.

Genera: *Heterodea*, Nyl.; *Pycnothelia*, Ach.; *Cladonia*, Hffm.; *Cladina*, Nyl.; *Cladia*, Nyl.; *Ramalea*, Nyl.

Series III.—*Ramalodei*, Nyl.

Thallus efoliolose, fruticulose, or filamentose. Apothecia generally lecanorine.

Tribe 8. *Roccellei*, Nyl.—Thallus simplish or branched, internally with filamentose medulla. Apothecia irregular (normally lecanorine), adnate, terminal, or lateral. Spermogones with simplish sterigmata.

Genera: *Combea*, DN.; *Roccella*, DC.

Tribe 9. *Siphulei*, Nyl.; Thallus podetiiform, simple or fruticulose, internally with filamentose or fistulose medulla. Apothecia unknown. Spermogones (where seen) with arthrosterigmata.

Genera: *Siphula*, Fr.; *Endocena*, Cromb.; *Thamnolia*, Ach.

Tribe 10. *Ramalinei*, Nyl.—Thallus fruticuloso-foliaceous, rounded or compressed, with woolly medulla. Apothecia lecanorine, scutellate. Spermogones with arthrosterigmata.

Genus: *Ramalina*, Ach.

Tribe 11. *Usneei*, Nyl.; Thallus much branched, rounded, or compressed, with firm medullary axis. Apothecia parmelioid, peltate. Spermogones with simplish sterigmata.

Genera: *Usnea*, Hffm.; *Neuropogon*, N. and Fl.; *Chlorea*, Nyl.

Tribe 12. *Alectoriei*, Nyl.—Thallus branched, rounded, or compressed, with woolly medulla. Apothecia parmelioid, scutelliform. Spermogones with simplish sterigmata or arthrosterigmata.

Genera: *Alectoria*, Ach.; *Dactylina*, Nyl.; *Dufourea*, Ach.

Tribe 13. *Cetrariei*, Nyl.—Thallus fruticulose or foliaceous, with woolly medulla. Apothecia parmelioid, marginal, obliquely affixed. Spermogones with simple sterigmata or arthrosterigmata.

Genera: *Cetraria*, Ach.; *Platysma*, Hffm.

Series IV.—*Phyllodei*, Nyl.

Thallus foliaceous, usually depressed, lobate. Apothecia generally peltiform or lecanorine.

Tribe 14. *Parmeliei*, Nyl.—Thallus frondosely dilated, or lobate, or laciniated, with woolly, rarely solid, medulla. Apothecia parmelioid, scutelliform. Spermogones with simple sterigmata or arthrosterigmata.

Genera: *Evernia*, Ach.; *Everniopsis*, Nyl.; *Parmelia*, Ach.; *Parmeliopsis*, Nyl.

Tribe 15. *Stictei*, Nyl.—Thallus large, lobate, cyphellate, or ecyphellate beneath; gonidial stratum composed either of nodulose gonimia or of true gonidia. Apothecia lecanorine, rarely parmeleine. Spermogones with arthrosterigmata.

Genera: *Stictina*, Nyl.; *Lobarina*, Nyl.; *Sticta*, Ach.; *Lobaria*, Nyl.; *Ricasolia*, DN.

Tribe 16. *Peltigerei*, Nyl.—Thallus frondosely dilated, the cortical stratum often wanting beneath; gonidial stratum consisting either of gonidia or (usually) of gonimia, rarely of gonidimia. Apothecia peltiform, adnate, or innate. Spermogones (where seen) with arthresterigmata.

Genera: *Nephroma*, Ach.; *Nephromium*, Nyl.; *Peltidea*, Ach.; *Peltigera*, Hffm.; *Solorina*, Ach.

Tribe 17. *Physciei*, Nyl.—Thallus stellato-orbicular, rarely fruticulose, internally with woolly medulla; gonidial stratum consisting of true gonidia. Apothecia lecanorine. Spermogones with arthrosterigmata.

Genus: *Physcia*, Nyl.

Tribe 18. *Pyxinei*, Nyl.—Thallus stellato-laciniated, with woolly medulla and true gonidial stratum. Apothecia lecideine. Spermogones with arthrosterigmata.

Genus: *Pyxine*, Fr.

Tribe 19. *Gyrophorei*, Nyl.—Thallus umbilicately affixed, with woolly medulla and true gonidial stratum. Apothecia lecanoroid, or lecideine and gyrose. Spermogones with arthrosterigmata.

Genera: *Umbilicaria*, Hffm.; *Gyrophora*, Ach.

Series V.—*Placodei*, Nyl.

Thallus variously crustaceous, sometimes evanescent, rarely hypophlœodal, without any filamentose medullary stratum. Apothecia lecanorine, or lecideine, or lirellæform.

Tribe 20. *Lecanorei*, Nyl.—Thallus crustaceous, rarely evanescent or obsolete; gonidial stratum consisting of gonidia, rarely of gonimia. Apothecia lecanorine, rarely subbiatorine or typically biatorine. Spermogones with simple sterigmata or arthrosterigmata.

Genera: *Pannaria*, Del.; *Gymnoderma*, Nyl.; *Erioderma*, Fée; *Heppia*, Næg.; *Amphiloma*, Fr.; *Psoroma*, Fr.; *Lecanora*, Ach.; *Glypholecia*, Nyl.; *Peltula*, Nyl.; *Dermatiscum*, Nyl.; *Dirina*, Fr.

Tribe 21. *Pertusariei*, Nyl.—Thallus crustaceous, continuous; gonidial system consisting of true gonidia. Apothecia endocarpoid or lecanoroid. Spermogones with simple sterigmata.

Genera: *Pertusaria*, DC.; *Varicellaria*, Nyl.

Tribe 22. *Thelotremei*, Nyl.—Thallus crustaceous, or pulverulent, or areolate, with true gonidial stratum. Apothecia urceolato-impressed with double margin. Spermogones with simple or somewhat branched sterigmata.

Genera: *Phlyctis*, Wallr.; *Tremotylium*, Nyl.; *Thelotrema*, Ach.; *Urceolaria*, Ach.; *Belonia*, Krb.; *Gyrostomum*, Nyl.; *Ascidium*, Fée; *Gymnotrema*, Nyl.

Tribe 23. *Lecideei*, Nyl.—Thallus variously crustaceous, pulverulent, evanescent or none proper, with the gonidial stratum consisting of gonidia (rarely chrysogonidia), rarely gonimia. Apothecia lecideine (or biatorine). Spermogones with simple or simplish sterigmata.

Genera: *Cœnogonium*, Ehrh.; *Byssocaulon*, Mnt.; *Pannularia*, Nyl.; *Coccocarpi*, Pers.; *Lecidea*, Ach.; *Gyrothecium*, Nyl.; *Epiphora*, Nyl.

Tribe 24. *Graphidei*, Nyl.—Thallus thinly crustaceous, or hypophlœodal, or rarely none proper; gonidial stratum consisting of gonidia (rarely chrysogonidia). Apothecia lirelline or rotundate. Spermogones with simple sterigmata.

Genera: *Xylographa*, Fr.; *Agyrium*, Fr.; *Lithographa*, Nyl.; *Graphis*, Ach.; *Thelographis*, Nyl.; *Helminthocarpon*, Fée; *Leucographa*, Nyl.; *Opegrapha*, Ach.; *Platygrapha*, Nyl.; *Stigmatidium*, Mey.; *Arthonia*, Ach.: *Melaspilea*, Nyl.; *Lecanactis*, Eschw.; *Schirzographa*, Nyl.; *Glyphis*, Ach.; *Chodecton*, Ach.

Series VI.—*Pyrenodei*, Nyl.

Thallus peltate, or crustaceous, or hypophlœodal, or evanescent. Apothecia nucleiform, with an apical ostiole.

Tribe 25. *Pyrenocarpei*, Nyl.—Thallus various, often macular or obsolete; gonidial system consisting of gonidia (rarely chrysogonidia), sometimes of gonimia. Apothecia pyrenodeine, often without paraphyses. Spermogones with simple sterigmata or arthrosterigmata.

Genera: *Cora*, Fr.; *Dichonema*, N. ab Es.; *Normandina*, Nyl.; *Endocarpon*, Hedw.; *Verrucarina*, Nyl.; *Verrucaria*, Pers.; *Thelenella*, Nyl.; *Thelopsis*, Nyl.; *Obryzum*, Wallr.; *Strigula*, Fr.; *Parathelium*, Nyl.; *Melanotheca*, Fée; *Trypethelium*, Ach.; *Astrothelium*, Eschw.

Series VII.—*Peridiodei*, Nyl.

Thallus thin, often wanting. Apothecia peridieine, without any ostiole.

Tribe 26. *Peridei*, Nyl.—Thallus thin, macular, or none proper. Apothecia consisting of a peridium. Spermogones (where seen) with simple sterigmata.

Genera: *Thelocarpon*, Nyl.; *Thelococcus*, Nyl.; *Endococcus*, Nyl.; *Mycoporum*, Flot.

Family IV.—*Myriangiacei*, Nyl.

Thallus unstratified, entirely and equally cellulose. Fructification not discrete.

Tribe 1. *Myriangiei*, Nyl.—Thallus noduloso-pulvinate. Apothecia sublecanorine. Spermogones unknown.

Genus: *Myriangium*, Mnt. and Berk.

In the Nylanderian arrangement, most of these tribes and genera are again divided into subtribes and subgenera, the latter being further subdivided into sections according to the affinities of the different species.

Habitats and Distribution of Lichens.

These two subjects are intimately related and present many interesting features which here we can only very generally notice without entering into details.

1. *Habitats of Lichens.*—These are extremely varied, and comprehend a great number of very different substrata. Chiefly, however, they are the bark of trees, rocks, the ground, mosses, and, rarely, perennial leaves. (*a*) With respect to *corticole* lichens, some prefer the rugged bark of old trees (*e. g.*, *Ramalina*, *Parmelia*, *Stictei*) and others the smooth bark of young trees and shrubs (*e. g.*, *Graphidei*, and some *Lecideæ*). Many are found principally in large forests (*e. g.*, *Usnea*, *Alectoria jubata*); while a few occur more especially on trees by roadsides (*e. g.*, *Physcia parietina* and *Ph. pulverulenta*. In connection with corticole lichens may be mentioned those *lignicole* species which grow on decayed or decaying wood of trees and on old pales (*e. g.*, *Caliciei*, various *Lecideæ*, *Xylographa*). (*b*) As to *saxicole* lichens, which occur on rocks and stones, they may be divided into two sections, viz., *calcicole* and *calcifugous*. To the former belong such as are found on calcareous and cretaceous rocks, and the mortar of walls (*e. g.*, *Lecanora calcarea*, *Lecidea calcivora* and several *Verrucariæ*), while all other saxicole lichens may be regarded as belonging to the latter, whatever may be the mineralogical character of the substratum. It is here worthy of notice that the apothecia of several calcicole lichens (*e. g.*, *Lecanora Prevostii*, *Lecidea calcivora*) have the power (through the carbonic acid received from the atmosphere) of forming minute faveoli in the rock, in which they are partially buried. (*c*) With respect to *terricole* species, some prefer peaty soil (*e. g.*, *Cladonia*, *Lecidea decolorans*), others calcareous soil (*e. g.*, *Lecanora crassa*, *Lecidea decipiens*), others argillaceous soil or hardened mud (*e. g.*, *Collema limosum*, *Peltidea venosa*); while many may be found growing on all kinds of soil, from the sands of the sea-shore to the granitic detritus of lofty mountains, with the exception of course of cultivated ground, there being no agrarian lichens. (*d*) *Muscicole* lichens again are such as are most frequently met with on decayed mosses and jungermannias, whether on the ground, trees, or rocks (*e. g.*, *Leptogium muscicola*, *Gomphillus calicioides*). (*e*) The *epiphyllous* species are very peculiar as occurring upon perennial leaves of certain trees and shrubs, whose vitality is not at all affected by their presence as it is by that of fungi. In so far, however, as is known, they are very limited in number (*e. g.*, *Lecidea Bouteillei*, *Strigula*). With the exceptions of these last, it is to be observed that all the rest may, under different conditions of locality and climate, be found growing for the most part indiscriminately on the substrata mentioned, a normally saxicole species becoming corticole, a terricole one becoming muscicole, and *vice versa*. Amongst other instances of this that might be adduced, the case of *Lecidea geographica*, a peculiarly saxicole species,

growing on the stems of *Rhododendron* in the Tyrolese Alps, and that of *Lecidea rivulosa*, a like peculiarly saxicole species, growing on the bark of trees in Germany, are especially striking. Sometimes also various lichens occur abnormally in such unexpected habitats as dried dung of sheep, bleached bones of reindeer and whales, old leather, iron, and glass, in districts where the species are abundant. Consequently it is apparent that in many cases lichens are quite indifferent to the substrata on which they occur, whence we infer that the preference of several for certain substrata depends upon the temperature of the locality or that of the special habitat. Thus in the case of saxicole lichens the mineralogical character of the rock has of itself little or no influence upon lichen growth, which is influenced more especially and directly by their physical properties, such as their aptitude for imbibing and retaining heat and moisture. As a rule lichens have a propensity for open exposed habitats, though some are found only or chiefly in shady situations; while, as already observed, scarcely any occur where the atmosphere is impregnated with smoke. Many species also prefer growing in moist places by streams, lakes, and the sea, though very few are normally, and probably none entirely, *aquatic*, being always at certain seasons exposed for a longer or shorter period to the atmosphere (*e. g.*, *Lichina*, *Leptogium rivulare*, *Endocarpon fluviatile*, *Verrucaria maura*). Some species are entirely parasitical on other lichens (*e. g.*, various *Lecideæ* and *Pyrenocarpei*), and may be peculiar to one (*e. g.*, *Lecidea vitellinaria*) or common to several species (*e. g.*, *Habrothallus parmeliarum*). A few, generally known as *erratic* species, have been met with growing unattached to any substratum (*e. g.*, *Parmelia revoluta*, var. *concentrica*, *Lecanora esculenta*); but it seems somewhat doubtful if these are really free *ab initio* (*vide* Crombie in *Journ. Bot.*, 1872, p. 306). It is to the different characters of the stations they occupy with respect to exposure, moisture, etc., that the variability observed in many types of lichens is to be attributed. The fact also that in numerous instances they are so indifferent to the nature of their habitats clearly shows that they do not at all depend upon the substratum for their nourishment.

2. *Distribution of Lichens.*—From what has now been said it will readily be inferred that the distribution of lichens over the surface of the globe is regulated, not only by the presence of suitable substrata, but also and more especially by atmospherical and climatal conditions. At the same time it may safely be affirmed that their geographical range is more extended than that of any other class of plants, occurring as they do in the coldest and warmest regions—on the dreary shores of the palæocrystic sea and in the torrid valleys of tropical climes, as well as on the greatest mountain elevations yet attained by man, on projecting rocks even far above the snowline (*e. g.*, *Lecidea geographica*), where, as in many other situations, fungus-mycelium and gonidioid algæ are unknown. Our knowledge of the distribution of lichens in various countries, like that of other plants, is derived from general and local floras, from special works on lichenology, from the observations of scientific travellers and the collections made by them in distant parts of the world. Most of these, however, of an earlier date, are to be used with great caution, as the species recorded were, in the absence of microscopical examination, not sufficiently discriminated, and in many cases are *prima facie* entirely erroneous. Amongst botanical travellers whose contributions are most trustworthy may be mentioned pre-eminently Sir Joseph D. Hooker, whose remarks on this subject in his *Flora Antarctica* and in various papers in *Trans. Linn. Soc.*, vol. xiv., etc., are most valuable and suggestive. Again, in purely lichenological works, the general principles regulating lichen distribution (with statistical tables) are admirably expounded by Nylander in the introduction to his *Synopsis Methodica Lichenum*, while the only complete record of the distribution of species is that given by the same author in his *Enumération générale des Lichens*. Since the date of this latter work (1858) our knowledge of the range of lichens, both European and exotic, has been greatly extended, apart from the discovery of numerous species previously unknown. No special treatise, however, on the subject has been published, though there is now ample material, very much scattered no doubt, available for the purpose. It may, however, be observed that of the four thousand species (exclusive of numerous varieties and forms) which have been described, the geographical distribution is known almost as well as that of phanerogams and filices, as well, if not more so than that of mosses and hepatics, and far better than that of algæ and fungi. In arctic regions lichens form by far the largest portion of the vegetation, occurring everywhere on the ground and on rocks, and fruiting freely; while terricole species of *Cladonia* and *Stereocaulon* are seen in the greatest luxuriance and abundance spreading over extensive tracts almost to the entire exclusion of other vegetation. The lichen flora of temperate regions again is essentially distinguished from the preceding by the frequency of corticole species belonging to *Lecanora*, *Lecidea*, and *Graphidei*. In intertropical regions lichens attain their maximum development (and beauty) in the foliaceous *Stictei* and *Parmeliei*, while they are especially characterized by epiphyllous species, as *Strigula*, and by many peculiar corticole *Thelotremei*, *Graphidei*, and *Pyrenocarpei*. Some lichens, especially saxicole ones, seem to be cosmopolitan (*e. g.*, *Lecanora subfusca*, *Cladonia pyxidata*); and others, not strictly cosmopolitan, have been observed in regions widely apart. A considerable number of species, European and exotic, seem to be *endemic*, but further research will no doubt show that most of them occur in other climatal regions similar to those in which they have hitherto alone been detected. To give any detailed account, however, of the distribution of the different genera (not to speak of that of individual species) of lichens would necessarily far exceed the limits at our disposal. Suffice it to say that, both in horizontal and vertical range, they sufficiently correspond with the distribution of phanerogams in the several regions of vegetation into which the surface of the globe has been divided. The proportion of lichens to phanerogams in different regions increases in a regular ratio from the equator to the poles, and from the base to the summit of lofty mountains, till at length in more arctic and alt-alpine tracts lichens constitute almost and sometimes entirely the sole vegetation. (J. M. C.)

LICHFIELD, a city and municipal and parliamentary borough of Staffordshire, England, is situated in a pleasant and fertile valley, on a small tributary of the Trent, and on the South Staffordshire Railway, 16 miles north from Birmingham. The town is well built, and contains many handsome houses. Of the old Norman cathedral there are now no remains. The present building is supposed to belong to the end of the 12th or beginning of the 13th century. Its style is Early English approaching to Decorated, and it possesses an imposing central tower 285 feet in height, with two western spires, 183 feet. The transepts, which contain some portions of Norman architecture, are richly ornamented, and adorned with windows of beautiful tracery. The total length of the building from east to west is 403 feet. The damage which it suffered during the civil wars was repaired by Bishop Hackett in 1671, and at present (1882) it is undergoing extensive restorations. A new building for the King Edward's grammar school was erected in 1850. In the market-place is a statue of Dr. Johnson, facing the house where he was born. A guild-hall, a market-hall, a corn exchange, and a public library and museum are the principal buildings of a secular character. There are several charitable institutions. The industries of the town include brewing and coach-building; and in the neighborhood there are large nurseries and market gardens. The municipal and parliamentary boroughs have the same area (3416 acres); the population in 1871 was 7347, and in 1881 8360.

Lichfield is spelt by Bede Licidfeld, the word being supposed to mean "Field of the Dead," from a massacre which took place near it of a large number of Christians. It was made an episcopal see in 669, St. Chad being its first bishop. In the reign of Offa it was promoted to be an archbishopric, but in 803 the primacy was restored to Canterbury. In 1075 the see of Lichfield was transferred to Chester, and thence, a few years afterwards, to Coventry, but it was restored in 1148. The town has returned members to parliament since 1305, at which time it also received a charter of incorporation. Since 1867 it has returned only one member. It was made a city by Edward VI. in 1549.

See the histories of Lichfield by Jackson (1805) and Harwood (1806), and histories of the cathedral by Britton (1820) and Stone (1870).

LICHTENBERG, formerly a small German principality on the west bank of the Rhine, enclosed by the Nahe, the Blies, and the Glan, now forms the circle of St. Wendel in the government district of Treves, Rhenish Prussia. The principality was constructed of parts of the old electorate of Treves, Pfalz-Zweibrücken, and Salm, and lay between Rhenish Bavaria and the old Prussian province of the Rhine. Originally called the lordship of Baumholder, it owed the name of Lichtenberg and its elevation to a principality to Ernest, duke of Saxe-Coburg, to whom it was presented by Prussia in 1815 in accordance with terms agreed upon at the congress of Vienna. The duke, however, restored it to Prussia in 1834, in return for an annual pension of £26,000 sterling. The area is 210 square miles, and the population 45,000.

LICHTENBERG, Georg Christoph (1744–1799), physicist and satirical writer, was born at Oberramstadt, near Darmstadt, July 1, 1744. In 1763 he entered Göttingen university, where in 1770, after spending several years in England, he became extraordinary professor of physics, and five years later ordinary professor. This post he continued to hold till his death, February 24, 1799. As a physicist he is best known for his investigations in electricity, more especially as to the so-called Lichtenberg figures (see vol. viii. p. 62), which are fully described in two memoirs *De nova methodo naturam ac motum fluidi electrici investigandi* (Göttingen, 1778–79). He sent many excellent contributions to the Göttingen *Taschenkalender* from 1778 onwards, and to the *Göttingische Magazin der Literatur und Wissenschaft*, which he edited for three years (1780–82) along with J. G. A. Forster. His various scientific writings occupy the latter part of his *Vermischte Schriften*, edited by Kriess (9 vols., Göttingen, 1800–5; new edition, 6 vols., Gotha, 1844–46). The earlier volumes of these collected writings contain his satirical and humorous productions. His keen satire involved him in many a literary controversy with well-known contemporaries, such as Lavater, whose science of physiognomy he wittily ridiculed, and Voss, whose views on Greek pronunciation called forth a powerful satire *Ueber die Pronunciation der Schöpse des alten Griechenlandes* (1782). Notes of his lectures on natural philosophy, astronomy, and physical geography were published by Gamauf (Vienna, 1808–12, 1813, 1819); and more recently some of his brilliant sayings have been collected by Grisebach in one volume, *Lichtenberg's Gedanken und Maximen: Licht-Strahlen aus seinen Werken* (Leipsic, 1871.)

LICINIUS. Publius Flavius Galerius Valerius Licinianus Licinius, Roman emperor, of Dacian peasant origin, was born probably about 250 A. D., and was elevated after the death of Severus to the rank of Augustus by Galerius, his former friend and companion in arms, on November 11, 307, receiving as his immediate command the provinces of Illyricum. On the death of Galerius in May, 311, he shared the entire empire with Maximin, the Hellespont and the Thracian Bosphorus being their mutual boundary. In March, 313, he entered into alliance with Constantine at Milan, and in the following month inflicted a decisive defeat on Maximin at Heraclea, with the result of establishing himself as master of the East, while Constantine (now his brother-in-law) was supreme in the West. In the following year his jealousy led him to encourage a treasonable enterprise on the part of Bassianus against Constantine. When his perfidy became known a civil war ensued, in which he was twice severely defeated—first near Cibalis in Pannonia (October 8, 314), and next in the plain of Mardia in Thrace; the outward reconciliation, which was effected in the following December, left Licinius in possession of Thrace, Asia Minor, Syria, and Egypt, but added numerous provinces to the Western empire. In 323 Constantine, tempted by the "advanced age and unpopular vices" of his colleague, anew declared war against him, and having defeated his army at Adrianople (July 3, 323), succeeded in shutting him up within the walls of Byzantium. The defeat of the superior fleet of Licinius by Crispus, Constantine's eldest son, compelled his withdrawal to Bithynia, where a last stand was made; the battle of Chrysopolis (September 18) finally issued in his submission and death.

LIEBER, Francis (1800–1872), a distinguished publicist and writer on political science, was by birth a German, by adoption a citizen of the United States. He was the son of Frederick William Lieber, and was born at Berlin, March 18, 1800. Upon the return of Napoleon Bonaparte from Elba, young Lieber, then only fifteen years of age, volunteered as a soldier, and served with his two brothers under Marshal Blücher in the campaign of 1815. He fought at Ligny, Waterloo, and Namur. In the last-named battle he was twice severely and dangerously wounded. At the close of the war he returned to his studies, and joined the Berlin gymnasium under Dr. Jahn. Shortly afterwards he was arrested and thrown into prison for his political sentiments, the chief evidence against him being several songs of liberty which he had written. After several months' confinement he was discharged without a trial, but informed that he would not be permitted to pursue his studies at the Prussian universities. He accordingly went to Jena, where he took his degrees in 1820, subsequently continuing his studies at Halle and Dresden. When the Greek revolution broke out, young Lieber instantly resolved to take part in the struggle for Grecian independence. He made his way with great difficulty to Marseilles, travelling much of the way on foot, and thence embarked for Greece. His experiences there are recorded in his *Journal in Greece*, published at Leipsic in 1823, and at Amsterdam in the same year under the title of *The German Anacharsis*. Returning from Greece after the failure of the struggle, he landed at Ancona, and proceeded to Rome. There he made the acquaintance of Niebuhr, then Prussian ambassador to Rome, who took great interest in him and employed him as tutor to his son. He lived a year in the family of the historian, a period of his history which he afterwards embalmed in his *Reminiscences of Niebuhr*, first published in America, and afterwards in England. Returning from Rome to Berlin in 1823, he was soon again arrested by the Prussian authorities on the old charges of enmity to the Government and advocating republican opinions, and was imprisoned in the bastile of Koepnik, but was released after some months' confinement through the influence of Niebuhr. In 1825 he abandoned his country, and after spending a year in London went to the United States (1827), and as soon as possible was naturalized as a citizen of that country. Lieber took up his residence at Boston, and was occupied for five years in his laborious work *The Encyclopædia Americana* (13 vols.). In 1832 he removed to New York, where he published a translation of De Beaumont and De Tocqueville's work on the penitentiary system, with many notes. In 1833 he went to Philadelphia to prepare a plan of education for Girard College, then newly founded. While there he published *Letters to a Gentleman in Germany* and a supplement to his *Encyclopædia*. In 1835 he was appointed professor of history and political economy in South Carolina College at Columbia, S. C., where he remained more than twenty years, and during this period wrote and published the three great works upon which his fame as a writer chiefly rests—the *Manual of Political Ethics* (1838) *Legal and Political Hermeneutics* (1839), and *Civil Liberty and Self Government* (1853).[1]

In 1856 Lieber resigned the professorship in South Carolina College, and was immediately elected to a similar professorship in Columbia College, New York, and to the chair of political science in the law school of the same institution. He continued in the discharge of the duties of these positions until his death, which occurred October 2, 1872.[2] During the great war for the preservation of the Union from 1861 to 1865, Lieber rendered services of great value to the Government of his adopted country, and was frequently consulted by the secretary of war. He was one of the first to point out by his pen the madness of secession, and was ever active in supporting the Government and upholding the Union. He prepared, upon the requisition of the president, the *Code of War for the Government of the Armies of the United States in the Field*, which was adopted and promulgated by the Government in General Orders No. 100 of the war department. This code has been characterized by many European publicists as a masterpiece, and it suggested to Bluntschli his codification of the law of nations, as may be seen in the preface to his *Droit International Codifié*. During this period also Lieber wrote his *Guerilla Parties with Reference to the Laws and Usages of War*, a valuable contribution to the law of war. At the time of his death he was by appointment of the Government of the United States the umpire of the commission for the adjudication of Mexican claims. The political writings of Francis Lieber are held in great estimation by all publicists. Sir Edward S. Creasy, in his *First Platform of International Law*, alluding to his death, has justly said of him, "America and the civilized world in general have lately had to deplore in his death the loss of one whom the French jurist M. Laboulaye has truly styled 'une des figures les plus originales parmi les jurisconsultes de notre temps.'"

Besides the works already mentioned, Lieber published at various times many smaller works and pamphlets on different subjects, all of which attracted public attention, such as *The Origin and Development of the First Constituents of Civilisation*, *Great Events Described by Great Historians*, *Essays on Property and Labor*, *The Laws of Property*, *Penal Laws and the Penitentiary System*, *Prison Discipline*, *The Relation between Education and Crime*, *The Pardoning Power*, *The Character of the Gentleman*, *International Copyright*, *Laura Bridgman's Vocal Sounds*, *On Anglican and Gallican Liberty*, *The Post Office and Postal Reforms*, *Independence of the Judiciary*, *Nationalism*, *Rise of the Constitution* (an unfinished work), and many minor tracts and publications. These works are all written with as much ease and purity of idiom as if English had been his native tongue, a fact not more remarkable than that he, a German, should have become the great American teacher of the philosophy of Anglican political science. (M. R. T.)

LIEBIG, JUSTUS (1803–1873), was born at Darmstadt in 1803. His father carried on business as a drysalter and dealer in dye-stuffs, and made various experiments with a view to improved methods of preparing and purifying his wares. These led the son to take an interest in chemistry, and to seek for knowledge in the chemical books and periodicals in the grand-ducal library, which is rich in scientific works. At home he employed his time in repeating, as far as the means at his command admitted, the experiments he found described in books, and thus while still a boy attained a theoretical and practical knowledge of chemistry comparable with that of many full-grown professors of the science. He determined to be a chemist, to devote his life to the pursuit of science. The only kind of chemist available for teaching purposes was the chemist and druggist, and accordingly Liebig, at the age of fifteen, entered the shop of an apothecary at Heppenheim near Darmstadt to study chemistry. He soon found out how great is the difference between practical pharmacy and scientific chemistry, and returned to Darmstadt, after ten months, to look for another and more likely way of attaining his object. After some months spent in study at home he entered the university of Bonn, which he soon left for Erlangen. There he attended the lectures of Kastner on chemistry, and, besides the study of allied sciences, devoted some time to make up for the almost total neglect of school work caused by his early love of chemistry. He was much influenced by the metaphysical speculations of Schelling, and in after life referred to this influence as injurious to him as a scientific investigator. In those days there were no laboratories accessible to ordinary students, and Liebig had to content himself with what the university could give him in the lecture-room and in the library. Both at Bonn and at Erlangen he formed a students' chemical and physical society for the discussion of new discoveries and speculations as these appeared in scientific books or periodicals. In 1822 he left Erlangen with the degree of Ph. D. By means of the liberality of Louis I., grand-duke of Hesse-Darmstadt, Liebig was enabled to continue his chemical studies in Paris. There he made the acquaintance of Runge, Mitscherlich, and Gustav Rose. He attended the lectures of Gay-Lussac, Thenard, and Dulong, and, while carrying on the investigation into the composition and properties of the fulminates which he had already partly published, he attempted, as at Erlangen, to work up his neglected school studies. The results of his work on the fulminates were communicated to the Academy of Sciences, and attracted the favorable attention of Humboldt, who was at that time in Paris. Humboldt introduced Liebig to Gay-Lussac, who admitted him into his private laboratory as a pupil. Here he had opportunities of learning all the mysteries of the art from one of the most skilful and ingenious of experimenters. It was on the advice of Humboldt that Liebig determined to become a teacher of chemistry, but difficulties stood in his way. As a native of Hesse-Darmstadt, he ought, according to the academical rules of the time, to have studied and graduated at the university of Giessen, and Humboldt had to use his influence to induce the authorities to forgive his having attended the foreign university of Erlangen. After examination his Erlangen degree was recognised and in 1824, in his twenty-first year, he was appointed extraordinary professor of chemistry in the university of Giessen. Two years later he was promoted to the post of ordinary professor, which he held for twenty-five years, notwithstanding the most tempting offers from other universities. It was here, in the small town and small university of Giessen, that by far the most of Liebig's work was done. He began by remedying the evil which as a student he had himself felt. He induced the Darmstadt Government to build a chemical laboratory in which any student of the university might obtain a thorough practical training. It is difficult for us, who live in a time when nearly every university and many schools possess well-arranged and often well-endowed laboratories, to understand how great a revolution was made in the practical teaching of physical science by the foundation of the Giessen laboratory. We can form some idea of it by reading Liebig's articles on the condition of chemistry in Austria and Prussia, in which he goes over in detail the means of teaching afforded in the various universities of those great countries. He tells us that in 1838 two young Prussians came to Giessen to study chemistry, unable to obtain entrance to a laboratory in their own country, but were ordered back again by the Prussian Government. Fortunately other Governments were less strict, or other students were less obedient, and crowds of young men anxious to study chemistry came to Giessen, and carried home the light there acquired. Partly by Liebig's urgent appeals to the interests and to the shame of the great German states, partly by the influence of his pupils, a great reform was effected, and German universities now vie with one another in offering opportunities of practical instruction in chemistry and the other physical sciences.

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[1] New editions of these works and of his miscellaneous writings have been published recently at Philadelphia.

[2] [His son, Oscar M. (1830-1862), chemist, educated in Germany, state geologist for Alabama, Confederate soldier, died from wounds at Richmond.—AM. ED.]

The amount and the importance of the laboratory work done by Liebig in Giessen were very great. Without considering here the work done by his students under his direction, of which no doubt a very large part was conceived by him, and in the execution of which he constantly contributed his assistance and advice, we shall look only at what appears under his own name. During the twenty-six years he spent at Giessen as ordinary professor, he contributed to scientific journals more than two hundred papers, about twenty of which were records of joint work, chiefly with Wöhler. During the same time he published his works on organic analysis, organic chemistry, chemistry applied to physiology and agriculture, his *Chemical Letters*, and many smaller treatises. From 1832 he was joint editor of the *Annalen der Pharmacie*, from 1837 of the *Handwörterbuch der reinen und angewandten Chemie*, and from 1847 to 1856 of the *Jahresbericht der Chemie*. These statements give some idea of the amount of his work; of its importance and of its effect on the history of science we shall speak later.

In 1845 he was raised to the hereditary rank of baron under the title of Freiherr von Liebig. In 1852 he accepted the invitation of the Bavarian Government to the ordinary professorship of chemistry in the university of Munich. This office he held till his death in 1873.

In private life Liebig was hospitable, courteous, and kindly. Honored by all the great scientific societies of the world, and regarded by almost every one as the great authority in chemistry, he assumed no airs of superiority, and lived the simple and quiet life of a German professor. Liebig's influence on the history of chemistry may be considered under five heads: (1) the effect of the opening of the Giessen laboratory, and of Liebig's constant efforts to induce other universities to follow this example; (2) the improvements introduced by him in methods of investigation and in apparatus; (3) the discovery of new facts; (4) the development of theory; and (5) the application of chemistry to physiology, agriculture, and the arts.

We have already spoken of the first. Under the second head by far the most important change introduced by Liebig was his method of organic analysis. Organic substances were analyzed, and analyzed with accuracy, before 1830, but such analyses could then be carried out only by highly skilled chemists, and involved great labor and the use of cumbrous apparatus. Liebig's method of organic analysis, which was published in all its details in 1831, and which (with important but secondary improvements) is that still used, made it easy for any advanced student to make a fairly accurate and very useful analysis of an organic substance. Analysis is to the chemist what astronomical methods for determining longitudes and latitudes are to the geographical explorer. Without it many interesting and useful discoveries may be made, but it is only when complete and accurate analyses are made of all the new substances produced in the course of a research that the research becomes fully available to other explorers. If Liebig had contributed nothing to organic chemistry but his method of analysis, he would still have been in a perfectly true sense the founder of modern organic chemistry. Many other improvements of apparatus are due to him; we need only mention the simple form of condenser called by his name, and constantly used by every chemist, and the easy and accurate method for determining the quantity of urea in a solution, which was the first step towards introducing precise chemical methods into practical medicine. This is also the proper place to refer to his analyses of the natural alkaloids, and his discovery of the method of determining their equivalents by the analysis of their chloroplatinates. In the third place we have to consider the new facts discovered by Liebig. The very great addition to our knowledge of organic chemistry made by Liebig naturally throws into the shade his contributions to inorganic chemistry, but we ought to remember his numerous analyses of mineral waters and his contributions to the difficult question of the accurate separation of cobalt and nickel. It is, however, in organic chemistry that Liebig's great discoveries were made. These discoveries are so intimately connected with his chemical theories that we may most conveniently consider them along with the fourth head, his contributions to the development of chemical theory.

The notion of compound radicals is to be found in chemistry as far back at least as the time of Lavoisier. Lavoisier says, "Some experiments of my own and some made by M. Hassenfratz have convinced me that in general nearly all the vegetable acids, such as tartaric, oxalic, citric, malic, acetic, pyrotartaric, pyromucic acids, have for their radical hydrogen and carbon, but united so as to form a single base, that all these acids differ from one another by the difference in proportion of these two substances and the degrees of oxidation." Berzelius adopted this view and expressed it thus, "We find the difference between organic and inorganic bodies to be that, while in inorganic nature all the oxidized substances have a simple radical, all the organic substances have compound radicals. Just as ammonia is an alkali with a compound radical, but possessing nevertheless the greatest analogies with the mineral alkalies which have simple radicals, so we find the greatest analogy between the mineral and the organic acids, so that the relations of potash and soda to acetic, oxalic, citric acids are the same as their relations to sulphuric, nitric, phosphoric acids." These views were published by Berzelius in 1817. In 1815 Gay-Lussac had discovered cyanogen, and shown that this compound of carbon and nitrogen is the radical of prussic acid and its salts, in the same sense as chlorine is the radical of hydrochloric acid and the chlorides. Ampère had indicated a theory of the constitution of the ammonia salts, which Berzelius worked out in detail, according to which those salts contain a compound radical, ammonium, playing in them the part of potassium in the potash salts. Finally, Davy suggested in 1815 that the hydrated acids which correspond in function to hydrochloric acid should be regarded as the true acids, and proposed to represent them as compounds of hydrogen with a radical.

Such were the knowledge and the theoretical position of chemists on this question when Liebig became professor; the dates to which we have referred correspond to the time when as a schoolboy he was devouring the contents of chemical journals at Darmstadt, and no doubt he then became acquainted at first hand with the discoveries and speculations of Ampère, Davy, Gay-Lussac, and Berzelius.

We have seen that his first investigation referred to the fulminates. He continued his researches upon the compounds of cyanogen, and the substances connected with them formed frequent subjects of his researches during his whole life. In this region of organic chemistry he made many important discoveries, of which the limits of this article do not allow a detailed account; we can only mention melone, mellam, ammeline, ammelide, and melanine, as substances discovered and investigated by him. In the course of these investigations he discovered the precise nature of the chemical changes which occur in the manufacture of bromide of potash. In 1831 he examined the action of chlorine upon alcohol, among other substances discovered chloral, and commenced the series of investigations into the derivatives of alcohol and ether, to which we shall refer immediately. In 1832 Wöhler and Liebig published the results of their joint research on the oil of bitter almonds and its derivatives. This research may be said to stand at the head of modern organic chemistry. For elegance of method and for clearness of insight it is unrivalled, and will always remain a model of what such an investigation should be. They showed in the clearest manner that the compound C_7H_5O (here and elsewhere in this article we use the symbols now in common use, instead of those employed by the authors), to which they gave the name of benzoyl, is the constant part, or radical, of a great series of compounds. The importance of this investigation was generally recognized. Berzelius hailed it as the advent of real daylight on the subject of organic chemistry, and even suggested the names proin or orthrin (from πρωί and ὄρθρος) for the newly discovered radical.

We now come to the long controversy as to the constitution of alcohol and ether, which engaged so much of Liebig's time and energy. Gay-Lussac had shown in 1815 that alcohol and ether might, as far as their composition is concerned, be represented as compounds of olefiant gas and water, and further that, if we represent the quantities by volume of gas or vapor, ether contains one volume of olefiant gas and half a volume of water vapor, while alcohol contains equal volumes of the two. In 1828 Dumas and Boullay published an elaborate memoir on the preparations and properties of the ethers, in which they further developed the ideas suggested by Gay-Lussac. They regarded olefiant gas as the radical of all the etherial compounds, as ammonia is of the ammoniacal salts, and formulated them thus:—

	Base.	Acid.	Water.
Salammoniac	NH_3	HCl	...
Muriatic ether	C_2H_4	HCl	...
Nitrite of ammonia	$2NH_3$	N_2O_3	H_2O
Nitrous ether	$2C_2H_4$	N_2O_3	H_2O
Ether	$2C_2H_4$	...	H_2O
Alcohol	C_2H_4	...	H_2O
Ammonia solution	NH_3	...	$2H_2O$

We have given only a sample of their tables, leaving out among others some substances in reference to the composition of which they had fallen into error, error which Liebig detected and used as an argument, valid enough then no doubt, but of little interest now.

In 1833 Liebig proposed a quite different theory, one which stands to Dumas and Boullay's in the same relation which the ammonium theory holds to the ammonia theory of the constitution of the ammoniacal salts. Just as Ampère and Berzelius regarded salammoniac, not as NH_3,HCl, but as NH_4,Cl, so Liebig proposed for muriatic ether the formula C_2H_5,Cl instead of C_2H_4,HCl. The really cogent argument which he brought forward, the argument which we can now best appreciate, is that, while alcohol contains combined water, ether does not. According to Dumas and Boullay alcohol and ether are both hydrates, but in Liebig's view ether is $(C_2H_5)_2O$ and alcohol $(C_2H_5)_2O,H_2O$. If we wish to understand this argument we must recollect that to the chemists of that time oxidized hydrogen was water, and Liebig's arguments are as sound now as they were then, for the most recent views represent alcohol as $C_2H_5—O—H$, and this contains oxidized hydrogen, or, as we may say, half a molecule of water, and Liebig's tests do not distinguish preformed water, but hydrogen and oxygen combined as they are in water. Much debate and investigation followed, in the course of which the relations of all the substances derived from alcohol were thoroughly and practically studied in a fuller and more careful manner than would have been possible had there not been a theoretical point to defend and to attack. The enormous number of facts discovered by Liebig put him in a very favorable position as the advocate of his theory. Chemists could not do without a knowledge of these facts, and they could only get this knowledge through Liebig's papers, in which the facts were expressed in the language of his theory.

In 1835 Regnault began a series of most important researches into the compounds derived from olefiant gas. He showed that many of these substances might be classified and their relations explained by the assumption of a radical C_2H_3, to which he gave the name of aldehydene. Liebig saw that according to his view of the meaning of the word radical, as "the unchanging constituent in a series of compounds," the same radical may be assumed in alcohol and in acetic acid, and in 1839, in a note published in the *Annalen*, he puts the matter in a very clear light. He says, "Ether and ammonia have in their compounds a certain resemblance which was first indicated by Dumas and Boullay, and the view of the constitution of the ammonia salts which is generally held in France was the reason why ether was considered the first hydrate of olefiant gas, alcohol as the second hydrate, etc.; in Germany and other countries the water necessary for the constitution of the salts of ammonia with oxygen acids was considered as an integral part of the base; it was assumed that this water forms with the ammonia oxide of ammonium $(NH_4)_2O$, and this view in a certain sense smoothed the way for another, according to which the existence of organic oxides, capable of neutralizing acids, appeared very probable, as a necessary complement to the organic acids which chemists had long been inclined to regard as oxides of organic radicals. Ether was in these countries regarded as an organic oxide, and this difference of view excited a ten years' strife, as an immediate result of which we may regard the discovery of a great number of compounds which enriched science with innumerable important observations. No region of organic chemistry has been so thoroughly and so completely studied as the compounds connected with ether; and now, when the existence of organic oxides is no longer denied, the support of the opposite opinion has come to an end, although it cannot be said that the question itself has been experimentally decided. If we compare in the light of our present knowledge the ammonia compounds with the ether compounds, we at once see that the opposing views were fundamentally the same in the two cases. The disputes took place because we were not at one as to the interpretation of the phenomena. The ether and ammonia compounds assume in fact the same form if amidogen is regarded as the unchangeable radical of the ammonia compounds, and acetyl [Regnault's aldehydene] as the starting point of the ether compounds. The two sets of compounds differ only in so far as we must ascribe to acetyl the power of forming acids, a power which amidogen does not possess."

He then gives a table containing in two columns the ammonia and the ether compounds, in which C_2H_3 corresponds to NH_2, C_2H_4 to NH_3, and C_2H_5 to NH_4, and adds, "These formulæ require no explanation; they have been developed in order to show the extraordinary resemblance of the ammonia and the ether compounds, and to show why it was that many chemists regarded olefiant gas as the first member of the series of ether compounds. Both of the formerly antagonistic theories have, as may be easily seen, from this point of view the same foundation, and all further questions as to the truth of the one or other view is thus of course set at rest."

It was during the course of the controversy which then closed that Liebig had discovered aldehyde, chloral, and, simultaneously with Soubeiran, chloroform, besides numerous other substances of less general interest, and developed the theory now generally received of the formation of ether by the action of sulphuric acid on alcohol.

In the very short sketch given above of the discussion as to the constitution of ether, we mentioned that Liebig's ethyl theory was to some extent borrowed from Berzelius. Berzelius had suggested that ether was the oxide of a radical (Liebig's ethyl), but he was at first inclined to regard alcohol, not as the hydrate oxide of the same radical, but rather as the oxide of another one, which with our symbols would be written C_2H_6. But there was a deeper difference than this between the radical theories of Berzelius and Liebig. This essential difference first clearly showed itself in the notes which Liebig added to two letters from Berzelius to Wöhler, published in the *Annalen* in 1839. In these letters Berzelius gives his views of the constitution of oxychlorides, with which he classes such bodies as trichloracetic acid. All those bodies he represents as compounds of oxides and chlorides, in harmony with the dualistic system.

Thus, instead of SO_2Cl_2, $C_2HCl_3O_2$, etc., he writes SCl_6+2SO_3, $C_2Cl_6+C_2O_3$, etc. (taking the anhydrous acid). In his second letter on Malaguti's chlorinated ethers he naturally arrives at formulæ of extreme complexity. In his notes Liebig states that he does not agree with Berzelius, and that the analogy first pointed out by Berzelius between inorganic and organic compounds and his theory of organic radicals had been a guiding star in a labyrinth in which previously no one could find the way. "But, while there are points of resemblance, there are very many points of difference; we should follow a theory as long as it gives us light and explains facts; up to a certain point the principles of inorganic chemistry help us in organic chemistry; beyond it they leave us, and produce instead of removing complications; beyond this point we require new principles."

These new principles were supplied by Liebig's radical theory. As Liebig showed, abstract discussions as to the truth of a theory are out of place in an experimental science; the question is not as to their essential truth, but as to their practical fruitfulness. Do they help us to understand old and to discover new facts? If they do, the morrow may take thought for its own theories. These are not Liebig's words, but they seem to express his ideas.

Liebig early expressed his approval of Davy's views as to the constitution of acids, but he rarely used the language or the notation corresponding to that view. This divergence between his theory and his habitual language is interesting as showing that he held that the same truth may be expressed in more than one way, and that where no immediate point is to be gained it is well to employ the language best understood by those whom we address. In this, as in his preference for what was called the equivalent system of notation over that of Berzelius, he showed his sound practical judgment and common sense. We now see that the notation of Berzelius was nearer the truth, but its advantages could not be felt until chemistry had advanced further, and its retention would have led to complications of formulæ and obscuring of relations. The resemblance indeed of our present notation to that of Berzelius is to a great extent accidental, and the advance was hastened rather than hindered by what now looks like a retrograde step.

There is one other point which we have to mention under the present head. Liebig at once saw the importance of Graham's researches on the phosphates. He applied Graham's idea of polybasicity to organic acids, and satisfactorily proved, notwithstanding the opposition of Berzelius, that tartaric acid is dibasic and citric acid tribasic.

We have hitherto said nothing as to the relation of Liebig's theories to those at present held by chemists. On this subject a word may suffice. The great revolt against the radical theory led by Laurent and Gerhardt produced a long and acrimonious controversy. In that controversy Liebig took his part, and many hard and some unfair things were said by him. The controversy itself was of course the means of producing a vast amount of thorough research, and was thus, like all such contests, of direct use; it also led to the revision of all theoretical opinions from a totally new point of view. From this ordeal the radical theory has emerged, not very different in appearance. But it has undergone a profound change. Its foundations have been immensely strengthened, it has been to a great extent explained. Some chemists seem to think that this makes it an entirely new theory. We cannot share this view. Our reasons for believing in ethyl and benzoyl differ from the reasons adduced by Wöhler and Liebig only in this, that we have arguments which they had not; their arguments remain. We now know something of the reason why such radicals exist; we can, to a certain extent, deduce their properties from those of the elements which they contain, but explanation is something different from refutation; the theory has grown, but still remains the same theory.

Liebig all his life showed a special predilection for the study of the immediate products of animal life. He investigated with untiring zeal the substances contained in urine and in the juice of flesh. In these researches he discovered many new substances, and cleared up doubts and difficulties as to their relations to one another and to other bodies. Late in life he expressed the most lively interest in Volhardt's synthesis of sarcosin and creatine, substances with the preparation of which he had long before been engaged. In this connection it is right that we should mention his elaborate investigation on uric acid and its derivatives. This line of study led him to interest himself in the chemistry of food, and the importance of his work in this direction can scarcely be overestimated. We do not refer alone to his methods of preparing the extract of meat and the food for infants, which have perhaps spread his fame more widely than his strictly scientific work could have done; we refer rather to the influence which his analyses and calculations have had on medical opinion and practice. And this leads us to our fifth head, Liebig's influence on the application of chemistry to physiology, agriculture, and the arts.

Before Liebig undertook his investigations into the chemistry of vegetation, the views (they can scarcely be called theories) held as to the manner in which plants are nourished were vague in the extreme. The only point satisfactorily made out was that under the influence of light the green parts of plants are capable of decomposing carbonic acid, giving off oxygen and retaining the carbon. Saussure, to whose careful experiments the establishment of this fact, first noticed by Priestley, is mainly due, believed that the nitrogen of the plant came from soluble organic substances absorbed by the roots, and expressly says that the main use of ammonia in manure is as a solvent of humus, which he supposed to be one source of the carbon in plants; and, although the ashes of the various plants had been analyzed, the importance of the mineral constituents of vegetables was not at all recognized. Liebig undertook the investigation of this question in 1840. He showed that the plant derives its nourishment partly from the air, partly from the soil; the carbonic acid and water, the ammonia and nitric acid, which he showed to be the sources of the plant's nitrogen, come from the atmosphere; while the potash, soda, lime, iron, magnesia, sulphuric acid, phosphoric acid, and silica come from the soil. No exhaustion can take place of the former, but the soil contains only a limited amount of the latter in a soluble state, and when this is used up the soil becomes barren. Not only so, but the absence of any one of the necessary substances makes the soil barren. He showed how manure acts by restoring these deficient ingredients, and how, when the land is left fallow, atmospheric influences decompose the insoluble minerals and supply the soil with what has been removed. He further showed that plants use and therefore remove from the soil the articles of plant food in various proportions, and thus explained the advantage of a rotation of crops. The artificial manures which he introduced contained the essential mineral substances, and a small quantity of ammoniacal salts, because he held that while the air supplies ammonia, it does not always supply it fast enough, particularly to the less leafy plants. He bought a field near Giessen for his experiments, and treated it with the artificial manure, but the result was disappointing. The manure was not inactive, but not nearly so active as it should have been. It was many years before he detected the cause. To prevent the rain washing away the alkalies in the manure, he had taken great pains to render them insoluble. Way's experiments on the absorption of manure by soils (1850) occurred to him as suggesting an explanation, and in 1857 he made a number of experiments on the retention of various substances by earth. In these he confirmed and extended Way's observations, and thus saw that his effort to make his manure better had made it worse. As he says, "I had sinned against the wisdom of the Creator, and received my righteous punishment. I wished to improve His work, and in my blindness believed that, in the marvellous chain of laws binding life on the earth's surface and keeping it always new, a link had been forgotten which I, weak, powerless worm, must supply."

Now, just as he showed that plants require certain—often small—quantities of particular substances, else they will not grow at all, however great may be the quantities of other kinds of food supplied, so he showed that animals also require, not only a proper quantity of food, but also the right proportion of the different kinds of food, mineral as well as organic. In the classification of the kinds of organic food into heat-producing and blood-forming, it was necessary to examine whether the carbohydrates, starch, sugar, etc., should be placed alongside of fat. He was thus led to inquire into the power of the animal body to produce fat from starch or sugar, and came to the conclusion, contrary to the opinion of Dumas and Boussingault, that this transformation does take place.

Liebig's investigations into the relations of organic chemistry to physiology led him to the conviction that the only source of animal heat is the heat produced by the oxidation of the tissues, and, strange as it may appear, he had to defend this view against what he truly enough, though perhaps somewhat impolitely, called the absurd nonsense of his medical opponents. He also succeeded in demolishing, it is to be hoped finally, the ridiculous belief in the possibility of the spontaneous combustion of the human body.

Liebig's theory of FERMENTATION (*q.v.*) aimed at explaining the phenomena on purely chemical principles. He ridiculed the physiological theories, and looked upon the growth of fungi rather as an incident of fermentation, adducing the fermentative changes of amygdaline and similar substances as cases of fermentation without life.

We have still to notice one of Liebig's chemical discoveries, of secondary interest chemically, but of great practical importance. This is his discovery of a method for depositing a uniform film of metallic silver on smooth clean surfaces. This method may render it possible to use reflectors for astronomical telescopes of a size unattainable with the old speculum metal.

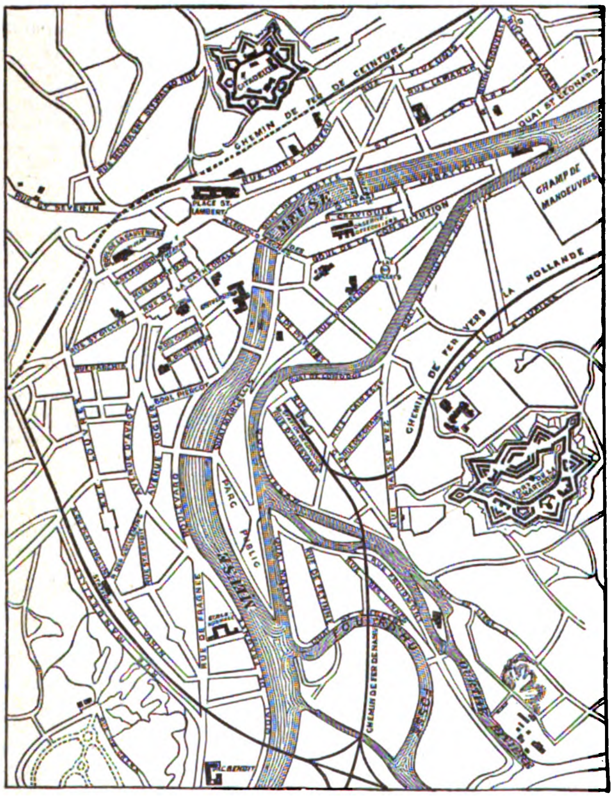
The most important of Liebig's works separately published are as follows:—*Anleitung zur Analyse organischen Körper*, 1837, 2d ed., 1853; *Die Chemie in ihrer Anwendung auf Agricultur und Physiologie*, 1840, 9th ed., 1875–76; *Die Thier-Chemie oder die organische Chemie in ihrer Anwendung auf Physiologie und Pathologie*, 1842, 3d ed., 1847; *Handbuch der Chemie mit Rücksicht auf Pharmacie*, 1843; vol. i. of Geiger's *Handbuch der Pharmacie*, new ed.; *Chemische Briefe*, 1844, 6th ed., 1878; *Chemische Untersuchungen über das Fleisch und seine Zubereitung als Nahrungsmittel*, 1847; *Grundsätze der Agricultur-Chemie*, 1855; *Zur Theorie und Praxis in der Landwirthschaft*, 1856; *Naturwissenschaftliche Briefe über die moderne Landwirthschaft*, 1859; *Reden und Abhandlungen*, 1874, a posthumous collection of some of his addresses and shorter publications. Liebig's scientific papers were chiefly published in Poggendorff's *Annalen* till 1839, and in Liebig's *Annalen* from 1832 onwards. His criticism of Bacon appeared in the *Augsburger allgemeine Zeitung* in 1863 and 1864, and also as a separate publication.

(A. C. B.)

LIECHTENSTEIN, a sovereign and independent principality, the smallest in Germany, is bounded on the N. E. and E. by the Austrian Vorarlberg, on the S. by the Swiss canton of Grisons, and on the W. by the Rhine, while on the north it tapers almost to a point. The state, consisting of the lordships of Vaduz and Schellenberg, is only 15 miles in length, hardly over 5 miles in its average breadth, and comprises an area of 68 square miles. Excepting in the immediate neighborhood of the Rhine, the surface of the country is mountainous, being traversed from south to north by spurs of the Rhætian Alps, which at some points attain an altitude of about 7000 feet. The climate is mild, and the soil generally fertile and well watered. The chief products are corn, wine, flax, fruit, and timber. Agriculture and the tending of cattle form the chief employment of the inhabitants. A branch of the Vorarlberg railway from Feldkirch to Buchs passes through the state. In 1876 the population amounted to 8664, of old German extraction, and Roman Catholics by confession. The capital is Vaduz or Liechtenstein, with 960 inhabitants.

Until 1866 Liechtenstein formed part of the German confederation, but from that date it has been constitutionally independent, although for the sake of convenience the postal system, customs, and currency are under the general Austrian administration, from which the principality receives annually some £1600 as its share in the customs dues. According to the charter of the 26th September, 1862, Liechtenstein is a constitutional monarchy, the sovereign prince sharing the legislative power with a diet of fifteen members (elected sexennially), of whom three are nominated by the prince, and twelve elected by popular suffrage. The chief control of the principality is carried on at Vienna by a court chancellory, which also serves as the judicial court of appeal of first instance, the ultimate court of appeal being at Innsbruck. The immediate direction of the principality in administrative and judicial matters is at Vaduz. The inhabitants are free from military service and direct taxation. The annual revenue amounts to about £6000. Although the sovereignty of the prince is so small, his estates in Austria and elsewhere render him one of the wealthiest landed proprietors in Germany, his income from them amounting to nearly £140,000 sterling. The house of Liechtenstein, one of the oldest in Central Europe, was elevated to the princely dignity in the early part of the 17th century. Anthony Florian in 1713 obtained a vote and seat in the imperial diet, and after the union, in 1719, of the lordships of Vaduz and Schellenberg into one principality under the name of Liechtenstein, his privileges were, in 1723, confirmed to his successors. See Jacob Von Falke, *Geschichte des fürstlichen Hauses Liechtenstein*, 2 vols. (Vienna, 1868–77).

LIÉGE (Germ., *Lüttich;* Dutch, *Luik;* Walloon, *Lîge;* usually Latinized as *Leodium*), a city of Belgium, the chief town of the province of Liége, is situated in 50° 39′ N. lat. and 5° 31′ E. long., 56 miles east of Brussels (62½ by rail), and 16 miles south-southwest of Maestricht. It occupies a remarkably fine position on the banks of the Meuse, which at this point is joined by the Ourthe. On the left-hand side stands the older city with the citadel and the more important historical buildings; on the right hand lies the lower and more modern portion, commanded by the fort of the Chartreuse. The river, there 460 feet across, is spanned by several bridges, of which the Pont des Arches, rebuilt in 1860–63, dates originally from the 8th century, and plays a prominent part in the local annals. Place St. Lambert is the historical centre of Liége. Here still stands the noble building—erected (1508–40) by Cardinal de la Marck in a late Gothic style—which down to the revolution was the palace of the prince-bishops, and is now with its modern extensions occupied by the public courts and other administrative offices. And here, till it was ruined by the revolutionists in 1794, and completely removed in 1808, stood the old cathedral of St. Lambert, originally founded in 712, and rebuilt after a great fire at the close of the 12th century. The rank of cathedral was in 1802 transferred to the abbey-church of St. Paul, the foundation of which is assigned to 968, though the nave is no older than the 16th century, and the choir belongs to 1280. The stained glass and the wood carving of the pulpit by Geefs deserve particular mention. Other churches of note are St. Jacques, a fine Gothic building founded in 1016, with a Romanesque west tower and a polygonal choir; St. Barthélemy, a completely modernized basilica of the 12th century; St. Martin, founded in 962 and rebuilt in the middle of the 16th century; and the Holy Cross, founded by Notker in 979, with a west choir dating from the 12th century, and the east choir and nave from the 14th. The university of Liége, established in 1817, is a flourishing institution with about 40 professors and 800 students, a library of 100,000 volumes, a botanic garden (1819) formerly the Jesuits' garden), a school of mines (1825), a school of arts and manufactures, a normal grammar school, and several other auxiliary foundations. There is no theological faculty,—the theological seminary, with a large library of its own, being an independent institution. The city further possesses a blind asylum, a deaf and dumb institute, schools of design, painting, and music, a zoological garden, a municipal museum, etc. The Place d'Avroi is adorned by an equestrian statue of Charlemagne by Jehotte; and in front of the theatre stands a bronze statue of Gretry, the composer, who was born at Liége.



Plan of Liége.

Liége is the centre of a great mining district rich in coal, lead, zinc, and iron; the coal-mines extend under the city and the river. In 1879 358,100 tons of coal were raised in the province, 22,156 persons being employed in the pits. The iron, lead, and zinc foundries in the town and neighborhood work up large quantities of ore in addition to the local supply. Steel, copper, and tin wares, steam-engines and general machinery, woollen goods, excellent saws and files, nails, needles, mirrors, clocks, leather, paper, and oil are among the products of the versatile industry of the place. Liége firearms have long enjoyed a wide reputation. They give employment to about 30,000 workmen, who for the most part work in their own houses, though in 1878 a large factory was erected in the American style for making all parts of the weapon by machinery. In 1873 183,806 single-barrelled guns, 113,121 double-barrelled guns, 403,649 revolvers, 19,395 saddle pistols, and about 85,000 army weapons, etc., were passed by Liége through the Government testing office. The trade of Liége is favored by the fact that the town is an important junction on the Rhenish Belgian Railway, commands more than one navigable river, and has long been one of the leading cattle-markets in the country. The population was 115,956 in 1874.

About 720 the bishops of Tongres, after oscillating between Tongres and Maestricht, settled at Liége, though they did not take the title of bishop of Liége for more than two centuries. Their church of St. Lambert received large territorial endowments, and in the 14th century they became princes of the empire. For centuries the struggle was maintained between episcopal tyranny and civic independence; and ducal and imperial armies were called in to crush the insurrections. In this way Charles the Bold of Burgundy made himself master of the city in 1467, and again with much bloodshed and barbarity in 1468. Bishop Ferdinand in 1650 and Bishop Maximilian in 1684 were each imposed on the citizens by force of arms, and kept them down by means of a strong citadel and foreign soldiers. In 1691 Liége was bombarded for five days by Marshal de Boufflers; in 1702 Marlborough took the citadel by storm from a French garrison; and in 1792 the town was the scene of a great defeat of the Austrians by the French.

See Henaux, *Hist. du pays de Liége;* Polain, *Hist. de l'ancien pays de Liége*, and *Liége pittoresque;* Polain and Raikem, *Coutumes du pays de Liége;* Baron de Gerlache, *Hist. de Liége* (2d ed., 1859); Becdelièvre, *Biographie Liégeoise.*

LIEGNITZ, the capital of a district of the same name in the Prussian province of Silesia, is picturesquely situated on the Katzbach, just above its junction with the Schwarzwasser, and 40 miles west-north-west of Breslau. It consists of an old town, surrounded by pleasant, shady promenades, and several well-built suburbs. The most prominent building is the palace of the former dukes of Liegnitz, rebuilt after a fire in 1835, and now occupied by the administrative offices of the district. The Ritter Academie, founded by the emperor Joseph in 1708, for the education of the young Silesian nobles, was reconstructed as a gymnasium in 1810. The Roman Catholic church, with two fine towers, contains the burial vault of the dukes. The principal Lutheran church dates from the 14th century. There are also several other churches and schools, and a number of benevolent institutions. The theatre, the barracks, the military hospital, and the town-house are the most noteworthy of the remaining buildings. The manufactures of Liegnitz are considerable, the chief articles being cloth, wool, leather, tobacco, and pianos. Its trade in grain and its cattle-markets are likewise important. The large market gardens in the suburbs grow vegetables to the value of £20,000 per annum. Population in 1880 37,168, about one-sixth being Roman Catholics.

Liegnitz is first mentioned in an historical document in the year 1004. In 1164 it became the seat of the dukes of Liegnitz, who greatly improved and enlarged it, especially in 1170 and 1175. The dukes were members of the illustrious Piast family, which gave so many kings to Poland. At Wahlstatt, near Liegnitz, the tide of Mongolian invasion was stemmed, in 1241, in a hard-fought battle between the Tartars and the Christian chivalry under the duke of Silesia. The victory, indeed, remained with the invaders, but the obstinate resistance deterred them from any further attack on Germany. During the Thirty Years' War Liegnitz was taken by the Swedes, but was soon recaptured by the Imperialists. The Saxon army also defeated the imperial troops near Liegnitz in 1634. On the death of the last duke of Liegnitz in 1675, the duchy came into the possession of Austria, which retained it until the Prussian conquest of Silesia in 1740–45. In 1760 Frederick the Great gained a decisive victory near Liegnitz over the Austrians under Laudon, and in 1813 the list of important battles in this neighborhood was completed by Blücher's defeat of the French at the battle of the Katzbach. During the present century Liegnitz has been uniformly prosperous, and its population has increased fivefold since 1800.

See Schuchard, *Die Stadt Liegnitz* (Berlin, 1868); Sammter and Kraffert, *Chronik von Liegnitz* (Liegnitz, 1861–73).

LIEN, in English and American law, properly means a right of detaining goods of another in your possession until a debt due to you from the owner of the goods is paid. To the original or common law conception of a lien it would appear to be necessary that the goods over which lien is claimed should be actually in the possession of the creditor, and further that the debt should have been incurred with reference to the goods which are detained. Such is the lien of the workman to whom articles are delivered for the purpose of being operated upon by him in the way of his trade. He is entitled to keep the article he has worked at until remuneration for his labor has been made to him. Of precisely the same character is the lien of the carrier over the goods conveyed by him, for the fare; of the farrier over the horse which he has cured, for his fee; of blacksmiths, shipwrights, and other artificers for the wages they have earned by working at or on the thing detained. This, the true lien of the English law, is denominated a particular lien in contradistinction to a right of detainer exercisable over the property of another for a debt not incurred in relation to the thing detained. The latter is a general lien. The former is said to be favorably, the latter strictly, construed by the law. The former arises by implication of law from the relation of the parties; the latter requires a special contract either expressed in terms or to be inferred from the usage of trade. Again, as possession is the foundation of lien in common law, a parting with the possession would in general operate as a waiver or forfeiture of the lien. The same effect would follow of course from any agreement by the lien holder to give up his right while retaining possession of the property. Again as a general rule lien means only a right of detention, not a power of sale,—a fact which distinguishes it from a pledge of property in security for a loan. But in special cases powers of sale have by statute or judicial decision been added to liens. Thus innkeepers now have, in addition to their ordinary right of lien, power to sell goods and chattels left with them after six weeks (41 & 42 Vict. c. 38). In the United States the principle of the particular lien has been developed in a notable manner in protecting the rights of workmen employed in building. At common law, the building belongs absolutely to the owner of the soil; and accordingly, when a house is erected by contract, the contractor may receive payment from his employer and may fail to pay the laborers he has employed, who are consequently left without redress. The "mechanics' liens," created by statute in several of the American States, give laborers a lien over the building which they have erected for their unpaid wages. Notice having been filed in the prescribed manner, they acquire a right to have their wages paid out of the property, which may if necessary be sold for that purpose. A similar preferential charge, not depending on possession, is recognized by the law in various cases, and goes by the name of lien. Thus in equity an unpaid vendor has a charge for the amount of the purchase money, or the balance thereof, over the estate, although it may no longer be in his possession. Charges of this kind are sometimes denominated equitable liens. Of the same nature is the charge acquired over a ship by a person who has supplied her with necessaries for the voyage under a lawful contract with the master (maritime lien).

LIERRE, or Lier, a town of Belgium, in the province of Antwerp, 9½ miles south-east of Antwerp (on the railway to Malines), at the junction of the Great and Little Neethe. It is a busy place of 15,659 inhabitants (1874), and manufactures silk, lace, and shoes, beetroot sugar, and a peculiar kind of white beer known as *cavesse*. The church of St. Gommarius (in plan a Latin cross with a lofty tower in front) is one of the most notable buildings of its class in Belgium. It was commenced in 1425, but not completed for more than a century. Of the fine stained glass windows three were presented by the emperor Maximilian.

Lierre, which dates from the 9th century, owed much to the favor of the dukes of Brabant, to whose territory it belonged. The more important facts in its annals are the celebration of the marriage of Philip the Fair with Joanna of Castile (1496); the residence in the town of Christian II. of Denmark during his exile; and the contests between the Dutch and Belgian forces in 1830. Joseph II. ordered the fortifications to be razed in 1784.

LIFE ASSURANCE. See Insurance.

LIFEBOAT. It will be convenient to consider here, not the lifeboat simply, but also other means of saving life at sea. When it is borne in mind that the vast commerce of such a country as Great Britain extends to every part of the world, that the arrivals and departures from the ports of the country in one year average six hundred thousand vessels, that these are manned by more than two hundred thousand men and boys, and carry goods to the estimated value of six hundred millions sterling, with unknown thousands of passengers, that its seaboard is nearly 5000 miles in extent, many parts of it being exceedingly dangerous to shipping, that about two thousand wrecks occur every year on its shores, and above seven hundred lives are lost, the necessity that exists for a well-organized system of life-saving apparatus becomes very apparent. It is satisfactory to be able to add that this well-organized system is most efficiently provided by the Royal National Lifeboat Institution, with its splendid fleet of two hundred and seventy-one lifeboats, and by the Rocket Service. The number of lives saved annually, either by the lifeboats or by special exertions for which the institution has granted rewards, averages in round numbers nine hundred, and by far the greater proportion of these (four-fifths) are saved by lifeboats. These lifeboats, too, are the means of saving every year from twenty to thirty vessels which, owing to stress of weather, exhausted men, etc., would almost certainly have been lost but for the aid afforded by the fresh and experienced lifeboat crews.

The qualities of the lifeboat first deserve our attention. These are such that this boat is able to live in seas, and go into positions of danger, that would overwhelm ordinary boats or insure their destruction. Eight important qualities are possessed by it in a very high degree:—(1) buoyancy; (2) great lateral stability, or resistance to upsetting; (3) the power to right itself if upset; (4) the power of immediate self-discharge when filled with water; (5) strength; (6) stowage room for a large number of passengers; (7) speed against a heavy sea; (8) facility in launching and taking the shore.

The *buoyancy* of the institution's lifeboat, or its inability to sink, be it ever so deeply laden, is secured chiefly by means of a watertight deck or floor, air-cases round the sides inboard, and two large air-chambers, one in the bow, the other in the stern. The "extra buoyancy" thus obtained cannot be too great so long as it does not interfere with the space necessary for working the boat and stowing shipwrecked persons. The air-cases round the sides serve also to confine any water shipped to the centre of the boat, a point of great importance. There is an air-tight space between the boat's floor and its bottom, filled partly with air, partly with cork-ballast, which gives it additional buoyancy, but the air-chambers above the floor would float the boat even if she were stove in and this space filled with water. In a 33-feet boat the buoyancy obtained by all its chambers is equal to 11¼ tons.

Stability is obtained chiefly by means of ballast. Immense difficulty was experienced in arriving at the present form of the institution's splendid boat, because qualities of differing value had to be sacrificed to each other in due proportion. Thus, while breadth of beam secured stability, it seriously interfered with the self-righting quality. Ballast, therefore, in the form of a heavy iron keel, instead of breadth, became necessary to give the requisite stability.

Fig. 1 represents, let us say, the 33-feet, double-banked, ten-oared, self-righting, and self-emptying lifeboat of the institution on its transporting carriage, ready for launching; figs. 2 and 3, respectively, a section and a bird's-eye view of the same. The breadth is 8 feet, with stowage room for forty-three persons—thirty passengers and thirteen of a crew. The festooned lines (fig. 1) enable people in the water to clamber inboard even without assistance. The shaded parts of figs. 2 and 3 show the position of the air-cases. The white oblong space in fig. 3 shows the free space available for crew and passengers. In fig. 2 are seen the depth to which the air-cases descend, and the height to which the bow and stern air-chambers ascend above the gunwale, also the ballast space between the floor and the keel.

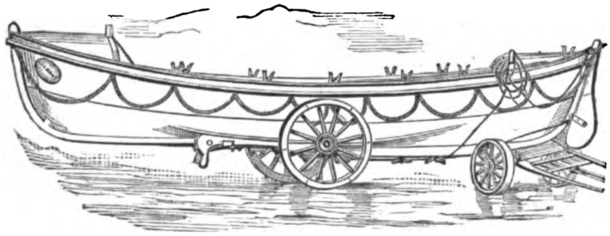


Fig. 1.—Ten-Oared Lifeboat.

The *self-righting* power is due to the large elevated air-chambers in bow and stern, coupled with great sheer, or rise fore and aft, of gunwale, to the iron keel, which weighs about 9 cwts. in a 33-feet boat, and to the air-cases and ballast, which latter weighs from 7 to 8 cwts. When the boat is upset it cannot rest on its two elevated air-chambers; it necessarily rolls on one side, then the heavy iron keel and ballast come into play and drag it back to its right position in a few seconds. This principle of self-righting was discovered—at all events first exhibited—at the end of last century, by the Rev. James Bremner of Orkney, but was not finally adopted till the middle of the present century.

The *self-emptying* quality depends chiefly on the well-known physical fact that water must find its level. The floor of the lifeboat (fig. 2, the dotted double line extending from stem to stern), on which the men's feet rest when seated on the thwarts, is placed so as to be very slightly—2 or 3 inches—above the level of the sea when the boat is fully manned and loaded. In this floor there are six holes of 6 inches diameter, into which are fitted six metal tubes. These pass through the boat's bottom into the sea. The water of course enters them, but cannot rise above them into the boat, because it cannot rise above its own level. Valves at the upper ends of the tubes, opening downwards, prevent the annoyance of water spurting in, but allow it freely to run out. When, then, a billow overwhelms the boat, and fills it, the water rushes violently down the discharging tubes until it reaches the sea-level; by that time it has descended below the level of the floor and left the boat empty. So complete and swift is the process that a filled boat frees herself in about half a minute. This principle was first applied by the institution in 1851. Lifeboats devoid of the self-discharging quality become temporarily useless when filled by a sea, as they can be emptied only by the slow and laborious process of baling.

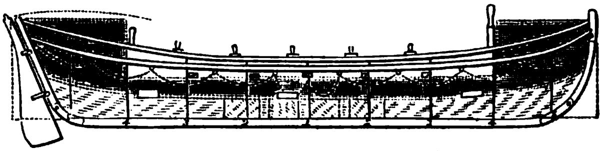


Fig. 2.—Lifeboat (Sheer Plan).

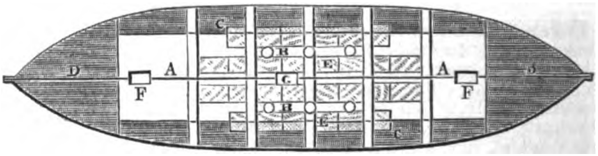


Fig. 3.—Lifeboat (Deck Plan).

Strength, that will enable the lifeboat to suffer treatment which no ordinary boat could stand, is dependent on peculiarity of construction and material. The best Honduras mahogany is used, and the diagonal plan of construction adopted,—that is, the boat has two distinct "skins" of planking, both sets of planks being laid on in a position diagonal to the boat's keel and contrary to each other, besides passing round from gunwale to gunwale under the boat instead of from stem to stern as in ordinary boats. The skins have a layer of prepared canvas between them, and thus great strength and elasticity are combined.

The *carriage* of the lifeboat is an essential adjunct for the purpose of conveying it over any kind of road or beach to the place where it may be required. It can be run deep into a raging surf, and the boat with its crew seated and oars ready out, can be launched at once, by blocks and tackle, so as to enable the men to dash forward and meet the incoming rollers with sufficient force to propel it through or over the seas, and thus avoid the risk of being hurled back on the beach. Each lifeboat is furnished with a set of spare oars, as these are frequently broken.

The institution's lifeboats are of various sizes—six, eight, ten, and twelve oared;—and they are placed at various points of the coast according to the necessities of each station. Some are called out at long intervals; others, such as those near the Goodwin Sands, are constantly on duty in rough weather—that of Ramsgate having a steamer to attend on it, which lies in the harbor, with its fires banked up, ready for instant action night and day. The average cost of a lifeboat station is £1000,—the boat and equipments, including belts and carriage, costing £650, and the boat-house £350. The average annual expense of maintaining a station is £70, which is expended in paying the crew for going off and saving or attempting to save life from shipwreck, for exercising the lifeboat once a quarter, paying coxswain's salary, replacing gear, and repairs.

The *lifebelt* of the institution is a part of the equipment of the lifeboat which merits special attention, because it is a very efficient contrivance, and has been the means of saving many lives in time past. Fig. 4 shows its appearance and the manner in which it is worn. It was designed in 1854 by Admiral J. R. Ward, the institution's chief inspector of lifeboats. It is made of cork fastened on canvas, and combines great buoyancy with strength and flexibility. It not only floats a heavily-clothed man head and shoulders above water, but enables him to support a comrade easily—the extra buoyancy being 25℔. One of its distinctive features is its division at the waist, by which means great freedom of action is allowed. It serves also as a species of armor to protect the wearer's most vital parts from blows against rock or wreck, while it affords some degree of warmth. No man may serve in the lifeboats of the institution without it, and it would be well if every British ship were obliged to carry lifebelts of this kind.

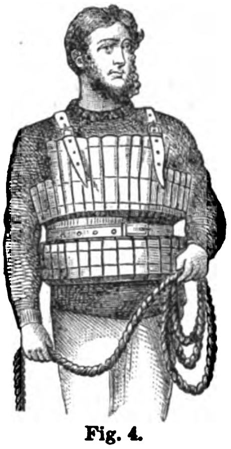


Fig. 4.

History.—The first lifeboat was conceived and designed by Lionel Lukin, a London coachbuilder, in 1785. Encouraged in his philanthropic plans by the Prince of Wales (George IV.), Lukin fitted up a Norway yawl as a lifeboat, took out a patent for it, and wrote a pamphlet descriptive of his "Insubmergible boat." Buoyancy he obtained by means of a projecting gunwale of cork and air-chambers inside—one of these being at the bow, another at the stern. Stability he secured by a false iron keel. The self-righting and self-emptying principles he seems not to have thought of; at all events he did not compass them. Despite the patronage of the prince, Lukin went to his grave a neglected and disappointed man. But he was not altogether unsuccessful, for, at the request of the Rev. Dr. Shairp, Lukin fitted up a coble as an "unimmergible" lifeboat, which was launched at Bamborough, saved several lives the first year, and afterwards saved many lives and much property.

Public apathy in regard to shipwreck was at length swept away by the wreck of the "Adventure" of Newcastle in 1789. This vessel was stranded only 300 yards from the shore, and her crew dropped, one by one, into the raging breakers in presence of thousands of spectators, none of whom dared to put off in an ordinary boat to the rescue. An excited meeting among the people of South Shields followed; a committee was formed, and premiums were offered for the best models of a lifeboat. This called forth many plans, of which those of William Wouldhave, a painter, and Henry Greathead, a boatbuilder, of South Shields, were selected. The committee awarded the prize to the latter, and, adopting the good points of both models, gave the order for the construction of their boat to Greathead. This boat was rendered buoyant by nearly 7 cwts. of cork, and had very raking stem and stern-posts, with great curvature of keel. It did good service in after years, and Greathead was well rewarded; nevertheless no other lifeboat was launched till 1798, when the Duke of Northumberland ordered Greathead to build him a lifeboat which he endowed. This boat also did good service, and its noble owner ordered another in 1800 for Oporto. In the same year Mr. Cathcart Dempster ordered one for St. Andrews, where, two years later, it saved twelve lives. Thus the value of lifeboats began to be recognized, and before the end of 1803 Greathead had built no fewer than thirty-one boats—eighteen for England, five for Scotland, and eight for foreign lands. That these boats were lamentably insufficient to meet the necessities of England was shown year after year by the ever enlarging record of wreck and loss of life on her shores; nevertheless, public interest in lifeboats was not thoroughly aroused till 1823.

In that year Sir William Hillary, Bart., stood forth to champion the lifeboat cause. Sir William dwelt in the Isle of Man, had assisted with his own hand in the saving of three hundred and five lives, and felt the horrors of shipwreck so keenly that he resolved to stir up public men and the nation generally to a sense of their duty in regard to this matter. Eventually, in conjunction with two members of parliament—Mr. Thomas Wilson and Mr. George Hibbert—he founded the "Royal National Institution for the Preservation of Life from Shipwreck." This, perhaps the grandest of England's charitable societies, and now named the "Royal National Lifeboat Institution," was founded on the 4th of March, 1824. The king and many of the nobility and gentry patronized it. The archbishop of Canterbury presided at its birth; the most eloquent men in the land—among them Wilberforce—pleaded the cause; the institution was launched under the most favorable auspices, and began its noble career with a sum of only £9826. In the first year twelve new lifeboats were built and placed at different stations, besides which thirty-nine lifeboats had been stationed on the British shores by benevolent individuals and by independent associations over which the institution exercised no control, though it often assisted them. In its early years the institution placed the mortar apparatus of Captain Manby at many stations, and provided for the wants of sailors and others saved from shipwreck. The latter duty is now efficiently discharged by the "Shipwrecked Fishermen and Mariners' Royal Benevolent Society." At the date of the institution's second report it had contributed to the saving of three hundred and forty-two lives, either by its own life-saving apparatus or by other means for which it had granted rewards. With fluctuating success, both as regards means and results, the institution continued its good work from year to year, saving many lives, and occasionally losing a few brave men in its tremendous battles with the sea. District or branch societies were established in most of the coast towns. Ultimately it began to be recognized that inland towns owed something to the lifeboat cause, as well as towns on the coast, and now such cities as Manchester, Liverpool, Glasgow, Edinburgh, etc., have presented lifeboats to the institution and become annual contributors. Since the adoption of the self-righting boats loss of life in the service has been comparatively small and infrequent.

Towards the middle of this century the lifeboat cause appeared to lose interest with the public, though the life-saving work was prosecuted with unremitting zeal, but the increasing loss of life by shipwreck, and a few unusually severe disasters to lifeboats, brought about the reorganization of the society in 1850. The late Prince Albert became vice-patron of the institution in conjunction with the late king of the Belgians, and afterwards her Majesty the Queen, who had been its patron since her accession, became an annual contributor to its funds. About the same time its present secretary, Mr. Richard Lewis, barrister-at-law, was appointed. The following year (1851) the Duke of Northumberland became its president, and from that time forward a tide of prosperity set in which is literally unprecedented in the history of benevolent institutions, both in regard to the great work accomplished and the pecuniary aid received. Its flow of prosperity has never since been checked. In 1850 its committee undertook the immediate superintendence of all the lifeboat work on the coasts, with the aid of local committees. Periodical inspections, quarterly exercise of crews, fixed rates of payments to coxswains and men, and quarterly reports were instituted, at the time when the self-righting, self-emptying boat came into being. This boat was the result of a hundred-guinea prize, offered by the president, for the best model of a lifeboat, with another hundred to defray the cost of a boat built on the model chosen. In reply to the offer no fewer than two hundred and eighty models were sent in, not only from all parts of the United Kingdom, but from France, Germany, Holland, and the United States of America. The prize was gained by Mr. James Beeching of Great Yarmouth, whose model, slightly modified by Mr. Peake, one of the committee of inspection, became the foundation of the present boat, which, having been still further improved as time and experience have suggested, is now probably as near to perfection as can be attained.

The shortest way, perhaps, to exhibit the progressive work of the institution is to contrast the report of 1850 with that of 1880. In the former year the receipts had dwindled down to £84 of subscriptions and donations, which, with £270 of dividends (on a capital of £9000) and a balance of £476 on hand, gave an available income of £830. The expenditure was £590, and the lives saved were about one hundred. In 1880 donations and annual subscriptions amounted to £29,240; dividends and interest (on a capital of £231,000) amounted to £9266. The total income was £38,506, besides legacies in the same year to the amount of £40,782. The expenditure, including liabilities, was £40,586, and the number of lives saved was about seven hundred. In the past unusually disastrous year (1881) the institution has saved 966 lives by its boats, and granted rewards for the saving of 155 more, besides rescuing 33 vessels from destruction. The total number of lives saved, either by the lifeboats, or by special exertions, for which the institution has granted rewards, since its formation, is 28,724, for which services 95 gold medals, 939 silver medals, and £69,000 in cash have been granted as rewards. So highly are the services of the institution appreciated that donations of boats, gifts of money, acknowledgments, and legacies come in from nearly all quarters of the globe, in sums varying from a shilling to £10,000.

Rocket Apparatus.—This, next to the lifeboat, is the most important and successful means by which shipwrecked persons are rescued on the British shores. Many vessels are cast every year on the rocky parts of the coasts, under cliffs, where no lifeboat could be of service. In such places the rocket alone is available. It is worked by the men of the coastguard, with the aid, in a few places, of volunteer rocket brigades. The courage and skill displayed in its use are evinced by the saving of many lives every year, and by the fact that a large proportion of the medals given by the lifeboat institution for heroic conduct are awarded to the men of the coastguard, who besides managing the rockets, frequently man the lifeboats and also effect rescues in their own boats. The number of lives saved by means of the rocket apparatus in the year ending 30th June, 1881, was 657. This, however, is the greatest number saved in any one year since 1856, at which date the life-saving rocket apparatus was placed under the entire control and management of the Board of Trade. The rocket stations on the coast at the 30th June, 1881, numbered 288. The Board of Trade now gives a sum of money for each life saved, besides awarding silver and bronze medals for acts of special gallantry.

The apparatus consists of five principal parts, viz., the rocket, the rocket-line, the whip, the hawser, and the sling lifebuoy. The mode of working it is as follows:—A rocket, having a light line attached to it, is fired over the wreck. By means of this line the wrecked crew haul out the whip, which is a double or endless line, rove through a block with a tail attached to it. The tail-block, having been detached from the rocket-line, is fastened to a mast, or other portion of the wreck, high above the water. By means of the whip the rescuers haul off the hawser, to which is hung the travelling or sling lifebuoy. When one end of the hawser has been made fast to the mast, about 18 inches *above* the whip, and its other end to tackle fixed to an anchor on shore, the lifebuoy is run out by the rescuers, and the shipwrecked persons, getting into it one at a time, are hauled ashore. Sometimes, in cases of urgency, the lifebuoy is worked by means of the whip alone, without the hawser. A tally-board with instructions to wrecked crews, printed in English and French, is sent off with the whip, as ignorance in regard to the mode of working the apparatus has been the cause of much loss of life. Such ignorance is culpable, because the Board of Trade issues enamelled plates with instructions, which are supplied gratuitously to shipowners and masters to be placed on conspicuous parts of their vessels, and are fixed in public places along the British coast, while every certificated officer in the mercantile marine is required to understand the working of the rocket apparatus.

The late Captain G. W. Manby,[1] F. R. S., in 1807 invented, or at least introduced, the mortar apparatus, on which the system of the rocket apparatus is founded. Previously, however, in 1791, the idea of throwing a rope from a wreck to the shore by means of a shell from a mortar had occurred to Sergeant Bell of the Royal Artillery, and about the same time, to a Frenchman named La Fère, both of whom made successful experiments with their apparatus. In the same year (1807) a rocket was proposed by Mr. Trengrouse of Helston in Cornwall, also a hand and lead line as means of communicating with vessels in distress. The *heaving-cane*, a fruit of the latter suggestion, is now used at every station in the kingdom. In 1814 forty-five mortar stations were established, and Manby received £2000, in addition to previous grants, in acknowledgment of the good service rendered by his invention. Mr. John Dennett of Newport, Isle of Wight, introduced the rocket, which was afterwards extensively used. In 1826 four places in the Isle of Wight were supplied with Dennett's rockets, but it was not till after Government had taken the apparatus under its own control, in 1855, that the rocket now in use was adopted. It was invented by Colonel Boxer, and its peculiar characteristic lies in the combination of two rockets in one case, one being a continuation of the other, so that, after the first compartment has carried the machine to its full elevation, the second gives it an additional impetus, whereby a great increase of range is obtained. The rocket has now entirely superseded the mortar in England.

The United States Life-Saving Service is chief among the lifeboat societies of other nations, both as regards the extent of coast embraced and the amount of work done. There are several points of difference between this service and that of England which are noteworthy. In the first place the whole or nearly the whole of its support is provided for by annual grants of money from Congress. Secondly, besides protecting its vast extent of seaboard, it has to provide for the shores of its great lakes, or fresh-water seas. Then, the coasts of America, unlike those of England, are destitute of human habitations in many places, which renders necessary the constant employment of surfmen for the express purpose of looking out for vessels in distress and manning the surf-boats. It also necessitates the erection of houses of refuge, provisioned so as to afford shelter and food to shipwrecked crews for a considerable time, at places where, without such provision, those who escape the sea would probably perish from hunger and exposure.

The shores of the United States—lakes and sea—are over 10,000 miles in extent, embracing almost every variety of climate and formation of land. This vast extent of coast-line is divided into 12 districts, with a total of 179 stations. Of these 139 are on the Atlantic, 34 on the lakes, and 6 on the Pacific. Those on the desolate coast of Florida are houses of refuge only, without boats or apparatus. Many of the stations are closed during the fine months of the year, their crews being disbanded till the winter gales again summon them to the heroic and dangerous work of saving the shipwrecked. That they render noble service in this way may be gathered from the annual reports. The report for 1880 shows that the disasters to shipping in that year amounted to 300, that on board of the vessels thus endangered there were 1989 persons, of whom 1980 were saved and only 9 lost. The property imperilled at the same time was estimated at, in round numbers, £790,000, of which over £540,000 worth was saved, besides which, in one hundred and twenty-eight instances, stranded vessels were hove off, and piloted out of danger by the surfmen. The total number of lives saved by this service, since the introduction of the present system in 1871, to the close of the fiscal year in June, 1881, was 11,864; the total number of persons sheltered 2610, and the number of days' shelter afforded 7350; the total value of property saved, $14,958,875.

Owing to the flat shores of the Atlantic coast, and the sparseness of the population, heavy boats are found unsuitable. Only a few boats on the English model exist in the service. The boats chiefly in use are surf-boats, incapable of self-righting, and liable to be swamped, but which nevertheless seem well suited for the work, and are admirably managed. They are very light, and can, on their transporting carriages, be easily dragged along the shore by their crews. The cork life-belts worn by the men are of the plan first designed in 1854 by Rear-Admiral Ward. For projecting a line over a stranded vessel, the Americans prefer the mortar, or other piece of ordnance, to the rocket. In addition to the travelling lifebuoy, they use a metallic car, or small covered boat, which can hold three or four persons, who, entering it by a small manhole, are shut in and drawn ashore, safely protected from injury, even though overturned by the surf. This clever contrivance has been of great service in rescuing invalids, children, and aged persons. The total cost of the service is somewhere about £90,000 a year.

The history of the United States Life-Saving Service may be said to have begun in 1848, though half a century before that the Humane Society of Massachusetts had erected some huts of shelter and stationed some boats on the coast. In that year the United States Government was led to consider the subject of loss on their shores, chiefly through the energy of the Hon. W. A. Newell of New Jersey, a member of the House of Representatives. Captain Douglass Ottinger (the inventor of the life-car) was charged with the management and reconstruction of the service. The impetus given to it at this time was never quite lost. Again, in 1854, renewed efforts were made to improve the service, but no great progress was made till the year 1871, when the present effective system was organized; new stations were built; the patrol system between the stations was introduced; the regular keeping of journals and sending in of reports was ordered; libraries for the use of the men were sent to stations; uniformity in signals was arranged, and a thorough reform in all departments accomplished.

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[1] [This inventor (1765–1854) was born and died at Great Yarmouth.—AM. ED.]

The French Society for Saving Life from Shipwreck, modelled on the basis of the English system, is a vigorous and healthy offshoot. It continues steadily to extend its operations along the coasts of France, besides introducing its life-saving apparatus into Algeria and other colonies. It was founded in the year 1865, and from that year onward has continued to do good and ever-increasing service in the saving of life and property. At the date of its report ending 30th June, 1881, its lifeboat stations numbered 62, and its mortar or other projectile stations 391. During the year its lifeboats and gun apparatus had saved 209 lives and 16 ships, to which may be added 31 lives, for the saving of which the society had granted rewards. From the time of its commencement in 1865 to the above date it has rendered the following noble service:—

Lives saved by its own boats and apparatus......	1,826
Lives saved by other means, for which the society granted rewards in gold, silver, and bronze medals, and cash..............................	303
Total of lives saved from the beginning...	2,129

Besides this it has saved 149 vessels and succored 348, and has awarded 28 gold, 129 silver, and 319 bronze medals, 513 *diplômes d'honneur*, and about £20,400 in recompenses to those who have assisted in saving life in circumstances of unusual danger. It has also spent about £53,000 in the purchase and repair of its matériel. The receipts of the society show that its work is appreciated. At 31st December, 1880, the subscriptions and donations together amounted to nearly £2600, and the legacies bequeathed to it the same year were about £1000. The boats chiefly used are built on the model of those of the English institution. The gun is preferred to the rocket in connection with the life-saving apparatus. In addition to its direct work of saving life, the French society has accomplished much good indirectly by its influence. It has been instrumental in bringing about this result that, among the qualifications for a captain's certificate in the French mercantile marine, a thorough knowledge in detail of the means of saving life from shipwreck is required. It has also labored to extend the usefulness and reduce the cost of the gun and rocket apparatus, besides securing that this apparatus, on Mr. Delvigne's system, shall be supplied to every ship of the French navy.

The German Association for the Rescue of Life from Shipwreck, under the patronage of the emperor William, was founded at Kiel in May, 1865, and is prosperous both in regard to its work and finances. It is maintained by voluntary contributions, and has 21 local branches on the coast and 27 in the interior, besides 149 agencies over the country. Previous to 1865 several private societies for saving life from shipwreck existed in the chief seaports of the North Sea and Baltic. These have been absorbed in the present association, the proceedings of which are reported in a paper entitled *From Shore and Sea*, published at Bremen once a quarter, and largely modelled on the *Lifeboat Journal* of the English institution. The association provides the whole extent of the German coast with life-saving apparatus. It has 74 lifeboat stations, 20 of which are provided with the mortar or rocket apparatus. With these means it has, in the year 1880–81, saved 122 lives and 2 ships. The total number of human lives saved by the association since its commencement is 1184. From May, 1880, to May, 1881, the amount subscribed by its members was £57,000. As in America, the heavy self-righting and self-emptying boats of England have been found unsuitable to the thinly peopled and flat sandy beaches of Germany. Lighter and shallower boats have therefore been adopted. These are iron-plated and not self-righting, but almost impossible to capsize. The stations are visited at least once a year by an inspector, and the whole system seems to be well regulated and thoroughly efficient.

In addition to the above, lifeboat societies or other lifeboat organizations—formed more or less on the basis of the National Lifeboat Institution of Great Britain—are to be found in Russia, Italy, and Spain.

Life-saving Hammocks, etc.—Various forms of buoyant mattresses, pillows, and india-rubber cloth life jackets and belts have been contrived. Among these may be specially mentioned the air lifebelt of Admiral Ward, which has four compartments, separately inflated, so that the puncture of one does not quite destroy the belt. Admiral Ryder's hammock also deserves notice. Its virtue lies simply in a cork mattress, which, when rolled up in its hammock, forms an efficient lifebuoy capable of supporting a man with his head and shoulders well above water, and it enables three men to float in an upright position. Cork mattresses are said to be cheaper and more comfortable than those stuffed with hair. Two such hammocks lashed together, about 20 inches apart, will enable two or three men to propel themselves easily through the water. The advantage of having such mattresses in a ship is obvious, for every one on board would be thus provided with a life-preserver.

It has also been suggested that the cushions of deck and cabin seats should, in a similar way, be made life-preservers, and that cabin furniture should be constructed so as to form rafts in cases of emergency. It is well to know, on the authority of the *Philosophical Magazine* (vol. xx. p. 362), that even a hat tied in a pocket handkerchief and held with the crown downwards may help to sustain a drowning man. It need scarcely be added that empty water-casks, tightly bunged, with ropes arranged for clinging to, form pretty good life-preservers. (R. M. B.)

LIFTS may properly be held to include all sorts of apparatus whose object is the lifting of weights. When the apparatus consists of comparatively small, separate, and portable pieces, it is called *lifting tackle*. When the lifting apparatus reaches that degree of size and complication that entitles it to be called *machinery*, there seems to be no general technical term that will include all kinds, but for the different classes of lifting machines there are such special names as *cranes*, *hoists*, *elevators*, *lifts*, *winding engines*, and *lift pumps*.

There is very little distinction made between hoists, elevators, and lifts. The word *hoist* refers more particularly to machines used in warehouses and factories for raising goods from one story to another. They are worked by hand or by power, and are for comparatively light loads. *Elevator* is used in two different senses. It refers to apparatus for lifting passengers to the upper stories of buildings. It also refers to the very different sort of apparatus used in grain-mills and storehouses for transferring the grain from one floor to another. The grain is drawn along channels or pipes, which are sometimes vertical and more often inclined, by means of a rotating archimedean screw, or of a strap continuously travelling upwards through the interior of the channel and carrying, fastened to it, a series of small buckets. Occasionally, if the inclination to the horizontal be small, a broad strap of the same width as the bottom of the channel runs along that bottom, and carries the grain with it simply lying on its upper surface. This latter method of transportation is more efficient, however, as a horizontal carrier or distributor than as a means of lifting. Grain might also easily be blown up a pipe by an air-blast, but the writer does not know any instance of this method having been used. *Lifts* are constructed either for raising passengers in buildings or for heavier loads, such as freighted trucks and wagons, or the superstructure of bridges and large roofs during their erection.

In lifts or elevators, the working force is either hand, steam, or hydraulic power. Gas-engines are unsuitable as direct sources of power for lifts, but they may be advantageously used to store hydraulic power in an accumulator from which water is supplied to work an hydraulic lift. Electricity has quite recently been used, but has not yet been tried sufficiently to allow of any valuable opinion being formed of its ultimate practical success.

The lift consists of (1) a box or "cage" to contain the persons or material to be raised; (2) a vertical square well or shaft, to the walls of which are attached guides to prevent the cage swinging to and fro; (3) a rope or chain by which to haul the cage upwards from above, or else a long rod or pillar by which to push it up from below; (4) a "barrel" or "sheave" over which to wind the chain or rope, and which is mounted on a shaft lying in bearings firmly supported by the building, or else a cylinder to contain water or steam to actuate the lifting rod; (5) mechanism through which the working power is transmitted to the barrel, or else water or steam piping connecting the cylinder above mentioned with the source of power; and (6) the driving engine or other source of power.

Most accidents happen to lifts through the hauling chain or rope breaking. For the sake of safety, therefore, particular care should be exercised in the choice of material for this part, and an appliance should always be attached to the cage whereby, if the rope breaks, the cage is caught immediately in whatever position it may be at the time of the breakage.

For light loads hempen ropes are sufficient and more convenient than chains, because they are noiseless in their action. If of the best quality (Manila) they are quite as reliable as ordinary chains, and an advantage claimed for them is that their gradual destruction by wear becomes easily apparent, and gives timely warning before they become dangerous, whereas the failure of a chain may take place without any easily visible previous sign having been given. For very heavy loads, however, chains or wire ropes should be used in preference to hempen ropes. Wire ropes may be made stronger for a given weight per foot of length than chains are, but unfortunately as commonly manufactured their quality cannot be certainly relied on. Like hempen ropes, they are almost noiseless. To insure smoothness and noiselessness in passenger lifts, the sheave over which the rope passes is lined in the groove with leather.

For the sake of safety, the rope by which the cage hangs is often duplicated. Sometimes even three or four are used. In order that these should give additional safety, each rope must be capable of supporting the load by itself. Generally the load is lifted by one or other kind of power, and descends by the weight of the cage itself. This weight is always much more than sufficient for the purpose, and therefore counterpoises are introduced to balance the greater part of it, thus lessening the work to be done during ascent by an amount equal to the product of the balance weight and the height of the lift. In the commonest arrangement, the balance weights are hung on the same rope as that by which the cage is suspended. This passes over a pulley whose diameter is half the width of the well, so that the cage end of the rope rises vertically from the centre of the roof of the cage. This pulley is keyed on a horizontal shaft, which is driven by power from below, either directly by means of a rope or chain passing over another pulley, or else through intermediate spur gearing. The actual working rope is in this case not attached to the cage. Less frequently the rope from the engine forms one of the suspenders of the cage, the balance weights being attached by separate ropes.

The rope or chain by which the load hangs has to be so strong that its own weight is very considerable. A large excess of strength being more in demand in this kind of machinery than in other kinds, a greater stress than about 1 ton per square inch cannot be put upon the chain or rope (supposed to be of iron). This would make the rope weigh 3·4 ℔ per foot of length for every ton of load carried. If the height of lift were, for example, 60 feet, then, comparing the top and bottom positions of the cage, there would be in the former 60 feet less of rope on the cage side of the pulley, and 60 feet more on the counterpoise side, than in the latter position, so that if the counter-weight just balanced the load when the cage was at the bottom, it, along with the rope, would outweigh the cage in its highest position by the weight of 120 feet of rope, that is 408 ℔ for every ton of load, or nearly ⅕th of the whole load. Since the whole load—that is, that of cage, ropes, and passengers or goods—is three or four and sometimes five or six times as great as the net load, this is a very serious increase on the *unavoidable* loss of balance resulting from the fact that the cage is alternately loaded and unloaded. The difficulty can be got over by extending the rope downwards from the balance weight to pass underneath a grooved pulley at the bottom of the well, and up from this to the under side of the cage, where it is attached. There will then be an equal length of rope always hanging on each side of the top bearing pulley; but an extra amount of friction occurs at the bearing journals due to the weight of the extra rope. The lower half of the rope may be of cheap inferior material, since there is very little stress upon it.

A precisely similar difficulty occurs if the cage be lifted from below by an hydraulic ram or piston-rod. Occasionally the weight of the cage and ram is left unbalanced. In this case the water pressure on the ram or piston has to support the whole load. Suppose the pressure in the reservoir from which the water is drawn to remain steady during the ascent, then evidently at the top of its stroke the water pressure on the ram is less than at the bottom of its stroke, by the weight of a column of water, of section equal to that of the ram, and height eqnal to the lift. Suppose, for example, that the water pressure at the level of the face of the ram in its highest position is 200 ℔ per square inch. Then for every ton of total load there must be provided about 11 square inches of piston area. A column of water of this horizontal section and 1 foot high weighs about 4·75 ℔. This would give a difference of supporting pressure of 285 ℔ for every ton of total load in a lift of 60 feet,—that is, about ⅛th of the total load. More commonly the weight of the cage and the ram is balanced by counterpoises on chains fastened to the top of the cage and passing over a pulley overhead, while the water pressure is used to overcome only the frictiou, and the additional load of passengers or goods. In this case again, owing to the passage of the chains over the pulleys, the balance is disturbed in a rise of 60 feet, by about ⅕th the weight of the cage and the ram, while the upward water pressure on the ram is in the same rise diminished by ⅛th. The former disturbance of balance is a *decrease* of the load resting on the base of the ram, while the latter is a *decrease* of the supporting pressure on the same base. If these were made equal, the cage and load would be perfectly balanced in every position. To make them equal, it would be necessary simply to adjust the ratio of the part of the load borne by the counterpoise to the part borne by the water. Let the former part be W_1 and the latter W_2, the total load being $W_1 + W_2$. Then for a water pressure of 200 ℔ per square inch, it would be necessary to have

$$\tfrac{1}{5}W_1 = \tfrac{1}{8}W_2, \text{ or } W_1 = \tfrac{5}{8}W_2 = \tfrac{5}{13}(W_1 + W_2).$$

For a pressure of 400 ℔ per square inch, the equation would be

$$W_1 = \tfrac{5}{16}W_2 = \tfrac{5}{21}(W_1 + W_2).$$

For 100 ℔ per square inch it would be

$$W_1 = \tfrac{5}{4}W_2 = \tfrac{5}{9}(W_1 + W_2).$$

This adjustment would necessitate a large unnecessary consumption of water, because the weight of cage and ram always bears a much greater ratio to the extra weight of passengers or goods than any of the above fractions $\tfrac{5}{16}$, $\tfrac{5}{8}$, or even $\tfrac{5}{4}$. The adjustment being attainable by other means, this waste can in no case be desirable.

If a second cylinder stand beside the lift-well and be connected by a pipe to the cylinder directly underneath the cage, so that there is a continually open passage between the two cylinders, then the supporting rod underneath the cage, together with the column of water leading from its base through the pipes to the second cylinder, is the exact counterpart in compression of the overhead ropes in tension in the other class of machine; and, as counter-weights are hung upon these ropes, a balancing weight may be laid on the surface of the water in the second cylinder. The balance weight, equalling that of cage and ram, rests on a plunger or piston fitting this cylinder, and the rod is extended upwards into a third smaller cylinder, on the plunger of which is admitted, by means of the valve worked from the cage or landing-platforms, an extra amount of water pressure sufficient to elevate the extra load of passengers or goods. This is the arrangement in Tomassi's hydraulic balanced lift. The column of water which takes the place of the rope in the overhead arrangement passes from one cylinder to the other, and *vice versa*, in the same way as the rope passes from the cage side to

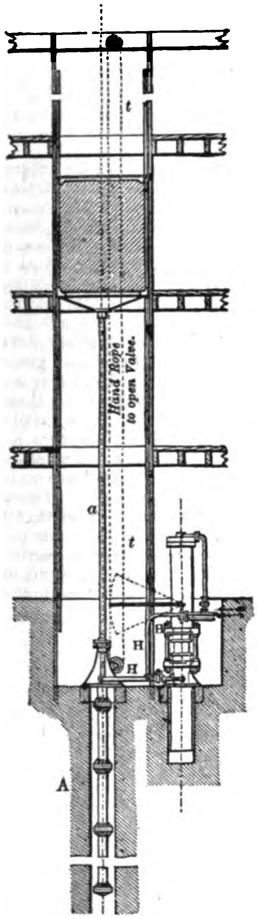

Fig. 1.

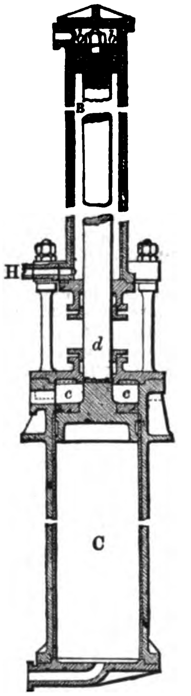

Fig. 2.

the counter-weight side of the overhead pulley. Thus the balance, which may be made correct for one position of the lift, becomes disturbed for other positions by a similar amount to that already investigated. A perfect balance of the constant part of the total load, namely, that of the cage and ram, is, however, obtained for all positions of the cage by the arrangement shown in figs. 1 and 2. This is the design of Mr. Edward Ellington, described by him in a paper read before the Institution of Mechanical Engineers in January, 1882. The whole load is borne by the rod *a* underneath the cage, which enters as a ram into the vertical cylinder A. This rod is made solid in order to reduce the size of the cylinder as much as possible, and, therefore, also the size of the well that has to be bored in the ground to contain this cylinder. This class of lifts is especially expensive on account of this boring, and the objection to them on the score of expense is lessened by making the well small. The rod is made only just strong enough to safely bear the load on it. Its section should be designed with reference to the height of lift, because the longer the free length of the supporting pillar the greater is its tendency to buckle under a given load. If *k* be the stress per square inch calculated to be admissible on its section, and if W be the weight of cage and ram together, and W′ that of passengers or goods to be raised, the section is made equal to $\frac{W+W'}{k}$. Since this same load has to be supported by the water pressure on the lower end of this rod, that water pressure is made also equal to *k*. This cylinder A is kept always in open communication with the lower end of the cylinder B. In this moves a piston *b* fastened to the top of the thick piston rod *d*. This passes downwards into the third cylinder C, and to its lower extremity is fastened the large piston *c*. These pistons have a common stroke, which is much shorter than the lift of the cage. The cylinders are correspondingly shorter than A, and they stand above ground. The ratio of the strokes may range from 5 to 8, and is the same as the ratio of the annular area of the under side of the piston *b* to that of the rod *a*. If *b* and *d* be the areas of the piston and piston rod, and *a* that of the rod supporting the cage, the ratio of the strokes is $b-d:a$. Suppose the piston *b* to be at the top of its stroke and the cage to be consequently at the bottom of the lift-well, then, if in this position the piston *b* be at a height above the lower end of *a* equal to *h* inches, and if *w* be the weight of a cubic inch of water, then, the pressure per square inch on *a* being *k*, that on the *lower* side of piston *b* is $k-hw$. The whole upward pressure on this piston is therefore $(k-hw)(b-d)$; and a downward pressure equal to or rather more than this must be exerted on this piston in order to lift the cage. This is supplied by admitting the water from the main, or from the hydraulic accumulator if force-pumps are employed to provide water pressure, into the upper ends of the cylinders B and C. The lower end of C is always kept in open communication with the atmosphere. The water is continually admitted to B, and the water pressure on the top surface of piston *b* is designed to balance the constant load of cage and ram when this piston is at the top of its stroke. During the ascent of the cage, the water is admitted into C by a valve moved from the cage or platforms by means of the rope *t*, and the water pressure on the annular top surface of piston *c*, when that piston is at its highest position, is designed to balance the extra load of passengers or goods. During the descent, the cage being empty, the connection between C and the accumulator is shut by the valve actuated from the cage, and the water is allowed to escape freely to the drains, so that the pressure on *c* becomes equal to atmospheric pressure. If *p* be the pressure per square inch of the working water at the level of the piston *b* at its highest position, and *c* be the area of the cross-section of cylinder C, and if *h′* be the length of plunger *d*, then in this position the whole downward force that is borne by the water underneath the piston *b*, and distributed over its area $(b-d)$, is $pb+(p+h'w)(c-d)$, when the pressure is on piston *c*, and simply pb when this pressure is cut off from C. (To this should be added the weight of *b*, *d*, and *c*, but for our present purpose of explanation only this may be left out of account.) The former quantity has to equal $(k-hw)(b-d)$, and the latter should equal

$$\left(k\frac{W}{W+W'}-hw\right)(b-d).$$

These two equations serve to determine two of the quantities involved in terms of the others.

When the water pressure is admitted to the upper side of *b* alone, the intensity of pressure on the under side of *b* is evidently as many times greater than the intensity on its upper side as the area of its upper side is greater than that of its lower surface. Thus any increase of intensity on the upper surface will cause a correspondingly greater increase of intensity on the lower. Now if the pressure on the under side of *b* were to remain the same while the cage ascended, the pressure on the lower end of *a* would decrease by an amount proportional to the change in their difference of level. If, for example, the ratio of the strokes $b-d:a$ is 6 : 1, then, as the cage rises 6 inches, *b* will fall 1 inch, and *h*, the difference of level between *b* and *a*, will be decreased 7 inches. The pressure per square inch on *a* would decrease $7w$ if that on the under side of *b* kept constant. But, as the upper side of *b* also sinks 1 inch, the pressure per square inch on it will increase by *w*. If now the ratio of this upper area of *b* to its lower area be made 7, this increase of *w* on the top face will cause an increase of $7w$ on the lower face, and thus just neutralise the diminution of pressure on *a* due to the combined rise of the cage and fall of the lower side of *b*. Thus the unloaded cage will be in perfect balance, at whatever height it stands, if the areas *b* and $b-d$ are given the ratio

$$\frac{b}{b-d}=\frac{b-d}{a}+1.$$

The ratio $b-d:a$ of the two strokes having been already chosen, this equation gives *b* directly. From the other two equations *c* and the necessary pressure *p* are found. This pressure *p* may be obtained by hydraulic pumps and an accumulator loaded to the right amount. If, however, the water from the mains is to be used, the ratio of the strokes or the size of *a* may be modified so as to suit the available working pressure *p*. If *c* be proportioned for the extra load at a given height, it will not be correct for all other heights, but this is of little consequence, because the extra load itself is variable from 0 upwards, so that no adjustment of *c* except to its maximum desired amount is possible. An excess of pressure on *c* above that needed for any given load has the effect simply of accelerating the speed of ascent, and this is modified roughly by partially closing the valve admitting water to C.

We have chosen this lift for description as the latest improvement in the design of hydraulic lifts. In it no water is wasted in raising or lowering the constant load.

When the hydraulic power is applied to the cage through a chain or rope passing over an overhead pulley, the hydraulic cylinder is usually laid horizontally for facility of setting and examination. Of course this arrangement involves much greater frictional resistance to the motion of the apparatus, but in it all the severely stressed parts may be in tension. There is greater security when they are so than when they are in compression. Tangye Brothers' hydraulic lift is arranged in this way.

Accidents to lifts occur in two ways. First, the suspending chain or rope may break, or, in those supported from below, the ram may break, or the cylinder or pipes enclosing the water may burst. To lessen the risk of such breakages the only method is to insist on good design in the details, good materials (which should be subjected to test before being used), and good workmanship. The connection at both ends of the rope or chain to the load suspended from it, or the jointing of the different sections of the ram to each other and to the cage, is a point especially important. If such a breakage does actually occur, however, the cage is usually kept from falling by an automatic catch which grips it in whatever position it happens to occupy when the accident occurs. Tangye Brothers have for this purpose at each corner of the cage a toothed cam. The suspending rope sustains the cage through levers as shown in fig. 3. So long as there is a considerable pull on the rope, the levers keep the cams in the position shown. If the strain on the rope is relieved by accident to it, powerful spiral springs immediately force the cams outwards and the teeth become buried in the wooden guide-posts. A toothed rack is sometimes bolted to the vertical posts and tooth-shaped prongs are forced forward by springs to engage with the rack when the rope breaks. Similar arrangements are not placed between the top of the ram and the cage of direct-acting hydraulic lifts, but it is a mistaken idea that they are not as necessary in this case as in the other. Such appliances should be examined and tested at regular frequent intervals. They are apt to get out of working order through disuse. A double rope is a greater safeguard against accident.

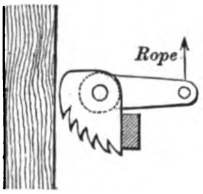

Fig. 3.

In chain or rope lifts the gearing or other machinery may break, and in consequence the cage might run down with dangerous rapidity without the rope either breaking, or being wholly relieved of tension, so that the above catches may not come into action. This may be prevented by a self-acting clutch on the shaft, which prevents the barrel rotating unless the clutch is specially released. The most perfect and mechanically beautiful of the many devices that have been invented for this purpose is Weston's frictional automatic coupling. Fig. 4 shows it as applied to a hand sack-hoist. To the shaft *a* is keyed a ratchet wheel *b*. A pawl gearing in this prevents the shaft from ever rotating except in one direction. The plate *c* is also keyed to the shaft. The hauling rope sheave *d* and the winding barrel *e* both run loose on the shaft. Their opposing end surfaces are cut helically, so that, according to the relative angular positions of *d* and *e*, they are either jammed against each other and between *c* and *b*, or are loose and free to rotate round the shaft. On pulling the sheave *d* in one direction all the parts are frictionally coupled together, and the barrel hauls up the load. The axial pressure producing friction between *c* and *e* and between *d* and *b* is greater than the load being hauled up in the ratio of the circumference of the barrel to the pitch of the helix. As there are two frictional surfaces, the whole friction is double this axial thrust multiplied by the coefficient of friction, and this friction must act at such a mean radius from the shaft as to have a moment greater than that of the load. If this is so for one load, it is so also for all others, as the friction is proportional to the load. To get sufficient friction for heavy loads with a diminished axial thrust, the very ingenious design shown in fig. 5 is adopted. Here the shaft *a* is driven by power, and is keyed to the boss *d* with a helix cut on one end. This helix abuts against a similar helix on the pinion *e*, which drives the hoisting barrel on a second shaft. The ratchet wheel *b* abuts against the collar *f* on the shaft *a*; *b* runs loose on the shaft and is cast on the end of a hollow drum containing three disks of hard wood, P, P, P. These disks can slide axially along the interior of the drum, but are prevented from turning except along with the drum. Intervening between these wood disks are two iron disks, O, O, which may slide axially along the boss of the pinion *e*, but are prevented from rotating except along with this pinion. The axial pressure is transmitted from *d* to *f*, through the surfaces of the disks P and O, and, there being six pairs of surfaces between which this pressure is exerted, a very slight axial thrust produces sufficient friction at these surfaces to couple the ratchet wheel *b* to the pinion *e*. So long as this is exerted all the parts are jammed together, and the pawl engaging in *b* prevents the load lowering. When, however, the shaft *a* is rotated backwards, the helices disengage and the friction no longer binds *e* with *b*, so that *e* along with *d* and *a* can be rotated backwards and the load thus lowered. The weight of the load keeps *e* following *d* closely in its backward motion, and as soon as the operator or machine ceases to turn the shaft backwards the whole apparatus becomes once more frictionally bound together, and the ratchet wheel prevents further lowering. Fig. 6 shows another arrangement whereby the pinion *e* is uncoupled and allowed to lower the load by only a slight backward motion of the shaft *a*, it being unnecessary to rotate the shaft backward continuously. This last is obviously the most handy arrangement, and when worked carefully is as absolutely safe as the other. This device in a modified form is used in Tangye's lifts.

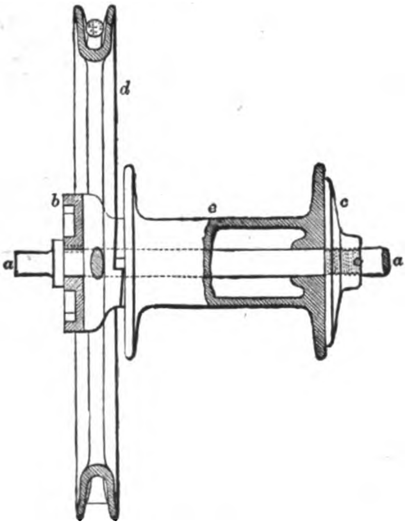

Fig. 4.

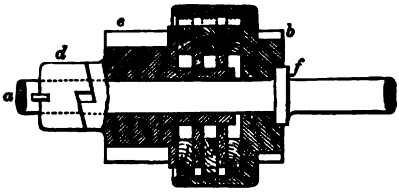

Fig. 5.

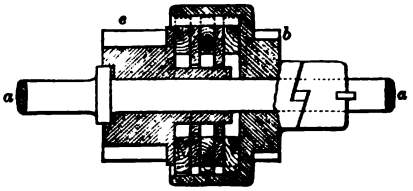

Fig. 6.

Thomas & Sons, of Cardiff, have a similar patent safety shaft coupling, which, although it has a very different form, is constructed on exactly the same principle as that of fig. 4.

Steam has been used as a motive power in long cylinders similar to those in hydraulic lifts. It has the great advantage of having very little weight, so that the difference of head occasioned by the rise of the piston is practically nil. The disadvantage is that the steam rapidly condenses, and thus the load could not be held up at any desired height for a length of time, without a continual fresh supply of steam to the cylinders. It is not likely to come into general use for passenger lifts, but may be used advantageously for goods lifts and heavy cranes. (R. H. S.*)

LIGHT.

ND may be defined as any effect on the sense of earing, and in the same way Light may be de- s any effect on the sense of sight. This is the purely subjective use of the terms. But both terms are quite as frequently used in the objective as in the subjective sense. Thus, as Sound may be defined in terms of the motion of the air in the cavity of the exter- r, mechanically affecting the tympanum, so Light e defined by the mechanical effect produced upon tension of the optic nerve which forms the sensi- urface of the retina.

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reating of Light it will be convenient to use the n a sort of mixed sense, at least until we come to s the different theories which have been devised oount for the propagation of the agent which s vision. Then we shall have to use the term en- in the objective sense. On the other hand, in ological Optics we are concerned chiefly with the tive sense of the term.

e present article is intended to give a general h of the subject of Optics, so far as it can be d by the help of elementary mathematics, but sufficient detail to show the connection of its va- branches, and to enable the reader who desires er information on any point to judge for himself r what heading he will find it in this work. The ct is arranged in the following order:—

rly History of Optics.
eliminary Statements with regard to Vision, Distinct n, the Color-Sense, and the Duration of Visual Im- ions.
urces of Light.
neral Reflections on the Mechanism of Propagation of t. Division of the Subject into Geometrical and sical Optics.

GEOMETRICAL OPTICS.

ctilinear Propagation of Light in Homogeneous Media, lows, Camera Obscura, etc.
tensity of Illumination as depending on the Distance he Source and the Obliquity of the Rays. Brightness Intrinsic Brightness.
hotometry.
elocity of Light.
ehavior of Light at the Common Surface of Two Homo- eous Media.
eflection. Plane, Spherical, and Cylindrical Mirrors. l and Virtual Images.
ingle Refraction. Composite Nature of White Light. ractive Index. Dispersion. Prisms; Fraunhofer's Lines. tionality of Dispersion. Achromatism. Lenses. Tele- e, Microscope. Pure Spectrum. Refraction by Cylin- . Rainbow.
efraction in a Non-homogeneous Medium. Hamilton's racteristic Function. Mirage.
bsorption, Abnormal Dispersion, Fluorescence, Phos- orescence.

PHYSICAL OPTICS. UNDULATORY THEORY.

Nature and Propagation of Waves. Huygens's Principle. planation of Reflection and Single Refraction. Disproof the Corpuscular Theory.
Sketch of the History of the Undulatory Theory. Young's scovery of Interference.
Interference Bands. Spectrum formed by Grating. asure of Wave-Length. Loss of Semiundulation. New- n's Rings. Colors of Thin Plates and of Grooved Sur- es.
Relation between Wave-Length and Refractive Index.
Double Refraction. Wave-Surface in Iceland Spar.
Polarization. Transverse Vibrations. Nature of Un- larized Light.
Plane, Circularly, and Elliptically Polarized Light. icol's Prism. Depolarization by Doubly-Refracting Plate. resnel's Rhomb.
Döppler's Principle. Measurement of the Relative Ve- city of Luminous Source and Spectator.

Under OPTICS (GEOMETRICAL, PHYSICAL and PHYSIOLOGICAL) further developments will be given; and the connection between light and radiant heat will be discussed under RADIATION.

The ancients' knowledge of optics.

EARLY HISTORY OF THE SUBJECT.—It is to sight that we are mainly indebted for our knowledge of external things. All our other senses together, except under very special conditions, do not furnish us with a tithe of the information we gain by a single glance. And sight is also that one of our senses which we are able most effectively and extensively to aid by the help of proper apparatus—not merely (as by spectacles, invented *circa* 1300) for the cure of natural defects, but (as by the telescope and microscope) for the examination of bodies either too distant or too minute to be studied by the unassisted eye.

Light moves in straight lines.

It is very remarkable, under these circumstances, to find how slowly men have reached some even of the simplest facts of optics. We can easily understand how constant experience must have forced on them the conviction that light usually moves in straight lines—*i. e.*, that we see an object in the direction in which it really lies. But how they could have believed for ages that objects are rendered visible by something projected from the eye itself—so that the organ of sight was supposed to be analogous to the tentacula of insects, and sight itself a mere species of touch—is most puzzling. They seem not till about 350 B. C, to have even raised the question—If this is how we see, why cannot we see in the dark? or, more simply,—What is darkness? The former of these questions seems to have been first put by Aristotle.

Reflection.

The nature and laws of reflection were, of course, forced on the ancients by the images seen in still water; and the geometers of the Platonic school were well acquainted with these laws. To Hero of Alexandria we owe the important deduction from them that the course of a reflected ray is the shortest possible.

Refraction.

The general nature of refraction also was known, with some of its special applications, such as, for instance, to burning-glasses and to magnifiers. These were probably either spherical glass shells filled with water (Pliny, *H. N.*, xxxvi. 67 [25]; Lact., *De Ira Dei*, c. 10) or balls of rock crystal (Pliny, xxxvii. 10).

In the first century of our era Cleomedes pointed out how a coin at the bottom of an empty cup, where the eye cannot see it, can be made visible by filling the cup with water; and he showed that, in a similar way, the air may render the sun visible to us while it is still under the horizon. Shortly after this date Ptolemy (the celebrated astronomer) published his great work on *Optics*. He treats of vision, reflection, the theory of plane and concave mirrors and refraction. He measured, with considerable accuracy, the angles of incidence and refraction, for rays passing from air into water and into glass, and from water into glass; it was not, however, till more than fifteen hundred years had passed that the true relation between these angles was discovered. In addition to what has just been mentioned, the ancients' knowledge of optics was limited to a very superficial acquaintance with some of the properties of rainbows, halos, mirage, etc. But it was fragmentary in the extreme—though it far surpassed in amount as well as in accuracy their knowledge of the other branches of physical science.

Color.

It is not easy to understand the ideas of the ancients about color. That it is a property of a body—just as its density, its hardness, or its smell is a property—was probably held by them. But they also imagined that a body could communicate its color to light; thus, for instance, the clouds were, by some of them, supposed to communicate their colors to the sunbeams which form a rainbow.

Our next glimpse of real progress dates from the 11th or 12th century, when ALHAZEN (*q. v.*)[1] wrote a treatise on optics in Arabic, which for five hundred years or more was a recognized authority on the subject. It was, in many parts, founded on the work of Ptolemy, but with considerable additions and improvements. Alhazen gives an anatomical description of the eye, and points out, fairly enough, how with two eyes we see only one image. But he also points out that we see each object, however small, by a *pencil* of diverging rays,—not (as the ancients imagined) by a single ray. Alhazen accounts for twilight, and shows how by it to measure the height of the atmosphere. He also gives the now generally received explanation of the curious fact that the sun and moon appear larger when rising or setting than when they are high in the heavens.

The farther progress of the subject we need not now trace. From the end of the 16th century that progress has been extremely rapid. The dates of the more important steps, and the names of their authors, will be given when we treat of these, in their turn, in the course of the article; and we will give them the additional interest of being presented, when this can readily be done, in the author's own words.

Vision. PRELIMINARY STATEMENTS.—Before we commence a more rigorous treatment of the subject, it may be well to make a few preliminary statements as to the nature of *vision* and the conditions for *distinct vision*. Properly speaking, these belong to OPTICS (PHYSIOLOGICAL) (*q. v.*), but it is impossible to treat intelligibly any part of our subject without presupposing some, generally very slight, knowledge of other parts. And the few preliminary statements we have now to make are in no respect theoretical, while they are so simple that any one may at once test their truth for himself.

Distance of most distinct vision. Except in the case of a very abnormal eye (extremely short-sighted or long-sighted as the case may be) there is a distance from it—usually somewhere about 10 inches—at which if an object be placed it is seen more distinctly than if placed at any other distance. Almost every one, perhaps without knowing it, habitually places at or about that distance from his eye an object which he wishes to examine carefully. When he places it at a smaller distance he becomes conscious of the *effort* required to see it distinctly. He has, in fact, to alter the form of the optical machinery of the eye, by a muscular effort, so that it may become capable of bringing to a focus on the retina rays more divergent than those for which the parts were in their unstrained state adapted. A corresponding effort, but usually much more slight, is commonly felt to be required if the object be at a distance greater than 10 inches.

Limits of distinct vision. Hence we arrive at the conclusion that, for the minimum of strain on the eye, rays should fall on it diverging as if they came from a point about 10 inches distant. But for all ordinary eyes any divergence from double of this (*i. e.*, divergence as if from a distance of 5 inches) to zero (*i. e.*, parallel rays) is consistent with the possibility of distinct vision. Rays either more divergent than the former limit, or convergent, are unfit to produce distinct vision. Hence every optical instrument, whatever be the reflections or refractions to which light has been subjected in passing through it, must finally allow the light to escape either in parallel rays or with a divergence within the above specified limits, if it is to be employed by an ordinary eye. The comparatively slight differences which exist among ordinary eyes are easily compensated by the rack-work, or screw adjustment, which is invariably attached to the eye-piece of a good telescope and to the body of a good microscope. Every motion of this rack-work alters the divergence of the rays as they finally escape from the instrument. Any eye, however abnormal, if it be capable of producing distinct vision at all, has only to be furnished with suitable spectacles in order that it may behave exactly as does a normal eye. This statement, however, refers only to sharpness of definition, not in any degree to *color*. The deficiency which causes *color-blindness* cannot be supplied by any conceivable process. A definite part of the ordinary organ of vision is wanting (or inactive) in such cases—while the merely optical parts of the eye are usually in perfect order.

Inverted image on the retina. Another fact which must be stated here is that, to produce vision of a body in its natural position, the image on the retina, as seen from the back, must be inverted—not merely as regards up and down, but also as regards right and left. Thus, in the ordinary astronomical telescope, the image on the retina is not inverted, and we therefore see an inverted image.

Judgment of distance. A third is that our judgment of the relative distances of objects is formed mainly by the use of the two eyes simultaneously. One eye, kept still, can inform us only of relative distance in virtue of the greater or less effort to see distinctly (already spoken of). With both eyes, or with one eye moved from side to side, *parallax* comes in, and gives us the *stereoscopic* effect, as it is called. This power of judging distance is, of course, greater as the eyes are set more widely apart. There is, practically, no limit to the effective distance between the eyes when the proper instrumental methods (as with the telestereoscope) are employed.

Color. It is also necessary to premise a few words about color. The various homogeneous rays of the solar spectrum have each a color of its own which no refraction can modify. But what about the many colors which do not occur in the spectrum? To such a question as "What is *yellow*"? the answer is, "*Each particular kind of yellow may be any one of an infinite number of different combinations of homogeneous rays.*" And the same is true, in general, of all other colors. Clerk Maxwell found that a yellow equivalent to that of the spectrum can be obtained by mixing in proper proportions certain homogeneous red and green rays. This single example is sufficient to show that the color-sense is of a very singular nature. This question will be fully treated in OPTICS (PHYSIOLOGICAL); but for our present purpose it is only necessary to say that we now know (after Wünsch and Young) that the normal eye has only *three color-sensations*—a red, a green, and a violet,—and that the apparent color of any light which falls on it depends merely on the *relative intensities of the excitement* produced by the light on the three organs of sense corresponding to these sensations. This is true, however, only within certain limits of intensity; for extremely bright light, whatever be its real color, seems to excite all the three sensations simultaneously, much as white light does; and with very feeble light (as, for instance, that of an ordinary aurora or of a lunar rainbow) we are sometimes scarcely conscious of colors.

Color-blindness. In *color-blindness* one or more of these organs of sense is wanting, or imperfect. The most common form, Daltonism, depends on the absence of the red sense. Great additions to our knowledge of this subject, if only in confirmation of results already deduced from theory, have been obtained in the last few years by Helmgren;[1] who has experimented on two persons, each of whom was found to have one color-blind eye, the other being nearly normal. In this way was obtained, what could otherwise have been matter of conjecture only, a description of color-blind vision in terms of (at least approximately) normal vision.

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[1] The proper name of this geometer is El-Ḥasan (or by other accounts Mohammed) ibn el-Ḥasan ibn el-Haitham, and it is as Ibn el-Haitham that he is commonly referred to. See Woepcke, *L'Algèbre d'Omar Alkhayâmî* (Paris, 1851), p. 73 *sq.*, and Bar Hebræus, *Chron.*, p. 221 *sq.* Several of his mathematical treatises exist in English libraries (see the Catalogues of the Br. Mus., Bodl., and India Office MSS.); but the only copy of his great optical work—the *Kitâb el Manâẓir*—known to be in Europe is No. 1011 of the Leyden collection, with the commentary *Tanḳîḥ el Manâẓir*—of Kemâl ed-Dîn Abu'l Ḥasan (*Cat. Cod. Or. Lugd. Bat.*, iii. 61). A smaller work (Woepcke, *ut supra*) was based on the optical treatises ascribed to Euclid and Ptolemy, and Ibn el-Haitham claims to have restored the lost first book of the latter. The Arabs had Euclid's *Optics* (*Kitâb el Manâẓir*) in the version of Nâṣir ed-Dîn Tusy (*H. Khal.*, No. 10,582; Loth, *MSS. of India Office*, No. 743).

Duration of visual impressions.

Finally, the sensation of sight is not limited to the duration of the mechanical action on the eye. It is known that we do not see a sudden flash (an electric spark for instance) until a measurable, though very short, period has elapsed. This depends on the rate at which an excitation is propagated along the optic nerve. But the familiar experiment of whirling a red-hot stick in a dark room shows that the sensation of sight lasts for a short period after the mechanical action which produced it has ceased. This period is probably different for different eyes, and for different amounts of excitement even in the same eye. (If the light be very intense the effect lasts much longer, but completely changes its character.) For our present purpose it may be assumed that the duration is somewhere about $\frac{1}{8}$th of a second. Thus, if the end of the red-hot stick describes a circle once in $\frac{1}{8}$th of a second, we see the complete circle; if in a longer period, we only see at once such a part of it as was described in $\frac{1}{8}$th of a second. Connected with this is the remarkable result obtained experimentally by Swan,[2] that the amount of sensation is, for flashes of short duration, directly proportional, not only to the brightness of the flash, but also to its duration. A flash which lasts for $\frac{1}{10}$th of a second produces the full effect on the eye; but an electric spark, as a flash of lightning, which certainly does not endure for more than $\frac{1}{1000000}$th of a second, produces at most only $\frac{1}{100000}$th of the effect it would produce if it lasted $\frac{1}{10}$th of a second. On this short duration of visual impressions depends the action of the *thaumatrope*, the *wheel of life*, etc. By various kinds of machinery a succession of views of an object in different positions or forms is presented to the eye, each for a brief interval. The result is that we fancy we see one and the same object going through a species of *continuous* motion, or of change of form, which would present it to the eye in these successive positions or forms. Thus, a tadpole may be represented as wriggling about, or as developing continuously into a frog, etc.

Intensity as depending on duration of exciting cause.

SOURCES OF LIGHT.—This subject will be fully treated in other parts of this work under various heads: from the purely scientific point of view under RADIATION; from the more practical side under LIGHTING (ELECTRIC), etc. For our present purpose a very brief summary of the question will suffice; and we do not require to investigate the *process* by which, in any case, the light is produced.

Incandescence.

1. The main source of light is *incandescence*. (It is usually understood that to be incandescent a body must be at a high temperature.) This may be due to any of a number of causes, such as the following:—

(*a*) *The Potential Energy of Gravitation of Scattered Fragments of Matter.*—When these fall together, as in the formation of the sun and stars, heat enough is generated by impact to render the whole vividly incandescent. It is probable that the light of nebulæ, and the *proper* light of comets, is due to this cause. The proximate cause, in all these cases, is the kinetic energy of the fragments before impact. To this class, therefore, can be reduced the light given out when a target is struck by a cannon shot.

(*b*) *The Kinetic Energy of Current Electricity or of an Electric Discharge.*—Here we have lightning, the electric light, and probably also the light of the aurora.

(*c*) *The Potential Energy of Chemical Affinity.*—The lime-light, gas-light, candle and lamp-light, fire-light, the magnesium light, etc.; also phosphorus, dead fish (?), etc., glowing in the dark.

(*d*) *Friction*, as in the trains of sparks from a grindstone or brake; though here, in general, chemical affinity also has a share.

(*e*) *Sudden great Compression of a Gas*, as of air by meteoric stones and falling stars.

Fluorescence.

2. Another very curious source, not (so far as is known) reducible to incandescence, is *the giving out* (*usually in an altered form*) *of light previously absorbed*:—fluorescence, phosphorescence, etc.

3. A third source is *physiological*:—fire-flies, glow-worms, *Medusæ*, dead fish (?), etc., the eye of a cat.

Any not black and not transparent body, exposed to any of these sources of light, becomes in its turn what may for our purpose also be treated as a source.

As will be shown in RADIATION, the only bodies which, when incandescent, give *every* constituent of white light are bodies which are black in the sense of absorbing each and every ray which falls upon them. Such bodies are not *necessarily* solids—though the best examples we have of them are lamp-black, and (somewhat less perfect) charcoal and gas-coke.

Newton on sources of light.

Newton's speculations on these subjects, taken from the "Queries" at the end of his *Optics*, give an exceedingly interesting sketch of the state of this subject in his time. We quote a few of the more curious. There is a strange admixture of errors, but a still more strange anticipation of some of the most important of modern discoveries.

"Query 6. Do not black bodies conceive heat more easily from light than those of other colors do, by reason that the light falling on them is not reflected outwards; but enters the bodies, and is often reflected and refracted within them, until it be stifled and lost?

"Query 8. Do not all fixed bodies, when heated beyond a certain degree, emit light and shine; and is not this emission performed by the vibrating motions of their Parts? And do not all bodies, which abound with Terrestrial parts, and especially with Sulphureous ones, emit light, as often as those Parts are sufficiently agitated, whether that agitation be made by heat, or by friction, or percussion, or putrefaction, or by any vital motion, or any other cause? . . .

"Query 9. Is not Fire a body heated so hot as to emit light copiously? For what else is a red hot iron than fire? And what else is a burning coal than red hot wood?

"Query 10. Is not Flame a vapor, fume, or exhalation heated red hot, that is, so hot as to shine? For bodies do not flame without emitting a copious fume, and this fume burns in the flame. The *Ignis Fatuus* is a vapor shining without heat; and is there not the same difference between this vapor and flame, as between rotted wood shining without heat and burning coals of fire? In distilling hot spirits, if the head of the still be taken off, the vapor, which ascends out of the still, will take fire at the flame of a candle, and turn into flame, and the flame will run along the vapor from the candle to the still. Some bodies heated by motion or fermentation, if the heat grow intense, fume copiously; and if the heat be great enough, the fumes will shine, and become flame. Metals in fusion do not flame for want of a copious fume, except spelter, which fumes copiously, and thereby flames. All flaming bodies, as oil, tallow, wax, wood, fossil coals, pitch, sulphur, by flaming waste and vanish into burning smoke; which smoke, if the flame be put out, is very thick and visible, and sometimes smells strongly, but in the flame loses its smell by burning; and, according to the nature of the smoke, the flame is of several colors; as that of sulphur, blue; that of copper opened with sublimate, green; that of tallow, yellow; that of camphire, white. Smoke passing through flame cannot but grow red hot; and red hot smoke can have no other appearance than that of flame. . . .

"Query 11. Do not Great bodies conserve their heat the longest, their parts heating one another; and may not Great dense and Fixed bodies, when heated beyond a certain degree, emit light so copiously, as by the emission and re-action of its light, and the reflections and refractions of its rays within its pores, to grow still hotter, till it comes to a certain period of heat, such as is that of the sun? And are not the sun and fixed stars great earths vehemently hot; whose heat is conserved by the greatness of the bodies, and the mutual action and re-action between them, and the light which they emit; and whose parts are kept from flaming away, not only by their Fixity, but also by the vast weight and density of the atmospheres incumbent upon them, and very strongly compressing them, and condensing the vapors and exhalations which arise from them? . . . . And the same great weight may condense those vapors and exhalations, as soon as they shall at any time begin to ascend from the sun, and make them presently fall back again into him; and by that action increase his heat, much after the manner that in our earth the air increases the heat of a culinary fire. And the same weight may hinder the globe of the sun from being diminished, unless by the emission of light, and a very small quantity of vapors and exhalations."

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[1] *Proc. Roy. Soc.*, Jan., 1881.

[2] *Trans. Roy. Soc. Edin.*, 1849, 1861.

Mechanism of propagation of light.

THEORIES OF PROPAGATION OF LIGHT.—We may begin by assuming that the sensation of light is due to a mechanical action on the retina (see EYE). Now such a mechanical action must have a mechanical cause, and, as far as we can judge with our present knowledge, the latter must consist of impacts on the retina, due to moving matter. This matter may have travelled all the way from the source of light, or it may have been set in motion in the eye by a disturbance (analogous to a wave) which has travelled from the source. What is transferred, or what moves, is a quite independent question. Light must, as far as we can conceive, consist in the motion of particles of some kind from external objects to the eye, or in the propagation of some disturbance or wave-motion in an as yet unknown medium. Though it has been proved, as we will presently show, that some of the consequences of the first supposition are entirely inconsistent with observed facts, the nature of the propagation of the supposed luminous particles is still a very interesting study, and indeed many of the fundamental propositions in optics follow more easily from this hypothesis than from the other. We will therefore *not* at present dismiss this hypothesis, but will refer freely to it now and then, until its truth is shown to be inconsistent with experiment.

Corpuscular theory.

This view, associated with the names of Newton, Laplace, and Biot, is known as the *corpuscular theory* of light. A formidable objection to it, *in limine*, will be easily seen to be furnished by the velocity of light. Since every point of every visible body must (on this theory) send such corpuscles to the eye, moving as we shall find at a rate of nearly 200,000 miles per second, their masses must be inconceivably minute in order that their united momentum may not amount to something comparable with that of a cannon shot, a supposition of course utterly destructive of all belief in the hypothesis. But, as we shall see, there are still higher grounds of objection, and such as no mere smallness of mass or size of each corpuscle can explain away.

Undulatory theory.

The rival theory labors under considerable disadvantages, inasmuch as the theory of wave-propagation is very much more obscure and difficult than that of the motion of free particles; but the student, who has mastered the fundamental difficulties of sound (see ACOUSTICS), which presents a fair although not an exact analogy, will find it comparatively easy to obtain a clear conception of the fundamental principles of the explanation offered by the *undulatory theory* of light.

The difference between these two theories of light may be illustrated by contrasting wind moving at the rate of 1100 feet per second (an inconceivably violent hurricane) and sound, gentle or violent, moving at precisely the same rate—yet how different in its effects!

Geometrical and physical optics.

DIVISION OF THE SUBJECT.—Optics, or the science of Light, is usually divided into two parts. A simple illustration of the nature of this division will be found in the different conditions of fluid equilibrium according as we do not or do introduce the idea of action between the fluid and the containing vessel (CAPILLARY ACTION, *q. v.*). In the first or hypothetical case it is known that the free surface must be horizontal, and that all its separate parts must lie in the same plane; in the second, *i. e.*, the actual, case we find molecular action modifying these results, sometimes indeed to a very large extent, so that no part of the free surface is plane, and no two portions of it are at the same level. So in what is called GEOMETRICAL OPTICS it is assumed from experiment that light moves in straight lines in air, while PHYSICAL OPTICS, or the undulatory theory, agrees with experiment in showing that under certain circumstances a ray of light bends round an obstacle. But as, in obtaining the main facts of fluid equilibrium, capillary forces may be neglected, so, for the explanation of the ordinary phenomena of light, even with accuracy sufficient for the construction of the very finest telescopes and microscopes, it suffices that Geometrical Optics, based on laws *nearly* verified by experiment, be followed out to its consequences. The residual phenomena then came in to be treated by the undulatory theory. Pouillet divides the subject, in consequence of this distinction, into two parts, viz., (1) that in which we deal with the direction only of the rays, and (2) that in which we deal with the physical properties of the rays themselves.

Proposed order of treatment.

In this order we will consider the subject, giving the explanations of the approximate experimental laws of Geometrical Optics, as we reach them, in the language of either theory. But before we come to the residual phenomena we shall have found that the corpuscular theory must be rejected, and we will therefore give, without detail, the principles of the undulatory explanation, which will be fully discussed in a special article.

GEOMETRICAL OPTICS.

Rectilinear Propagation of Light.

It is approximately true that, in any homogeneous medium, *light moves in straight lines.*

If an opaque body be placed anywhere in the straight line between the eye and an object, the object is concealed. Through a long straight tube no objects can be seen but those situated in the direction of its axis produced. This is so fundamental a fact, or it is so evident a result of experience, that it is the foundation of every process which involves the direction in space of one object as regards another,—whether it be for the aiming with a rifle, the pointing of a telescope, or for the delicate observations of a geodetic survey. But we must carefully observe the restrictions under which the statement is made. Not merely is it said to be only approximately true, but it is so only in a homogeneous medium. To both of these restrictions we will revert later.

Shadows.

(*a*) On this is founded the geometrical theory of *shadows*,—a subject of some importance, especially as regards eclipses. In this application the results may be considered as absolutely true, though, as we shall see in a subsequent page, the statement is liable in certain delicate cases to somewhat startling exceptions. When an opaque body is placed between a screen and a luminous *point*, it casts a shadow on the screen. (The sun's image formed by a lens or burning glass of short focus is our best mode of attempting to realize the conception of a luminous point; but a fair approximation may be made by piercing a very small needle-hole in a large plate of thin metal, and placing it close to any bright flame or incandescent body.) The outline of the shadow is, of course, to be found by drawing straight lines from the luminous point so as to touch the opaque body all round. These lines form a cone. The points of contact form a line on the opaque body separating the illuminated from the non-illuminated portion of its surface. Similarly, when these lines are produced to meet the screen, their points of intersection with it form a line which separates the illuminated from the non-illumninated parts of the screen.

Geometrical shadow.

This line is called the boundary of the *geometrical shadow*. A common but beautiful instance of it is seen when a very small gas-jet is burning in a ground-glass shade, near the wall of a room. In this case the cone, above mentioned, is usually a right cone with its axis vertical. Thus the boundary of the geometric shadow is a portion of a circle on the roof, but a portion of an hyperbola on the vertical wall. If the roof be not horizontal, we may obtain in this way any form of conic section. Interesting and useful hints in *projection* may be obtained by observing the shadows of bodies of various forms cast in this way by rays which virtually diverge from one point: *e. g.*, how to place a plane quadrilateral of given form so that its geometric shadow may be a square; how to place an elliptic disk, with a small hole in it, so that the shadow may be circular with a bright spot at its centre, etc.

Penumbra. When there are more luminous points than one, we have only to draw separately the geometrical shadows due to each of the sources, and then superpose them. A new consideration now comes in. There will be, in general, portions of all the separate geometrical shadows which overlap one another in some particular regions of the screen. In such regions we still have full shadow; but around them there will be other regions, some illuminated by one of the sources alone, some by two, etc., until finally we come to the parts of the screen which are illuminated directly by all the sources. There will evidently be still a definite boundary of the parts wholly unilluminated, *i. e.*, the true shadow or *umbra*, and also a definite boundary of the parts wholly illuminated. The region between these boundaries—*i. e.*, the partially illumined portion—is called the *penumbra*.

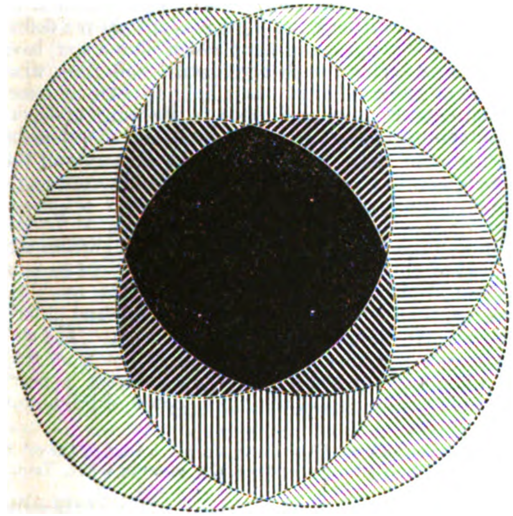

Fig. 1.

Fig. 1 shows these things very well. It represents the shadow of a circular disk cast by four equal luminous points arranged as the corners of a square.—the disk being large enough to admit of a free overlapping of the separate shadows. The amount of want of illumination in each portion of the penumbra is roughly indicated by the shading. The separate shadows are circular, if the disk is parallel to the screen. If we suppose the number of sources to increase indefinitely, so as finally to give the appearance of a luminous *surface* as the source of light, it is obvious that the degrees of darkness at different portions of the penumbra will also increase indefinitely; *i. e.*, there will be a gradual increase of brightness in the penumbra from total darkness at the edge next the geometrical shadow to full illumination at the outer edge. It is most instructive to contrast with the above figure that now given (fig. 2), in which the size of the disk is considerably diminished—everything else being unchanged. Here there is no true shadow—only four *equally bright* portions of the penumbra, each illuminated by three of the sources.

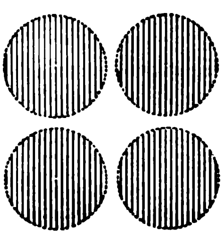

Fig. 2.

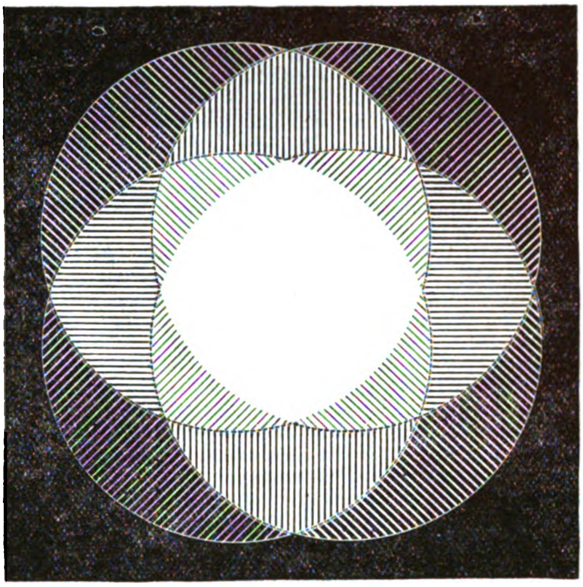

Fig. 3.

Sharpness of shadows. Thus we see at once why the shadows cast by the sun or moon are in general so much less sharp than those cast by the electric light (when it is not surrounded by a semi-opaque screen). For, practically, at moderate distances from the electric arc, it appears as a mere luminous point. But, if we place a body at a distance of a foot or two only from the arc, the shadow cast will have as much of penumbra as if the sun had been the source. The breadth of the penumbra when the source and screen are nearly equidistant from the opaque body is equal to the diameter of the luminous source. Simple as is the question from the point of view we have adopted, it may to some persons appear simpler to imagine themselves placed (as spectators) on the screen in different parts of the shadow or penumbra, and to consider what portions of the luminous source they would then be in a position to see.

Eclipses. This is what happens to us when we observe an eclipse of the sun. When the eclipse is total, there is a real geometrical shadow,—very small compared with the penumbra (for the *apparent* diameters of the sun and moon are nearly equal, but their distances are as 370: 1); when the eclipse is annular, the shadow is all penumbra. In a lunar eclipse, on the other hand, the earth is the shadow-casting body, and the moon is the screen, and we observe things according to our first point of view.

Light passing through an aperture. Suppose, next, that the body which casts the shadow is a large one, such as a wall, with a hole in it. If we were to plug the hole, the whole screen would be in geometrical shadow. Hence the illumination of the screen by the light passing through the hole is precisely what would be cut off by a disk which fits the hole. Fig. 3, which is the complement of Fig. 1, gives therefore the effect of four equal sources of light shining on a wall through a circular hole. And it is evident that, with the change of a word here and there, the previous reasoning may be applied to this case also. The umbra in the former case becomes the fully illuminated portion, and *vice versa*. The penumbra remains the penumbra, but it is now darkest where before it was brightest, and *vice versa*. For further information we subjoin the complement (Fig. 4) of the second case above, — the same four sources, but the smaller hole. Here we have four *equally* bright, separate images —one belonging to each of the sources. Thus we see how, when a *small* hole is cut in the window-shutter of a dark room, a picture of the sun, and bright clouds about it, is formed on the opposite wall. This picture is obviously inverted, and also perverted, for not only are objects depicted lower the higher they are, but also objects seen to the right are depicted to the left, etc. But it will be seen unperverted (though still inverted) if it be received on a sheet of ground glass and looked at from behind. The smaller the hole (so far at least as Geometrical Optics is concerned) the less confused will the picture be. As the hole is made larger the illuminated portions from different sources gradually overlap; and when the hole becomes a *window* we have no indications of such a picture except from a body (like the sun) much brighter than the other external objects. Here the picture has ceased to be one of the sun, it is now a picture of the window. But if the wall could be placed 100 miles off, the picture would be one of the sun. To prevent this overlapping of images, and yet to admit a good deal of light, is one main object of the lens which usually forms part of the camera obscura.

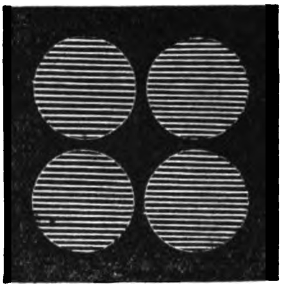

Fig. 4.

Images by small hole.

The formation of pictures of the sun in this way is well seen on a calm sunny day under trees, where the sunlight penetrating through small chinks forms elliptic spots on the ground. During a partial eclipse these pictures have, of course, a crescent form. When detached clouds are drifting rapidly across the sun, we often see the shadows of the bars of the window on the walls or floor suddenly shifted by an inch or two, and for a moment very much more sharply defined. They are, in fact, shadows cast by a *small* portion of the sun's limb, from opposite sides alternately. Another beautiful illustration is easily obtained by cutting with a sharp knife a *very small* T aperture in a piece of note paper. Place this close to the eye, and an inch or so behind it place another piece of paper with a fine needle-hole in it. The light of the sky passing through the needle-hole forms a bright picture of the T on the retina. The eye perceives this picture, which gives the impression of the T much magnified, but *turned upside down*.

Shadow image.

Phantom palisades.

Another curious phenomenon may fitly be referred to in this connection, viz., the *phantoms* which are seen when we look at two parallel sets of palisades or railings, one behind the other, or look through two parallel sides of a meat-safe formed of perforated zinc. The appearance presented is that of a magnified set of bars or apertures which appear to move rapidly as we slowly walk past. Their origin is the fact that where the bars appear nearly to coincide the apparent gaps bear the greatest ratio to the dark spaces; *i. e.*, these parts of the field are the most highly illuminated. The exact determination of the appearances in any given case is a mere problem of convergents to a continued fraction. But the fact that the apparent rapidity of motion of this phantom may exceed in any ratio that of the spectator is of importance,—enabling us to see how velocities, apparently of impossible magnitude, may be accounted for by the mere running along of *the condition of visibility* among a group of objects no one of which is moving at an extravagant rate.

(*b*) Another important consequence of this law is that *if the medium be transparent the intensity of illumination which a luminous point can produce on a white surface directly exposed to it is inversely as the square of the distance.*

Illumination.

The word transparent implies that no light is absorbed or stopped. Whatever, therefore, leaves the source of light must in succession pass through each of a series of spherical surfaces described round the source as centre. The same *amount* of light falls perpendicularly on all these surfaces in succession. The amount received in a given time by a unit of surface on each is therefore inversely as the number of such units in each. But the surfaces of spheres are as the squares of their radii,—whence the proposition. (We assume here that the velocity of light is constant in the medium, and that the source gives out its light uniformly and not by fits and starts.) When the rays fall otherwise than perpendicularly on the surface, the illumination produced is proportional to the cosine of the obliquity; for the area seen under a given spherical angle increases as the secant of the obliquity, the distance remaining the same.

Brightness at different distances.

As a corollary to this we have the further proposition that *the apparent brightness of a luminous surface (seen through a transparent homogeneous medium) is the same at all distances.*

The word brightness is here taken as a measure of the amount of light falling on the pupil per unit of spherical angle subtended by the luminous surface. The spherical angle subtended by any small surface whose plane is at right angles to the line of sight is inversely as the square of the distance. So also is the light received from it. Hence the brightness is the same at all distances.

The word brightness is often used (even scientifically) in another sense from that just defined. Thus we speak of a bright star, of the question—When is Venus at its brightest? etc. Strictly, such expressions are not defensible except for sources of light which (like a star) have no apparent surface, so that we cannot tell from what amount of spherical angle their light appears to come. In that case the spherical angle is, for want of knowledge, assumed to be the same for all, and therefore the brightness of each is now estimated in terms of the *whole* quantity of light we receive from it. It is in this sense only that we use the word when we speak of Venus at its brightest; for if we take the former definition of brightness the solution of this once celebrated problem would be very different from that usually given. As the question, however, is an interesting one both in itself and historically, we give an approximate solution of it. The approximation assumes what is certainly not true, that the illuminated portion of Venus always appears *uniformly* bright, and of the same degree of brightness in all aspects.

Maximum brightness of Venus.

Let a be the radius of the earth's orbit, b that of the orbit of Venus, δ the distance between the planets when Venus is brightest.

Then if θ be the apparent angular distance of the earth from the sun as seen from Venus, the illuminated part of the disk of Venus as seen from the earth is

$$\frac{1+\cos\theta}{2}$$

of the whole disk. Hence

$$\frac{1+\cos\theta}{2\delta^2}$$

is a maximum,—with the obvious trigonometrical relation

$$a^2 = \delta^2 + b^2 - 2b\delta\cos\theta.$$

Substituting for $\cos\theta$, and putting the differential coefficient $= 0$, we have a quadratic equation of which the only admissible root is the positive one

$$\delta = \sqrt{3a^2+b^2} - 2b.$$

From this the other quantities can be calculated.

Effect of contraction of pupil.

But another matter has to be taken into consideration when we apply the above definition of brightness in practice. For the aperture of the pupil is usually very much contracted when we look at a brightly illuminated sky or cloud. Thus there is a rough compensation which, to a certain extent, modifies the effect on the retina.

Argument for finite number of stars.

Founded on the above is Cheseaux's celebrated argument about the finite dimensions of the stellar universe. For it is easy to see, as below, that if stars be scattered through infinite space, with average closeness and brightness such as is presented by those nearest us, and if stellar space be absolutely transparent, the whole sky should appear of a brightness like that of the sun. Cheseaux and Olbers endeavored to show that, because the sky is not all over as bright as the sun, there is absorption of light in stellar space. This idea was ingeniously developed by Struve.

Consider a small spherical angle ω. The number of stars included in it whose distances are between r and $r + \delta r$ from the earth is proportional to

$$\omega r^2 \delta r.$$

The whole amount of light received from such a portion of the sky must be therefore as

$$\omega \int_0^\infty dr,$$

provided that no star intercepts the light coming from another. This condition is unattainable, so that the conclusion is that the brightness is as great as it can be with the materials employed. Every portion of the background shines as if it were a star.

Brightness at different obliquities.

(*c*) A third very important fact, connected with our present subject, but not immediately deducible from our principle, is—*The brightness of a self-luminous surface does not depend upon its inclination to the line of sight.*

Thus a red-hot ball of iron, free from scales of oxide, etc., appears flat in the dark; so, also, the sun, seen through mist, appears as a flat disk. This fact, however, depends ultimately upon the second law of thermodynamics, and its explanation will be fully given under RADIATION.

It may be stated, however, in another form, in which its connection with what precedes is more obvious—*The amount of radiation in any direction from a luminous surface is proportional to the cosine of the obliquity.*

General principles of the theory of illumination.

The flow of light (if we may so call it) in straight lines from the luminous point, with constant velocity, leads as we have seen to the expression $\frac{\mu}{r^2}$ (where r is the distance from the luminous point) for the quantity of light which passes through unit of surface perpendicular to the ray in unit of time, μ being a quantity indicating the rate at which light is emitted by the source. This represents the illumination of the surface on which it falls. The flow through unit of surface whose normal is inclined at an angle θ to the ray is of course

$$\frac{\mu}{r^2} \cos \theta,$$

again representing the illumination. These are precisely the expressions for the gravitation force exerted by a particle of mass μ on a unit of matter at distance r, and for its resolved part in a given direction. Hence we may employ an expression

$$V = \Sigma \frac{\mu}{r},$$

which is exactly analogous to the gravitation or electric potential, for the purpose of calculating the effect due to any number of *separate* sources of light.

And the fundamental proposition in potentials, viz., that, if n be the external normal at any point of a closed surface, the integral

$$\iint \frac{dV}{dn} dS,$$

taken over the whole surface, has the value

$$-4\pi\mu_0,$$

where μ_0 is the sum of the values of μ for each source lying *within* the surface, follows almost intuitively from the mere consideration of what it means as regards light. For every source *external* to the closed surface sends in light which goes out again. But the light from an internal source goes wholly out; and the amount per second from each unit source is 4π, the total area of the unit sphere surrounding the source.

It is well to observe, however, that the analogy is not quite complete. To make it so, all the sources must lie on the same side of the surface whose illumination we are dealing with. This is due to the fact that, in order that a surface may be illuminated at all, it must be capable of *scattering* light, *i. e.*, it must be to some extent opaque. Hence the illumination depends mainly upon those sources which are on the same side as that from which it is regarded.[1]

Though this process bears some resemblance to the heat analogy employed by Sir W. Thomson for investigations in statical electricity (*Cambridge Mathematical Journal*, 1842) and to Clerk Maxwell's device of an incompressible fluid without mass (*Cam. Phil. Trans.*, 1856), it is by no means identical with them. Each method deals with a substance, real or imaginary, which flows in conical streams from a source so that the same amount of it passes per second through every section of the cone. But in the present process the velocity is constant and the density variable, while in the others the density is virtually constant and the velocity variable. There is a curious reciprocity in formulæ such as we have just given. For instance, it is easily seen that the light *received from* a uniformly illuminated surface is represented by

$$\iint \frac{dS \cos \theta}{r^2}$$

As we have seen that this integral vanishes for a closed surface which has no source inside, its value is the same for all shells of equal uniform brightness whose edges lie on the same cone.

Theoretical explanations of rectilinear propagation.

We have said that light moves in straight lines in a homogeneous medium. This rectilinear path follows at once from the corpuscular theory, as well as from the undulatory theory of light; in the first case there is no deflecting cause, so each corpuscle moves in a straight line; in the second, the direction of propagation of a plane wave in an uniform isotropic medium is always perpendicular to its front. Looking along a hot poker or the boiler of a steamboat, we see objects beyond *distorted; i. e.*, we no longer see each point in its true direction. Here we have a non-homogeneous medium, the air being irregularly expanded in the neighborhood of the hot body. To this simple cause are due the phenomena of mirage, the fata morgana, the reduplication of images of a distant object seen through an irregularly heated atmosphere, the scintillation or twinkling of stars, and the uselessness of even the best telescopes at certain times, etc. It is interesting to note here that Newton[2] says:—"Long telescopes may cause objects to appear brighter and larger than short ones can do; but they cannot be so formed as to take away that confusion of the rays which arises from the tremors of the atmosphere. The only remedy is a most serene and quiet air, such as may perhaps be found on the tops of the highest mountains, above the grosser clouds."

Non-homogeneous medium.

Photometers.

PHOTOMETRY.—The principle above explained suggests many simple methods of comparing the amounts of light given by different sources. If, for instance, a porcelain plate, or even a sheet of paper, of uniform thickness, have one half illuminated directly by one source of light, the other by a different source, and if one or other of these sources be moved to or from the plate till the halves appear equally illuminated, it is obvious that the amounts of light given out by the two sources are directly as the squares of their distances from the screen. This is the principle of Ritchie's photometer.

Ritchie's. Rumford's.

Rumford suggested the comparison of the intensity of the shadows of the same object thrown side by side on a screen by the two lights to be compared. In this case the shadow due to one source is lit up by the other alone; and here again the amounts of light given out by the sources are as the squares of their distances from the screen when the shadows are equally intense. The shadow-casting object should be near the screen, so as to avoid penumbra as much as possible; yet not too near, so that the shadows may not overlap.

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[1] From the formula of which the proof has been indicated Green's theorem and its consequences follow immediately. But we need not give these here.

[2] *Optics*, end of part i.

Bunsen's photometer. Bunsen has recently suggested the very simple expedient of making a grease-spot on white paper for photometric purposes. When the paper is equally illuminated from both sides, the grease-spot cannot be seen except by very close inspection. In using this photometer, the sources are placed in one line with the grease-spot, which lies between them and can be moved towards one or other. To make the most accurate determinations with this arrangement the adjustment should first be made from the side on which one source lies, then the screen turned round and the adjustment made from the side of the other source,—in both cases, therefore, from the same side of the paper screen. Take the mean of these positions (which are usually very close together), and the amounts of light are as the squares of the distances of the sources from this point. **Wheatstone's.** Wheatstone suggested a hollow glass bead, silvered internally, and made to describe very rapidly a close path, for use as a photometer. When it is placed between two sources, we see two *parallel* curves of reflected light, one due to each source. Make these, by trial, equally bright; and the amounts of light from the sources are, again, as the squares of the distances. These simple forms of apparatus give results which are fairly accurate, so long at least as the *qualities* of the light furnished by the two sources are nearly the same. But, when we endeavor to compare differently colored lights, the result is by no means so satisfactory. In fact, we cannot well define equality of illumination when the lights are of different qualities. In the undulatory theory, no doubt, we can distinctly define the intensity of any form of radiation. **Difficulties of photometry.** But the definition is a purely dynamical one, and has not necessarily any connection with what we usually mean by intensity, viz., the amount of effect produced upon the nerves of the retina. Thus the theoretical intensities of a given violet and a given red source may be equal, while one may appear to the eye very much brighter than the other. Think, for instance, of a color-blind person, who might, under conceivable circumstances, be unable to see the red at all. We are *all* as it were color-blind as far as regards radiations whose wave-lengths are longer or shorter than those included in the range of the ordinary solar spectrum.

Chemical photometry. Other modes of measuring the intensity of light usually depend upon more recondite physical principles,—such as, for instance, the amounts of chemical action of certain kinds which can be produced by an exposure of a given duration to the light from a particular source. But all have the same grand defect as the simpler processes,—they are not adapted to the comparison of sources giving different qualities of light. And those last mentioned are liable to another source of error, viz., the action of radiations which are not called light, only because they are not visible to the eye; for in all other respects they closely resemble light, and are often more active than it is in producing chemical changes.

Velocity of light. VELOCITY OF LIGHT.—Light moves with a velocity of nearly 186,000 miles per second. Of this we have four distinct kinds of proof, on each of which depends a method which is capable of giving pretty accurate results.

Römer's method. 1. *Römer's Method.*—By this the finite velocity of light was discovered in 1676. Suppose, to illustrate this, that at a certain place a cannon is fired precisely at intervals of an hour while the weather is perfectly calm. A person provided with an accurate watch travels about in the surrounding district. When he first hears the cannon let him note the time by his watch, then on account of the non-instantaneous propagation of sound, if at the next discharge he be *nearer* the gun than before, the report will arrive at his ear *before* the hour's interval has elapsed; if he be farther from the gun, the interval between the discharges will appear longer than an hour; and the number of seconds of defect or excess will evidently represent the time employed by sound in travelling over a space equal to the difference of his distances from the gun at the successive observations.

Now the satellites of Jupiter are subject—like our moon, only much more frequently—to eclipse, and the interval between two successive eclipses can easily be observed. The almost sudden extinction of the light is a phenomenon similar to the discharge of the gun; and, if light take time to move from one place to another, we should find the interval between successive eclipses too short when we are approaching Jupiter, too long when we are receding from him. Such was found to be the case by Römer; and he also found that the shortening or lengthening of the interval depended upon the rate at which the earth was approaching to or receding from Jupiter. The inevitable conclusion from these facts is that light is propagated with finite velocity. Römer calculated from them that light takes about $16^m.5$ to cross the earth's orbit. The exact velocity deduced by this method is, after making all corrections, and assuming the most probable value of the solar parallax, about 186,500 miles per second.

Bradley's method. 2. *Bradley's Method.*—This depends on the *aberration of light*, discovered by Bradley in 1728. When in a calm rainy day one stands still he holds his umbrella vertical in order to protect himself. If he walk he requires to hold it forwards, and more inclined the faster he walks. In other words, to a person walking the rain does not appear to come in the same direction as to a person standing still.[1] Now the earth's velocity in its orbit is a very large quantity, some 18½ miles per second, or about $\frac{1}{10000}$th of that of light. Hence the light from a star does not appear to come in the proper direction unless the earth be moving exactly to or from the star, and, as the direction of the earth's motion is continually changing, so the directions in which different stars are seen are always changing, and thus this phenomenon, called the "aberration of light," proves at once the finite velocity of light and the earth's motion round the sun.

As an additional illustration of the phenomenon, suppose a bullet fired through a railway carriage, in a direction perpendicular to the sides of the carriage. If the carriage be standing still, the bullet will make holes in the sides, the line joining which is perpendicular to the length of the carriage; if it be in motion, then the second side of the carriage will have moved through a certain space during the interval occupied by the bullet in passing from side to side, and thus the line joining the holes in the sides (*i. e.*, the line pursued by the bullet relatively to the carriage), will be inclined at an angle greater than a right angle to the direction of the train's motion.

It is evident that the path apparently described by each star during a year, in consequence of aberration, will be found by laying off from the star lines which bear the same ratio to the star's distance as the velocity of the earth does to that of light,—their directions being always the same as that of the earth's motion at every instant. This is precisely the definition of the HODOGRAPH (*q. v.*) of the earth's orbit. Hence, on account of the finite velocity of light, each star appears to describe in space a circle (not an ellipse) of fixed magnitude in a plane parallel to that of the ecliptic. As seen from the earth, therefore, stars will appear to describe paths which are the projections of these circles on the celestial sphere. These are in general ellipses,

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[1] In fact, to estimate the relative direction and velocity of two moving bodies we must subtract the vector velocity of the first from that of the second.

ircles for stars at the poles of the ecliptic and
ht lines for stars in the ecliptic. This is found to
uite consistent with observation; and the major
of these ellipses, the diameters of the circles, or
ngths of the lines subtend equally angles of about
t the earth. Hence the velocity of light is to the
ty of the earth as 1 : tan ½ 41″; that is, about
0 : 1.

th these methods depend, for their final result,
a true knowledge of the earth's distance from the
But the most accurate measurements of this
tity are probably to be obtained from the velocity
ht itself, this being independently determined by
hysical processes next to be described. Thus the
's distance from the sun will in future be measured
r by the constant of aberration, or by the accele-
n or retardation of the eclipses of Jupiter's satel-
than by a transit of Venus, by the moon's mo-
or by the parallax of Mars. Thus Römer's and
ley's processes are now applied to the determina-
of solar parallax.

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od.

3. *Fizeau's Direct Measurement of the Velocity of Light.*—To illustrate the next
and by far the most convincing *popular*
f of the finite velocity of light, suppose a person
ing at himself in a mirror, before which is moving
een with a number of apertures, the breadth of
aperture being equal to the distance between any
of them. If the screen be at rest with an aperture
re the mirror, the light from the observer's face
es through the aperture and is reflected back, so
he sees himself as if the screen were not present.
pose the screen to be moving in such a way that,
n the light which passed through the aperture re-
s to the screen after reflection, the unpierced part
he screen is in its way, it is evident that the ob-
er cannot see himself in the mirror. If the screen
twice as fast, the light that escaped by one aper-
will, after reflection, return by the next, so that he
see his image as at first. If three times as fast,
second unperforated part of the screen will stop the
rning light; so he cannot see his image. To apply
practically a thin metallic disk had a set of teeth
on its circumference so that the breadth of a tooth
equal to that of the space between two teeth. This
k could be set in very rapid rotation by a train of
eelwork, and the rate of turning could easily be de-
mined by Savart's method (see ACOUSTICS, vol. i. p.
l). Light passed between two teeth to a mirror sit-
ted at 10 miles' distance, which sent it back by the
ne course, so that when the wheel was at rest the
lected light could be seen. On turning the disk with ac-
erated velocity the light was observed to become more
d more feeble up to a certain velocity, at which it was
tinguished; turning faster it reappeared, growing
ighter and brighter till the velocity was doubled;
en it fell off, till it vanished when the velocity was
bled, and so on. It is evident from the first illustra-
n above that the velocity of light in air is to that of
e tooth, at the first disappearance of the reflected
ht, as the distance of the mirror from the disk is to
e half breadth of the tooth. It is not to be supposed
at the description we have just given embodies all
e details of this remarkable experiment. On the
ntrary, telescopes were used at each station to pre-
nt loss of light as much as possible, and many other
ecautions were adopted which would be unintelligible
ithout references to later parts of this article. This
ethod and its first results were published in 1849 in
he *Comptes Rendus*. The experiments gave, on their
ery careful repetition by Cornu in 1874, the value
86,700 miles for the velocity in vacuo (*Nature*, xi. p.
74).

oucault's
ethod,

4. *Foucault's Method.*—This was described in 1850 to the Academy of Sciences. It depends upon the principle of the
apidly revolving plane mirror introduced by Wheat-
tone to demonstrate the non-instantaneous propagation of an electric discharge. The mirror was made to revolve from 600 to 800 times per second, by means of a *siren* (see ACOUSTICS) driven by steam. A ray of sunlight fell upon it from a small aperture crossed by a grating of platinum wires. Between the wires and the mirror was placed an achromatic lens—the wires being farther from it than its principal focus, but *not twice as far*—so that the rays falling on the mirror were slowly convergent. They formed an image of the wires at a distance of about 4 metres from the mirror. In certain positions of the revolving mirror, the rays fell upon a concave mirror of 4 metres radius whose centre of curvature was at the centre of the revolving mirror. They were, therefore, reflected back directly to the revolving mirror, and, passing again through the lens, formed an image of the wire grating which, when the adjustment was perfect, coincided with the grating itself. This coincidence was observed by reflection from a piece of unsilvered glass, placed obliquely in the track of the rays, the image in which was magnified by an eye-piece. It is obvious that, when the mirror is made to turn, the light which comes back to it after passing to the fixed mirror, finds it in a position slightly different from that in which it left it. That difference is due to the amount of rotation during the time of passage of the light to and fro along an air-space of 4 metres. Accordingly, as soon as the mirror began to rotate with considerable velocity, the coincidence between the wires and their images was destroyed; and the two were separated more and more widely as the velocity of rotation was increased. It was easy to calculate, from the measured dimensions of the apparatus, the amount of deflection, and the rate of rotation of the mirror, the velocity of light. The rate of rotation was, of course, given by the pitch of the note produced by the siren.

Foucault's early results with this apparatus showed that the velocity of light which had been deduced from the old methods was too large; and he concludes his first paper by the statement that the determination of the distance of the earth from the sun must now be made by physical instead of astronomical methods. Foucault's process has recently been very considerably improved by Mitchelson, who, in 1879, found for the velocity of light in vacuo 186,380 miles per second (*Nature*, vol. xxi. p. 226).

Proof that light moves faster in air than in water.

By interposing a tube filled with water, and having flat glass ends, between the fixed and revolving mirrors, Foucault found that (for the same rate of rotation) the displacement of the image was greater than before in the proportion of the refractive index of water to unity. Thus it was at once evident, by a mode of experimenting exposed to no possible doubt, that light moves faster in air than in water, and, therefore, as will be seen later, that the corpuscular theory of light must be abandoned.

Other methods of determining the velocity of light in air, and for comparing the velocities of light in air and water (on which depends the most definite proof of the erroneousness of the corpuscular theory), and in still and moving water, will be afterwards explained. They give results of very great value, but we cannot introduce them here, as they depend upon somewhat more recondite principles of *physical* optics.

Time of passage of light from the nearest stars.

It is interesting to observe that, as the nearest fixed star is probably about 200,000 times farther from us than the sun is, we now see such a star by light which left it more than three years ago. If, as is now supposed, *variable* stars (such as Mira Ceti) owe their rapid periodical changes of brightness to eclipses, and if different homogeneous rays travel with different velocities in free space, it is evident that such stars would show a gradual change of color as they wax, and an opposite change as they wane. Nothing of the kind has as yet been observed, though it has been carefully sought for. Hence we have every reason to conclude that, in free space, all kinds of light have the same velocity. It will be seen later that *dispersion* has been accounted for by the different velocities of light of different wave-lengths in the same refracting medium,—this being a consequence of the ultimate grained structure of ordinary matter, which is on a scale not incomparably smaller than the average wave-length.

Behavior of Light at the Common Surface of Two Homogeneous Media.

Effect at a surface of separation between two media.

When a ray of light, moving in one homogeneous medium, falls on the bounding surface of another homogeneous medium, it is in general divided into several parts, which pursue different courses. These parts are respectively—(*a*) reflected; (*β*) refracted (singly or doubly); (*γ*) scattered; (*δ*) absorbed.

In the first two categories the result is two or three rays of light pursuing definite paths according to laws presently to be given. The fraction of the incident light which is reflected is in general greater as the angle of incidence is greater. In one important class of cases the reflection is *total.* But at direct incidence the reflected portion is much greater for some bodies, such as mercury, than for others, such as water or glass. In bodies which give no scattering, the refracted portion of a ray consists of all the non-reflected portion, and therefore usually diminishes as the angle of incidence increases.

In the third category the common surface of the two media becomes illuminated, and behaves as if it were itself a source of light, sending rays in all directions. It may be objected to this, that in many cases the rays are scattered while penetrating the second medium. But in such cases the second medium cannot be called *homogeneous.* This will come up for discussion when we treat of absorption and colors.

In the fourth category the light ceases for an instant to exist as light; but its energy may either become heat in the absorbing body, or it may again be given out by the absorbing body in the form of light, but of a *degraded* character. This is called *fluorescence*, or *phosphorescence*, according as the phenomenon is practically instantaneous or lasts for a measurable time.

In category (*a*) the light is sent back into the first medium; in (*β*) it penetrates into the second; in (*γ*) it goes, in general, mainly to the first; in (*δ*) it is shared by both.

Visibility of non-luminous objects.

It is by scattered light that non-luminous objects are, in general, made visible. Contrast, for instance, the effects when a ray of sunlight in a dark room falls upon a piece of polished silver, and when it falls on a piece of chalk. Unless there be dust or scratches on the silver you cannot see it, because no light is given from it to surrounding bodies except in one definite direction, into which (practically) the whole ray of sunlight is diverted. But the chalk sends light to *all* surrounding bodies from which any part of its illuminated side can be seen; and there is no special direction in which it sends a much more powerful ray than in others. It is probable that if we could, with sufficient closeness, examine the surface of the chalk, we should find its behavior to be of the nature of reflection, but reflection due to little mirrors inclined in all conceivable aspects, and at all conceivable angles, to the incident light. Thus scattering may be looked upon as ultimately due to reflection. When the sea is perfectly calm, we see in it one intolerably bright image of the sun only. But when it is continuously covered with slight ripples, the definite image is broken up, and we have a large surface of the water shining by what is virtually scattered light,—though it is really made up of parts each of which is as truly reflected as it was when the surface was flat.

We have spoken above of the behavior of light at the common surface of two media. Now we do not by this phrase necessarily mean two media different in their chemical composition. We mean merely media *optically* different. Thus water with steam above it, and in very special cases layers of water or air of different temperatures, give surfaces of separation at which reflection and refraction may and do take place. But, except in such special cases, we rarely have an abrupt change, such as is necessary for reflection, between two portions of the same substance *in the same molecular state.* In general the transition is gradual; and special mathematical methods must be applied for the purpose of tracing the behavior of the ray, which is now really travelling in a *non-homogeneous* medium.

Gradual transition from one medium to another.

Reflection of light.

Reflection of Light.—If light be reflected from a plane surface bounding two dissimilar isotropic media, *the incident and reflected rays are in one plane with, and are equally inclined* (*on opposite sides*) *to, the perpendicular to the reflecting surface at the point of incidence.* This is sometimes stated in the form—*The angles of incidence and of reflection are equal to one another, and in one plane.* The best experimental proof of the truth of this statement is deduced from the use of a reflecting surface of mercury in observations with the mural circle. The graduation of such an instrument is the most perfect that human skill can accomplish, and no one has ever been able to find by it the slightest exception to the preceding statement.

The principle of Hadley's quadrant, and of the sextant as now used (an invention of Newton's), is founded on this fact. If a plane mirror on which a ray falls be turned through any angle about an axis perpendicular to the plane of reflection, the reflected ray is turned through twice that angle. This is an immediate consequence of the above law. For, if the plane be turned through any angle θ, the perpendicular to it is turned through the same angle. Hence the angle between the incident ray and the perpendicular is increased or diminished by θ, and therefore that between the incident and reflected rays (which is double of this) is altered by 2θ. A plane mirror is now extensively used for the purpose of indicating, by the change of direction of a reflected ray, the motion of a portion of an instrument to which the mirror is attached. Thus the magnetometers of Gauss, the tuning-forks of Lissajoux, and the electrometers and galvanometers of Sir W. Thomson are all furnished with mirrors. The law of reflection is also the basis of the goniometer, for the measurement of the angles of crystals and prisms.

Minimum length of path.

It follows from this law that, if a ray pass from one point to another, after any number of reflections at fixed surfaces, the length of its whole path from one point to the other is the least possible—subject to the condition that it shall *meet* each of the reflecting surfaces. For the point in a given plane the sum of whose distances from two given points (on the same side of the plane) is the least possible is that to which, if lines be drawn from the points, they are in one plane with the normal (or perpendicular) to the given plane and make equal angles with it. And, as the same is true of each separate reflection, it is true for the whole course of the ray, since for any one of the reflecting surfaces may be substituted its tangent plane at the point of incidence.

It is to be remarked that there are exceptions to this form of the statement. The true form is that the actual path of a ray, under the given conditions, is less in length than any other path (satisfying the conditions) which is nowhere finitely divergent from it. This may be best seen by another method. Suppose a series of ellipses to be described whose foci are the source of light and an assigned point which is to be reached by the reflected ray. Let this system turn about the line joining the foci; it generates a series of prolate spheroids such that the time of light's passing from one focus to a point in any one of the surfaces, and thence to the other focus, is the same whatever point be chosen on that particular surface. If we take any point *without* that surface, for it the corresponding time is obviously greater. Hence to find the path of that one of a system of rays diverging from a given point which, after reflection at a given surface, shall pass through a given point, we have only to imagine spheroids constructed as before. Of these one at least will *touch* the given surface. All points on the surface *in the neighborhood of the point of contact* (mark this limitation) will in general be outside the spheroid. Hence this point gives the shortest path. But the spheroid and the reflecting surface have the same tangent plane, and therefore the parts of the ray are equally inclined to the surface.

Images by reflection.

Formation of Images by Reflection at a Plane Surface.—We may assume here—what is indeed evident from the rectilinear propagation of light—that objects are rendered visible to the eye by rays *diverging* from them. Hence, if we have a set of reflected or refracted rays diverging from any point, or diverging as if they came from any point, they will convey to the eye the impression of the existence of a luminous source at that point. The eye, in fact, can only tell us what effect is produced upon it, *i. e.*, what sort of mechanical action it is subjected to. Its indications must therefore depend only upon what reaches it, and in no other sense whatever upon the source or the path of light. This point from which rays diverge, or appear to diverge, is called an *image*.

The image of any point in a plane mirror is found by drawing from the point a perpendicular on the mirror and producing it till its length is doubled.

Real and virtual images.

The extremity of the line so drawn is the image of the point; or, in other words, rays proceeding from the point diverge after reflection as if they came from the image so found. The image in this case is called *virtual*, to distinguish it from cases, subsequently to be mentioned, where it is *real*—the distinction being that the rays have actually passed through a real image, while they only appear to come from a virtual one.

To prove this it is only necessary to observe that, if A (fig. 5) be a luminous point or a point from which rays diverge, and CB any section of the mirror by a plane through AB, the perpendicular to it, and if we make Ba = AB, and take any point P, then, joining AP, *a*P, and producing the latter, the angles APB, *a*PB, and therefore CPQ are equal; also the plane of the paper contains the perpendicular to the mirror at P. Hence PQ is the reflected ray; or the ray, after reflection, appears to come from *a*. Hence *a* is the image—a virtual one, as before noticed. Also, if R be any point whatever (not P) in the plane of the mirror, we have obviously *a*R = RA. Hence the path AR, RQ is equal to *a*R, RQ, two sides of the triangle *a*RQ, of which *a*Q, which is equal to the actual path (AP, PQ), is the third side.

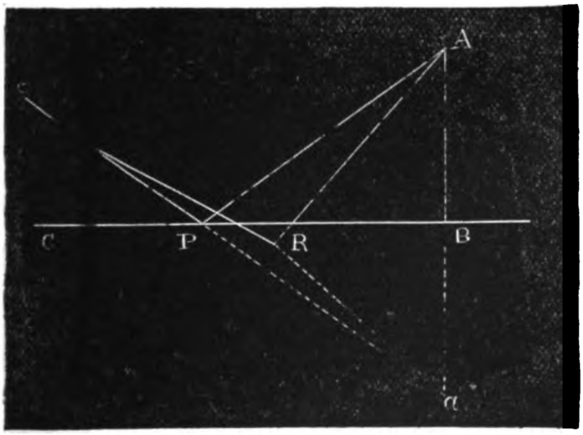

Fig. 5.

Fig. 6 represents the pencils of diverging rays by which two points of the image are rendered visible to an eye placed in front of the mirror. From the requisite modification of this figure it follows that one can see his whole person in a mirror of only half his height and breadth.

Dircks's ghost.

Dircks's *ghost*, which has played a prominent part in popular entertainments for some years back, is the image, in a large sheet of unsilvered plate glass hung at the front of the stage, of an actor or figure strongly illuminated, and concealed from the audience in a sort of enlarged prompter's box. Any one can see the phenomenon completely by looking into a plate-glass window on a sunny day, when he sees the passers-by apparently walking *inside* the house.

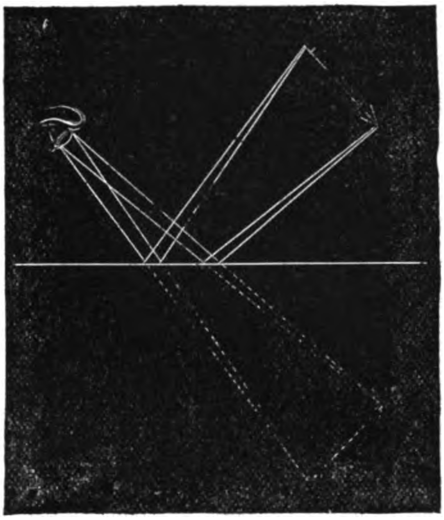

Fig. 6.

The principles already stated suffice fully for the explanation of the curious vistas of images formed by two *parallel* plane mirrors facing one another at opposite sides of a room. The only additional observation necessary on this subject is that, if the mirrors are silvered on the back, the light at each reflection has to pass twice through the glass. Thus, if the glass be pinkish or greenish, the various images are more and more colored as they are due to more numerous reflections.

Kaleidoscope.

These principles also easily explain the Kaleidoscope (*q. v.*) of Sir D. Brewster, where images are formed by two mirrors inclined to one another. It is easy to see that the series of images of a luminous point produced by such an arrangement after one, two, etc., reflections must all lie on a circle; also that, if the angle between the mirrors be an aliquot part of four right angles, these images will form a finite number of groups, each consisting of an infinite number of images which have exactly the same position.

The explanation of the law of reflection which is furnished by the corpuscular theory is excessively simple. We have only to suppose that at the instant of its impact on the reflecting surface the velocity of a corpuscle *perpendicular* to the surface is reversed, while that *parallel* to the surface is unchanged. It bounds off, in fact, like a billiard-ball from the cushion. The undulatory theory gives an explanation, which is, in reality, quite as simple, but requires a little more detail for those who are not familiar with the common facts of wave-motion. We therefore reserve it for a time.

Spherical mirror.

Reflection at a Spherical Surface.—Let APB (fig. 7) be a section of a concave spherical mirror by a plane passing through its centre of curvature O, and through the luminous point U. Then, if any ray from U, as UP, meet the surface, it will be reflected in a direction PV, such that UP, PO, and PV are in one plane, and so that PO bisects the angle UPV. (This follows because OP, a radius of the sphere, is normal to the surface at P.) Hence it is *rigorously* true that, if V be the intersection of PV with UOA,

$$\frac{\mathrm{VO}}{\mathrm{VP}}=\frac{\mathrm{OU}}{\mathrm{UP}}\cdot$$

The full consequences of this *exact* statement will be developed under OPTICS (GEOMETRICAL). For our present purpose, an approximation will amply suffice. Let us suppose P to be so near to A that no sensible error is introduced by writing A for P in the above formula. This amounts to supposing the mirror's breadth to be very small in comparison with its radius of curvature. The formula now becomes

$$\frac{\mathrm{VO}}{\mathrm{AV}}=\frac{\mathrm{OU}}{\mathrm{AU}};$$

or, what is the same,

$$\frac{\mathrm{AO}-\mathrm{AV}}{\mathrm{AV}}=\frac{\mathrm{AU}-\mathrm{AO}}{\mathrm{AU}};$$

and V is, to the degree of approximation above stated, independent of the position of the point P. If we call r the radius AO of the mirror, $u=\mathrm{AU}$ the distance of the source, and $v=\mathrm{AV}$, the distance of the point V from the mirror, this becomes

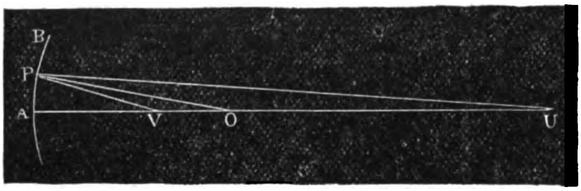

Fig. 7.

$$\frac{r-v}{v}=\frac{u-r}{u}, \text{ or } \frac{1}{u}+\frac{1}{v}=\frac{2}{r}. \quad . \quad . \quad . \quad (a).$$

Conjugate foci.

The formula, or the cut, shows at once that this relation between U and V is *reciprocal*; *i. e.*, all rays from V, falling on the mirror, will be made to converge at U. These points are therefore called *conjugate foci*.

The simplicity of (a) is remarkable; so, also, is that of its interpretation. For the rays passing from a source to a given object, like the mirror, are less and less divergent as the source is farther off. Hence (a) signifies that the (algebraic) sum of the divergences of the incident and reflected rays is equal to that divergence which the mirror can convert into parallelism.

In fact the rigorous geometrical relation may be written in the obvious form AVP + AUP = 2AOP,—which, when all three angles are small, is simply (a). A similar statement may easily be made in the case of refraction.

Generalization of the formula.

Before we proceed to develop the consequences of this simple formula, we may point out that it is applicable to all cases,—to convergent rays falling on a concave mirror, to divergent rays falling on a convex mirror, etc., etc. The reader may easily verify this by trial for himself. But it follows at once from the necessary interpretation of the negative sign in geometry. Thus, if the mirror were convex, O would be to the *left* of A, as the figure is drawn; and AO, if formerly positive, would now be negative. Thus, for a convex mirror, the formula is

$$\frac{1}{u}+\frac{1}{v}=-\frac{2}{r}.$$

If the incident rays be *convergent*, U is to the left of A, and therefore AU, or u, is negative; and so on.

We must now study the *relative* positions of U and V, in order to find the size and position of the image for different positions of the object.

Returning to the formula (a) above, we see that the following pairs of values of u and v satisfy it:—

u	v
Infinite.	$\frac{1}{2}r$.
Greater than r.	Greater than $\frac{1}{2}r$, less than r.
r.	r.
Less than r, greater than $\frac{1}{2}r$.	Greater than r.
$\frac{1}{2}r$.	Infinite.
Greater than 0, less than $\frac{1}{2}r$.	Negative.
0.	0.

Principal focus.

Thus, when the source is at a practically infinite distance (as the sun or a star) the image is formed at a distance from the mirror equal to *half* its radius of curvature. It is then said to be in the *principal* focus. As the source comes nearer, the image comes out to meet it, and they coincide at the centre of curvature of the mirror. In fact, a ray leaving the centre of the mirror must meet the surface at right angles, and thus go back by the way it came. When the source comes still nearer, the image goes further off, until, when the source is at the principal focus, the image is at an infinite distance; that is, the rays go off parallel to one another. This is the mode in which a concave reflector is employed for lighthouse purposes. When the source comes still nearer, the image is behind the mirror, *i. e.*, the incident rays are so divergent that part of their divergence remains after reflection. This remnant of divergence becomes greater and greater as the source is nearer to the mirror, *i. e.*, the (then *virtual*) image comes closer to the mirror, which finally behaves, for a very near source, almost precisely like a plane mirror.

All of these phenomena can be beautifully seen in a dark room by employing a beam of sunlight, rendered distinctly visible, in the fashion noted by Lucretius, by the motes in the air.

Paths of rays forming an image.

For further explanation pictures are given (figs. 8, 9), showing the course of the pencil of rays when (1) a *real* and (2) a *virtual* image is formed by a concave mirror. It will be seen at once that, in the cases figured, the *real* image is *inverted* and less than the object, the *virtual* image

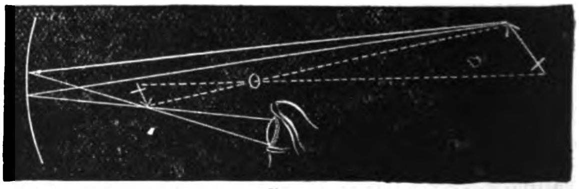

Fig. 8.

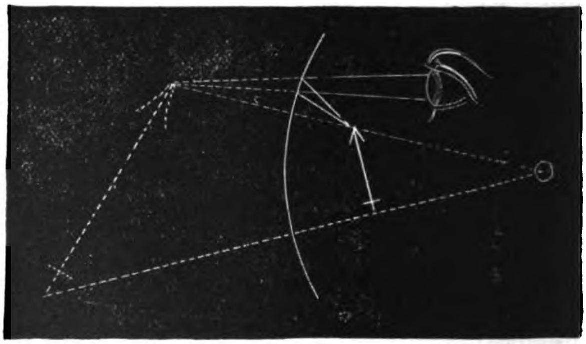

Fig. 9.

ıd larger. In fact the size of a small object is ly to that of its image in proportion to their dis- rom O, the centre of curvature of the mirror. e image is erect when it lies on the same side of ıtre of curvature with the object; inverted, if opposite. In other words, the image is inverted rays cross one another's path, erect if they do

When the breadth of the mirror is large compared with its radius, the approximation hich all these results depend can no longer be There is then no definite image even of a lumi- oint. It becomes spread over what is called a , a section of which is the bright curve familiar y one who has looked at a cup of milk in sun-

ɪl Even when the approximation is close enough for ordinary purposes, it is not so for astronomical purposes, and the effect of xactness upon the image is known as *spherical tion.* For the fine mirrors of reflecting TELE- ı (*q. v.*) the spherical form cannot be employed; :face of the mirror must be of *parabolic* section.

ical *Cylindrical Mirrors.*—As a simple example of the application of the law of reflection at curved surfaces, when the rigorous n is demanded, let us take the case of a vertical ylinder, the object being a drawing on a horizon- ne. Such mirrors, with the frightfully distorted ıgs necessary to give an image of natural propor- were very common fifty years ago, but are now seen. They are still, however, valuable as illus- ıs of our subject.

the plane of the object cut the axis OB of the cylin- right angles in O (fig. 10), and let A be the position

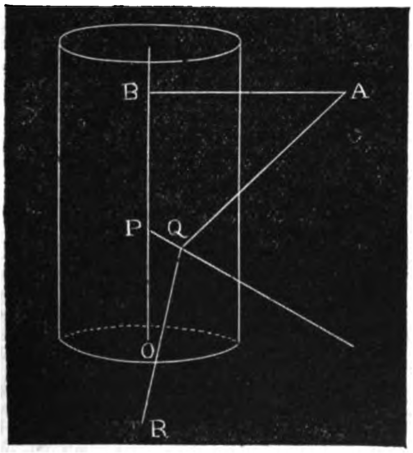

Fig. 10.

e eye, and RQA a ray from a point R of the object, ted at Q. Draw QP perpendicular to the axis. Then nd QR are in the same plane with QP (the normal to urface) and make equal angles with it. Hence, when igure is projected by vertical lines on the plane of the t, it takes the form in fig. 11; and AQ, QR now make l angles with OQ. Also, if AB be drawn (in fig. 10) ndicular to OP, the ratio of AQ to QR in fig. 11 is equal at of BP to PO in fig. 10.

ke $$\mathrm{QS} : \mathrm{QO} :: \mathrm{QR} : \mathrm{QA},$$

draw ST parallel to OA. Then it is obvious that

$$\mathrm{SR} = \mathrm{ST} = \frac{\mathrm{QS}}{\mathrm{QO}}\mathrm{OA};$$

also that the angles QSR and QST are equal. Hence following theorems, which enable us at once to draw ure on the object plane such that its image shall ar of any assigned form.

Any line, such as QR, on the object plane, drawn from int Q in the section of the cylinder so that the angles and OQA are equal, is seen after reflection as a gene- g line of the cylinder.

If an epicycloid be described by lines of fixed length OS, SR, turning about O with angular velocities 1 and 2, and both coinciding with OA at starting, its image will be a circular section of the cylinder.

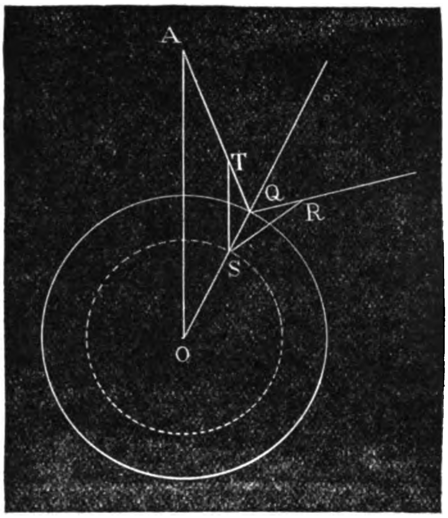

Fig. 11.

Diagrams for cylindrical mirror.

Thus, if we imagine as drawn on the cylinder any number of vertical and horizontal sections, forming a network, the object corresponding to them can be traced as a number of intersecting straight lines and epicycloids. Thus we have a well-known means of drawing the required object. A similar process may be applied to other modes of using such mirrors.

Reflection from polished rod.

When the cylinder has a small diameter, it may be usefully employed to intercept and reflect part of a beam of sunlight entering a dark room. It is easy to see, by a geometrical construction, that the reflected rays will in this case form a right cone, whose axis is that of the cylinder; and one of its generating lines will be parallel to the incident ray. Thus the angle of the cone becomes smaller as the inclination of the reflecting cylinder to the ray becomes less. If the ray, at the point of interruption, was at the centre of a spherical dome, after reflection it will form on the dome a circle, small or great, which passes through its original point of incidence.

In the language of QUATERNIONS (*q. v.*), let α be the incident ray, β the axis of the cylinder, τ any normal to the cylinder, ρ the reflected ray. Then the law of reflection gives

$$\mathrm{V}.\,\tau\alpha\tau\rho = 0.$$

The property of the normal gives

$$\mathrm{S}\beta\tau = 0.$$

Eliminating τ, we have at once

$$\frac{\rho^2}{\alpha^2} = \left(\frac{\mathrm{S}\beta\rho}{\mathrm{S}\alpha\beta}\right)^2,$$

the equation of a right cone.

Imitations, more or less perfect, of primary and secondary rainbows can easily be made by this process,—the sunbeam being led through a prism just before it falls on the cylindrical rod. This experiment is a very striking one; but, though capable of giving much information, it is of that dangerous kind which is liable to mislead instead of instructing an audience.

If we look at a great number of thin cylindrical rods, parallel to one another, and illuminated by sunlight, the rays which reach the eye must, by what we have already said, each form a side of some right cone (of definite angle) whose axis is parallel to each of the cylinders. The appearance presented will therefore be that of a luminous *circle*, passing through the sun. Its angular diameter becomes less as the axes of the cylinders are less inclined to the incident rays.

This phenomenon is beautifully shown by some specimens of crystals, especially of Iceland spar, which are full of minute tubes parallel to one another. In a plate of such a doubly-refracting crystal, however, there are necessarily four images. That which is *throughout* due to the ordinary ray (this term will be explained later) shows perfectly the phenomenon above described. The light of the luminous circle is white. The other three curves are not circles, and in them the colors are separated. One of them, which is elliptical, is usually very much brighter than either of the remaining two.

Ordinary refraction.

Refraction.—If homogeneous light be refracted at a plane surface separating two homogeneous isotropic media, *the incident and refracted rays are in one plane with the normal to the surface, and the sines of their inclinations to it are in a constant ratio.*

The law of single refraction was put in a form equivalent to this (all but one word) for the first time by Snell in Leyden, some time before 1626. It was first published in 1637 by Descartes, who undoubtedly obtained it from Snell; but he gave it without any mention of its author.

The one word referred to is *homogeneous* as applied to the incident light. For the fact that white light consists of innumerable different homogeneous constituents, which are separated from one another by refraction, was first established by Newton. We quote his own account of this important discovery from his letter to Oldenburg, dated Feb. , 167½:—

Newton on the composition of white light.

"To perform my late promise to you, I shall without further ceremony acquaint you, that in the year 1666 (at which time I applied myself to the grinding of optick-glasses of other figures than spherical) I procured me a triangular glass-prism, to try therewith the celebrated phænomena of colours. And in order thereto, having darkened my chamber, and made a small hole in my window-shuts, to let in a convenient quantity of the sun's light, I placed my prism at its entrance, that it might be thereby refracted to the opposite wall. It was at first a very pleasing divertisement, to view the vivid and intense colours produced thereby; but after a while applying myself to consider them more circumspectly, I became surprised to see them in an oblong form; which, according to the received laws of refractions, I expected should have been circular. They were terminated at the sides with streight lines, but at the ends the decay of light was so gradual, that it was difficult to determine justly what was their figure, yet they seemed semicircular.

"Comparing the length of this coloured *spectrum* with its breadth, I found it about five times greater; a disproportion so extravagant, that it excited me to a more than ordinary curiosity of examining from whence it might proceed. I could scarce think, that the various thickness of the glass, or the termination with shadow or darkness, could have any influence on light to produce such an effect: yet I thought it not amiss, first to examine those circumstances, and so tried what would happen by transmitting light through parts of the glass of divers thicknesses, or through holes in the window of divers bignesses, or by setting the prism without, so that the light might pass through it, and be refracted, before it was terminated by the hole: but I found none of those circumstances material. The fashion of the colours was in all these cases the same.

"Then I suspected, whether by any unevenness in the glass, or other contingent irregularity, these colours might be thus dilated. And to try this, I took another prism like the former, and so placed it, that the light passing through them both, might be refracted contrary ways, and so by the latter returned into that course from which the former had diverted it: for by this means I thought the regular effects of the first prism would be destroyed by the second prism, but the irregular ones more augmented, by the multiplicity of refractions. The event was, that the light, which by the first prism was diffused into an oblong form, was by the second reduced into an orbicular one, with as much regularity as when it did not at all pass through them. So that whatever was the cause of that length, it was not any contingent irregularity.

"I then proceeded to examine more critically, what might be effected by the difference of the incidence of rays coming from divers parts of the sun; and to that end, measured the several lines and angles belonging to the image. Its distance from the hole or prism was 22 foot; its utmost length 13¼ inches; its breadth 2⅝; the diameter of the hole ¼ of an inch. The angle which the rays, tending towards the middle of the image, made with those lines, in which they would have proceeded without refraction, was 44 deg. 56 min., and the vertical angle of the prism 63 deg. 12 min. Also the refractions on both sides the prism, that is, of the incident and emergent rays, were, as near as I could make them, equal; and consequently about 54 deg. 4 min. And the rays fell perpendicularly upon the wall. Now subducting the diameter of the hole from the length and breadth of the image, there remains 13 inches in the length, and 2⅜ the breadth, comprehended by those rays which passed through the center of the said hole; and consequently the angle of the hole, which that breadth subtended, was about 31 min. answerable to the sun's diameter; but the angle which its length subtended, was more than 5 such diameters, namely, 2 deg. 49 min.

"Having made these observations, I first computed from them the refractive power of that glass, and found it measured by the ratio of the sines 20 to 31; and then by that ratio I computed the refractions of two rays flowing from opposite parts of the sun's *discus*, so as to differ 31 min. in their obliquity of incidence, and found that the emergent rays should have comprehended an angle of about 31 min. as they did before they were incident.

"But because this computation was founded on the hypothesis of the proportionality of the sines of incidence and refraction, which though by my own experience I could not imagine to be so erroneous, as to make that angle but 31 min. which in reality was 2 deg. 49 min., yet my curiosity caused me again to take my prism: and having placed it at my window, as before, I observed, that by turning it a little about its axis to and fro, so as to vary its obliquity to the light, more than an angle of 4 or 5 degrees, the colours were not thereby sensibly translated from their place on the wall; and consequently by that variation of incidence, the quantity of refraction was not sensibly varied. By this experiment, therefore, as well as by the former computation, it was evident that the difference of the incidence of rays, flowing from divers parts of the sun, could not make them after decussation diverge at a sensibly greater angle, than that at which they before converged; which being at most but about 31 or 32 min., there still remained some other cause to be found out, from whence it could be 2 deg. 49 min.

"Then I began to suspect, whether the rays, after their trajection through the prism, did not move in curve lines, and according to their more or less curvity, tend to divers parts of the wall. And it increased my suspicion, when I remembered that I had often seen a tennis-ball, struck with an oblique racket, describe such a curve line. For, a circular as well as a progressive motion being communicated to it by that stroke, its parts, on that side where the motions conspire, must press and beat the contiguous air more violently than on the other, and there excite a reluctancy and re-action of the air proportionably greater. And for the same reason, if the rays of light should possibly be globular bodies, and by their oblique passage out of one medium into another acquire a circulating motion; they ought to feel the greater resistance from the ambient æther, on that side where the motions conspire, and thence be continually bowed to the other. But notwithstanding this plausible ground of suspicion, when I came to examine it, I could observe no such curvity in them. And besides (which was enough for my purpose) I observed, that the difference betwixt the length of the image and the diameter of the hole, through which the light was transmitted, was proportionable to their distance.

"The gradual removal of these suspicions at length led me to the *experimentum crucis*, which was this. I took two boards, and placed one of them close *behind the prism at the window*, so that the light might pass through a small hole, made in it for the purpose, and fall on the other board, which I placed at about 12 feet distance, having first made a small hole in it also for some of that incident light to pass through. Then I placed another prism behind this second board, so that the light trajected through both the boards might pass through that also, and be again refracted before it arrived at the wall. This done, I took the first prism in my hand, and turned it to and fro slowly about its axis, so much as to make the several parts of the image, cast on the second board, successively pass through the hole in it, that I might observe to what places on the wall the second prism would refract them. And I saw, by the variation of those places, that the light, tending to that end of the image towards which the refraction of the first prism was made, did in the second prism suffer a refraction considerably greater than the light tending to the other end. And so the true cause of the length of that image was detected to be no other, than that *light* is not similar or homogeneal, but consists of *difform rays, some of which are more refrangible than others;* so that without any difference in their incidence on the same medium, some shall be more *refracted* than others; and therefore that, according to their *particular degrees of refrangibility*, they were transmitted through the prism to divers parts of the opposite wall."

Refractive index.

The *constant ratio* mentioned in the above statement of the law of refraction is called the *refractive index*. Its numerical value depends upon the nature of the two media, and also upon the quality of the homogeneous light. It is usually greater for orange light than for red, for yellow than for orange, and so on,—so that the violet rays are often called the "more refrangible" rays.[1]

The following experimental facts are additions to the law.

When refraction takes place from a rarer into a denser medium, the angle of refraction is usually less than that of incidence.

If the refractive index for a particular kind of light from a medium A into another B be μ, that from B to A is $\frac{1}{\mu}$. In other words, a refracted ray may be sent back by the path by which it came.

If μ_1 be the refractive index for a particular ray from A into B, and μ_2 that for the same ray from A into C, that from B into C is $\frac{\mu_2}{\mu_1}$.

Refraction by water.

These being premised, let us consider a source of homogeneous light in air shining on a surface of water. Here we may take μ as about equal to $\frac{4}{3}$.

Let MN (fig. 12) be the perpendicular to the water surface at the point where the incident ray AP meets it. In the plane APM make the angle QPN such that

$$\sin APM = \tfrac{4}{3} \sin QPN,$$

then PQ is the refracted ray. If QP be produced backwards to meet the vertical line BA in q, we may present this statement in the form

$$\frac{PB}{PA} = \frac{4}{3}\frac{PB}{Pq},$$

or

$$PA = \tfrac{3}{4}Pq.$$

If the rays fall *nearly* perpendicularly on the surface we may put (approximately) B for P, and we have,

$$Bq = \tfrac{4}{3}BA.$$

Hence, an eye placed under water and nearly in the vertical through A, sees a *virtual image* of A at q, one-third farther from the surface of the water.

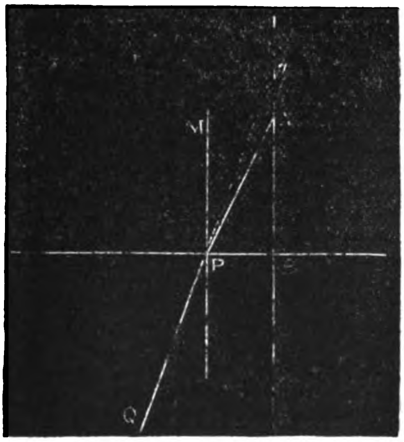

Fig. 12.

As P is taken farther and farther from A, the angle of incidence becomes more nearly a right angle, and the sine of the angle of refraction becomes more nearly equal to $\frac{3}{4}$. *A ray cannot go from air into water so as to make, with the perpendicular to the surface, an angle whose sine is greater than* $\frac{3}{4}$. The true nature of this curious statement is, however, best seen when we suppose the source to be under water, and the light to be refracted into air. If APQ (fig. 13) be the course of a ray, we have as before

$$AP = \tfrac{3}{4}Pq.$$

Hence, if P_1 be taken so that

$$AP_1 = \tfrac{3}{4}P_1B,$$

Total reflection.

it is clear that q coincides with B, or the ray AP_1, refracted at P_1, runs along the surface of the water. If AP_2 be less than $\frac{3}{4}$ P_2B, no point q can be found; so that the ray AP_2 *cannot get out of the water*. It is found to be completely reflected in the water. This reflection unaccompanied by refraction is called *total reflection*. The limiting angle of incidence (at P_1) which separates the totally reflected rays from those which (at least partially) escape into air is called the *critical angle*. When an equilateral triangular prism of glass is placed in a ray of sunlight, and made to rotate, we see (besides the spectra formed by refraction) beams of white light reflected alternately from the *outside* and the *inside* of each face. The totally reflected ray from the inside is seen to be very much brighter than that reflected from the outside.

Critical angle.

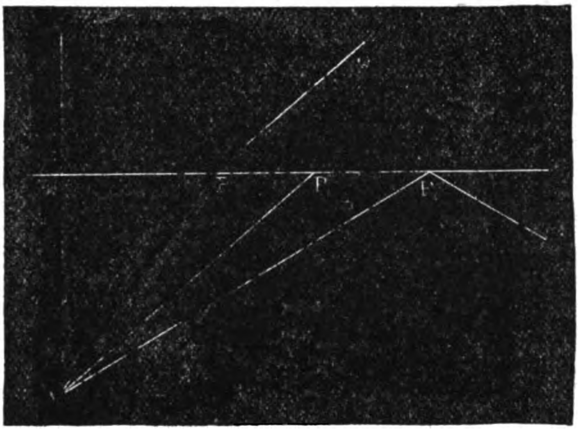

Fig. 13.

To an eye placed nearly in the vertical of A, A appears at A_0, where

$$A_0B = \tfrac{3}{4}AB.$$

Appearance of objects under water.

Thus a clear stream, when we look vertically into it, appears to be of only $\frac{3}{4}$ths of its real depth. But when we look more and more obliquely, seeing A for instance by the ray QP, the image appears nearer and nearer to the surface; or, if A be at the bottom, the water will appear more and more shallow; and all objects in it will appear to be crowded towards the surface. Thus the part of a stick immersed in water appears bent up towards the surface of the water.

Again to an eye at A, all objects *above* the water will be seen within a right cone of which AB is the axis and AP_1 a side. The rest of the water surface, outside the cone just mentioned, shows us objects at the bottom by reflection in a perfect mirror.

All this is on the supposition that the light is homogeneous. But when white light is emitted by A, the point A_0 will be nearer the surface for each constituent the greater is the refractive index. Thus a white point at A will appear drawn out into a colored line whose lower end is red and upper end violet.

It is easily seen from the law of refraction that light, on passing through a plate of homogeneous material with parallel faces finally emerges in a direction parallel to that at incidence, and therefore white light comes out from it still white. If the plate be water in a glass vessel with parallel sides, a body placed close to one side, while the eye is close to the other, appears to be at ¾ths of its real distance from the eye.

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[1] This statement is, however, liable to some very singular exceptions, which will be mentioned later, when we are dealing with anomalous dispersion.

Corpuscular explanation of the law of refraction.

The explanation of the law of refraction, on the corpuscular theory, was given by Newton. It is still of importance, as the earliest instance of the solution of a problem involving molecular forces. Newton shows that, as the molecular forces on a corpuscle balance one another at every point inside either of the media, its velocity must be constant in each, but that in passing through the surface of seperation of the two media the square of the velocity perpendicular to the surface undergoes a finite change.

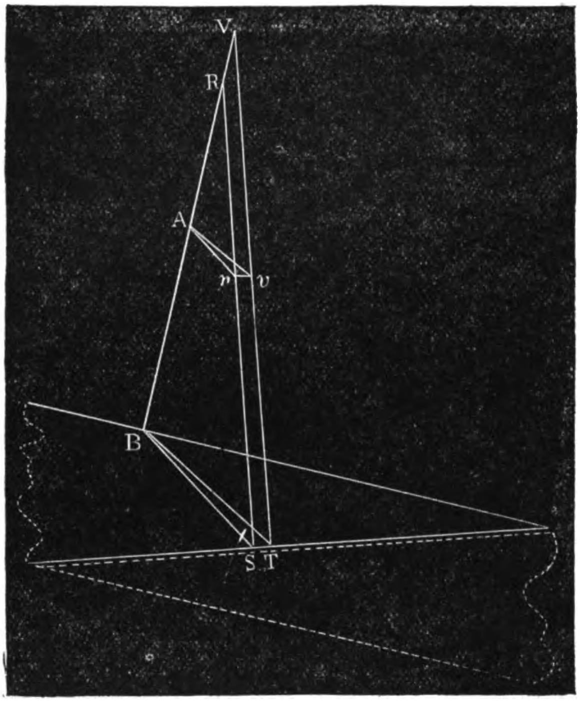

Fig. 14.

Thus, if v be the velocity in air, α the angle of incidence, then in glass the velocity parallel to the surface is still $v \sin \alpha$, but that perpendicular to the surface is $\sqrt{v^2 \cos^2 \alpha + a^2}$. Thus the whole velocity is $\sqrt{v^2 + a^2}$; and, if α' be the angle of refraction,

$$\sqrt{v^2 + a^2} \sin \alpha' = v \sin \alpha.$$

Prism.

Prisms.—When the surfaces are plane, but not parallel, we have what is called a *prism*. The general nature of the action of a prism will be easily understood by the help of the previous illustrations, if we restrict ourselves to the case of a prism of very small angle and to rays passing nearly perpendicular to each of its faces. Thus, the rays falling nearly at right angles to its surface from a point A (fig. 14) will, after the first refraction, appear to diverge from a luminous line RV, red at the end next to A, violet at the other. This line is in the perpendicular AB from A to the first surface of the prism. Draw from R and V perpendiculars RS, VT to the second surface of the prism. Join BS, BT, and draw A*r*, A*v* parallel to them so as to cut RS in *r* and VT in *v*. To an eye behind the prism, the bright point A will appear to be drawn out into a colored line *rv*, red at the end nearest to A.

If A be a narrow bright line of light, parallel to the edge of the prism, it will appear to be drawn out into a rectangle consisting of images of the line ranged parallel to one another, and due to the various homogeneous constituents of white light in order of their refrangibility. If the light do not contain rays of every degree of refrangibility, some of these images will be wanting, and there will be corresponding dark lines or bands crossing this *spectrum* (as it is called).

Spectrum.

The amount by which any part of this spectrum is shifted from the true position of the bright slit depends (*cæteris paribus*) upon the amount of the refraction. It also depends on the angle of the prism. And, for a given angle, the length of the spectrum depends upon the difference between the refractive indices for the red and the violet rays. This is called the *dispersion*.

Dispersion.

If a second prism, of the same glass, and of the same angle, as the first, be placed in a reversed position behind it (as indicated by the dotted lines in the figure), the effect of the two would be simply that of a *plate* of glass with parallel faces; the emergent rays would each be parallel to its original direction, and there would be no separation of colors. The reversed prism would therefore undo the work of the direct prism. Then we should have no dispersion, but we should also have no refraction. We have, however, as has already been shown, an increase of divergence, *i. e.*, the image is nearer to the eye than the object. Blair, Brewster, and Amici devised combinations of two pairs of prisms of the same glass, those of each pair having their edges parallel, such that the combination acted as a sort of achromatic telescope of low power.

Newton, from some rough experiments, hastily concluded that the amount of dispersion is in all substances proportional to that of the refraction. If such were the case it is easy to see that prisms of two differently refracting materials and of correspondingly different angles, combined (as above described) so as to annul the dispersion, would likewise annul the refraction. Thus Newton was led to suppose that refraction without dispersion is impossible.

Achromatism.

It was found by Hall in 1733, and afterwards (independently) by Dollond, that this idea is incorrect—that, in fact, we have in certain media large refraction with comparatively small dispersion, and *vice versa*, and thus that the dispersion may be got rid of while a part of the refraction remains. James Gregory had previously conjectured that this might be done by using, *as is done in the eye*, more media than one. Thus we have for certain specimens of flint and crown glass, whose optical constants were carefully measured by Fraunhofer, the following values of the refractive index for three definite kinds of homogeneous light:—

	C	D	F
Flint glass....................	1·6297	1·6350	1·6483
Crown glass..................	1·5268	1·5296	1·5360

The rays C and F are in the red and greenish blue respectively, and are given off by incandescent hydrogen. D is the orange-yellow ray of sodium.

When the angle of the prism is very small (the only case we treat here), we may consider A*rv* as approximately a straight line, whose length is (*cæteris paribus*) proportional to the angle of the prism. Also the distances A*r*, A*v*, are to one another in the proportion of the refractive indices of red and violet rays, *each diminished by unity*. Hence, for a prism of flint glass such as was employed by Fraunhofer, the distances from A to its images formed by these three kinds of homogeneous light respectively are very nearly as

630, 635, 648.

When a prism of crown glass is used they are nearly as

527, 530, 536.

The differences between the numbers for C and F are

For flint glass..	18
" crown glass..	9

or as 2 : 1. Hence if we make the small angle of the crown-glass prism twice that of the flint, and observe A through the two prisms, with their edges turned in opposite directions, the C and F images will coincide. Both, however, will be displaced from the real direction of A as if a prism had been employed, with its edge turned as that of the crown glass was, and to the same extent as that prism would have displaced them had its refractive index been about 1·21 and the same for the two kinds of light C and F.

In fact, the displacements by the flint prism are as

630, 648,

and those by the crown prism (to the opposite side) are as

1054, 1072.

The differences, in favor of the crown prism, are as

424, 424.

Irrationality of dispersion.

This combination of prisms is called *achromatic*, or colorless, but is not perfectly so. For if we inquire into the displacement of the D image, we find that it is as

635

for the flint prism; but as

1060

in the opposite direction, for the crown prism. Hence its whole displacement is as

425,

a little greater than that common to C and F. The reason for this is obvious from Fraunhofer's numbers given above. The interval from C to D is to that from C to F in a greater ratio in crown than in flint glass, —so that the spectra given by these media are not *similar*. The rays of higher refrangibility are more separated in proportion to those of lower refrangibility in flint than in crown glass. This is the *irrationality of dispersion*—which, so far as we yet know, renders absolute achromatism unattainable. Three lenses in combination give a better attempt at achromatism than can be made with two; and some remarkable results were obtained by Blair,[1] with two glass lenses enclosing a lenticular portion of a liquid.

Lines in the solar spectrum.

By looking through a prism at a very narrow slit, formed by the window shutters of a darkened room, Woilaston (in 1802) found that the light of the sky (*i. e.*, sunlight) gives a spectrum which is *not continuous*. It is crossed by dark bands, as already hinted. These bands are due to the deficiency of intensity of certain definite kinds of homogeneous light. They were, independently, rediscovered, and their positions measured, by Fraunhofer[2] in 1817 with far more perfect optical apparatus. He also found similar, but not the same, deficiencies in the light from various fixed stars. The origin of these bands will be explained in RADIATION, along with the theory of their application in spectrum analysis. In optics they are useful to an extreme degree in enabling us to measure refractive indices with very great precision. Wollaston's own account of his discovery is as follows:—

"If a beam of day-light be admitted into a dark room by a crevice $\frac{1}{20}$th of an inch broad, and received by the eye at the distance of 10 or 12 feet, through a prism of flint-glass, *free from veins*, held near the eye, the beam is seen to be separated into the four following colors only, red, yellowish-green, blue, and violet, in the proportions represented in fig. . . .

"The line A that bounds the red side of the spectrum is somewhat confused, which seems in part owing to want of power in the eye to converge red light. The line B, between red and green, in a certain position of the prism is perfectly distinct; so also are D and E, the two limits of violet. But C, the limit of green and blue, is not so clearly marked as the rest; and there are also on each side of this limit other distinct dark lines *f* and *g*, either of which in an imperfect experiment might be mistaken for the boundary of these colors.

"The position of the prism in which the colors are most clearly divided is when the incident light makes about equal angles with two of its sides. I then found that the spaces AB, BC, CD, DE, occupied by them were nearly as the numbers 16, 23, 36, 25."[3]

The mode of formation of a spectrum which was employed by Newton, and which is still used when the spectrum is to be seen by many spectators at a time, differs from that just explained in this, that the light from a source A is allowed to pass through the prism, and to fall on a white screen at a considerable distance from it. In this case the paths of the various rays as they ultimately escape from the prism are found by joining the points *r*, ... *v*, with the prism and producing these lines to meet the screen.

Impure spectrum.

Unless one surface of the prism be covered by an opaque plate, with a narrow slit in it parallel to the edge of the prism, the spectrum produced in this way is very *impure*, *i. e.*, the spaces occupied by the various homogeneous rays overlap one another. To make it really pure an achromatic lens is absolutely requisite. This leads us, naturally, to the consideration of the refraction of light at spherical surfaces.

Spherical refracting surface.

Refraction at a Spherical Surface.—Following almost exactly the same course as that taken with reflection above, let O (fig. 15) be the centre of curvature of the spherical refracting surface AB. Let U be the point-source of homogeneous light, and let PV be the prolongation (backwards) of the path pursued, after refraction, by the ray UP.

Then, *rigorously*, we have

$$\sin \mathrm{UPO} = \mu \sin \mathrm{OPV},$$

where u is the index of refraction between the two media employed. This may be written (by omitting a common factor) as

$$\frac{\mathrm{OU}}{\mathrm{PU}} = \mu \frac{\mathrm{OV}}{\mathrm{PV}}.$$

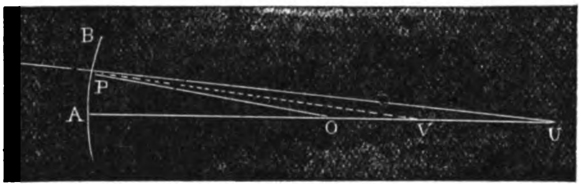

Fig. 15.

If, as before, the breadth of the surface be small compared with its radius of curvature, we may approximate (sufficiently for many important practical purposes) by writing A for P. Thus we have

$$\frac{\mathrm{OU}}{\mathrm{AU}} = \mu \frac{\mathrm{OV}}{\mathrm{AV}}.$$

Retaining the same notation as in the case of reflection, we get

$$\frac{u-r}{u} = \mu \frac{v-r}{v},$$

or

$$\frac{\mu}{v} - \frac{1}{u} = \frac{\mu - 1}{r} \quad . \; . \; . \; . \; . \; . \; . \quad (1).$$

Notice that, if we put $\mu = -1$, this becomes the formula for *reflection* at a concave mirror.

Thin lenses.

Lenses.—Suppose now that, after passing a *very short* distance into the refracting medium, the ray escapes again into air through another spherical surface whose centre of curvature also lies in the line OA. Let *s* be the new radius of curvature, *w* the value of the quantity corresponding to *v* for the escaping ray. Then, remembering that the refractive index is now, $\frac{1}{\mu}$, we have (by the previous formula)

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[1] *Trans. R. S. E.*, vol. iii. (1791).

[2] Gilbert's *Annalen*, lvi.

[3] "The correspondence of these lines with those of Fraunhofer I have, with some difficulty, ascertained to be as follows:—

A, B, *f*, C, *g*, D, E, ... Wollaston's lines.
B, D, *b*, F, G, H, ... Fraunhofer's lines.

There is no single line in Fraunhofer's drawing of the spectrum, nor is there any in the real spectrum, coincident with the line C of Wollaston's, and indeed he himself describes it as not being 'so clearly marked as the rest.' I have found, however, that this line C corresponds to a number of lines half-way between *b* and F, which, owing to the absorption of the atmosphere, are particularly visible in the light of the sky near the horizon."—Brewster, *Report on Optics*, *Brit. Association*, 1832.

$$\frac{\frac{1}{\mu}}{w} - \frac{1}{v} = \frac{\frac{1}{\mu}-1}{s},$$

or

$$\frac{1}{w} - \frac{\mu}{v} = \frac{1-\mu}{s} \; . \; . \; . \; . \; . \; . \; . \quad (2).$$

Adding (1) and (2) we get rid of *v*, which indicates the behavior of the rays in the substance of the lens, and have

$$\frac{1}{w} - \frac{1}{u} = (\mu-1)\left(\frac{1}{r} - \frac{1}{s}\right).$$

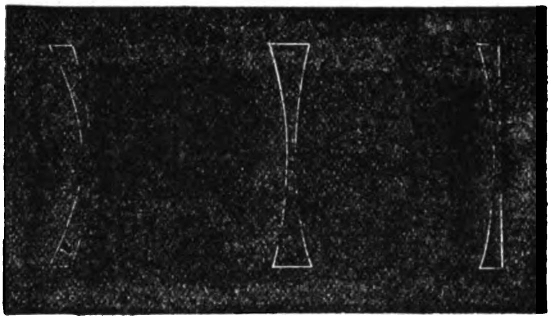

Fig. 16.

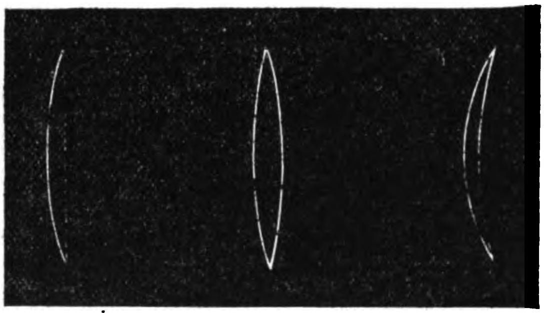

Fig. 17.

This contains the whole (approximate) theory of the behavior of a very thin *lens*.

When the source is at an infinite distance, or $u = \infty$, we have

$$\frac{1}{w} = (\mu-1)\left(\frac{1}{r} - \frac{1}{s}\right)$$

$$= \frac{1}{f} \text{ suppose.}$$

This quantity *f*, defined entirely in terms of the refractive index and of the curvatures of the two faces of the lens, is called the *principal focal distance*. If μ be greater than 1, *i. e.*, as in the case of a glass lens in air, *f* is *positive* if

$$\frac{1}{r} - \frac{1}{s}$$

Reversibility of thin lens.

be so; and it obviously retains the same value, and sign, if the lens be turned round. For, in the formula, *r* and *s* change places, and they also change signs; *i. e.*, we must put $-s$ for *r* and $-r$ for *s*. This leaves the result unchanged.

All lenses, therefore, whose sections are of any of the forms in fig. 16, whichever way they are turned, render parallel rays which pass through them *divergent*. Their characteristic is that they are thinnest at the middle. But

$$\frac{1}{r} - \frac{1}{s}$$

is negative for lenses whose sections are of any of the forms shown in fig. 17. Such lenses, whichever way they are turned, render parallel rays *convergent*. Their characteristic is that they are thickest at the middle. But these characters are interchanged when μ is less than 1; as, for instance, when the lens is an air-space surrounded by water. The similarity on reversal is *not* in general true in a second approximation.

The formula for a thin lens now takes the form,

$$\frac{1}{w} - \frac{1}{u} = \frac{1}{f},$$

and differs from that for a curved reflecting surface only in the sign of the second term. With the proper allowance for this, then, all that we have said of reflection at spherical mirrors holds true of refraction through thin lenses with spherical surfaces.

We may now put the whole matter in the excessively simple form which follows:—

A thin lens increases or diminishes by a definite quantity the convergence or divergence of all rays which pass through it.

This quantity is the divergence or convergence of rays falling on the lens from or passing from it to its principal focus. Or it is the convergence or divergence which the lens produces in parallel rays. Thus, if the distance of an object from a convex lens is twice the focal length of the lens, the image is formed at the same distance from the lens, and is equal in size to the object.

Images produced by lenses.

Real.

Virtual.

Figs. 18 and 19 show the production of a real image and of a virtual image by lenses which produce *convergence* of parallel rays —along with the rays by which these are seen by an eye placed behind the lens. In either case it is obvious that the sizes of object and image are, respectively, as their distances from the centre of the lens. Fig. 18 shows how a lens produces a real inverted image of a body placed farther from it than its principal focus. This is the case in the camera obscura, in the solar microscope, and in the object glass of a telescope. Fig. 19 shows how a virtual image is formed of a body placed nearer to a lens than its principal focus. This is the case of a single lens used as a microscope. In the former case the divergence of the incident rays is so small that the lens renders them convergent. In the latter the divergence is so great that the lens can only diminish, not destroy

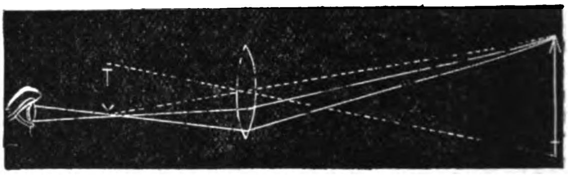

Fig. 18.

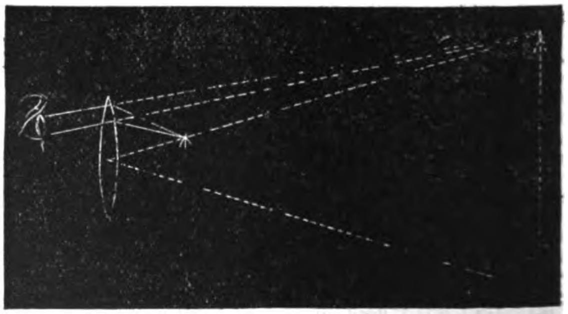

Fig. 19.

it. In using a hand-magnifier in this way, we so adjust it, by practice, that the enlarged image appears to be formed at the distance from the eye at which vision is most distinct. It is obvious that the amount of magnification must, then, be greater as the focal length of the lens is less.

Astronomical telescope. We can now understand the working of the ordinary *astronomical telescope* (fig. 20). The object glass furnishes an inverted but real image of a distant body, *within our reach*. We can, therefore, place the eye-glass (like the single microscope above spoken of) so as to form a virtual magnified image of this real image treated as an object. It is still, of course, inverted. It is easy to see that the angle subtended at the eye by the virtual image seen through the eye-piece is to that subtended by the object at the unaided eye approximately as the focal length of the object lens is to that of the eye lens. These angles are, in fact, those subtended at the centres of the two lenses by the real image. This ratio is, therefore, called the *magnifying power* of the telescope.

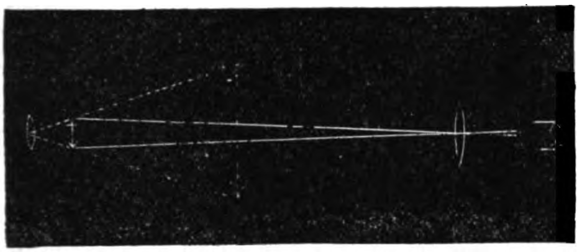

Fig. 20.

Compound microscope. The *compound microscope*, in its simplest form, is precisely the same arrangement as the astronomical telescope. The only difference is that the object, being at hand, can be placed near to the object-glass (still, however, beyond its principal focus), so that the real image formed is already considerably larger than the object, and is then still further magnified by the eye-glass.

The magnifying power of a single lens, when used as a hand microscope, is to be measured by the ratio of the angle under which the virtual image of an object is seen (at the distance of most distinct vision) to that at which the object itself would be seen (at that same distance); *i. e.*, it is the ratio of 10 inches to the focal length of the lens.

Lenses in contact. *Combinations of Lenses in Contact.*—From the formula

$$\frac{1}{f} = (\mu - 1)\left(\frac{1}{r} - \frac{1}{s}\right)$$

we see that the focal length of a simple lens is less as μ is greater. Thus all that we have just said is true for homogeneous light alone.

Achromatic lenses. But if we combine two thin lenses, placing them close together, we may arrive at an approximately achromatic arrangement. For we have, for the first lens,

$$\frac{1}{w} - \frac{1}{u} = \frac{1}{f}.$$

For a second, close to it, we have

$$\frac{1}{x} - \frac{1}{w} = \frac{1}{f'}.$$

For the two, considered as one, we have

$$\frac{1}{x} - \frac{1}{u} = \frac{1}{f} + \frac{1}{f'}.$$

Now

$$\frac{1}{f} + \frac{1}{f'} = (\mu - 1)\left(\frac{1}{r} - \frac{1}{s}\right) + (\mu' - 1)\left(\frac{1}{r'} - \frac{1}{s'}\right),$$

and there is an infinite number of ways in which r' and s' can be chosen, when r and s are given, such that the values of the right hand side shall be equal for *two* values of μ and the corresponding values of μ'. Any one of these gives an achromatic combination, of the necessarily imperfect kind described above in considering prisms. But, as we have now the curvatures of *four* surfaces to deal with, we can adjust these so as not only to make the best attainable approximation to achromatism, but also to reduce the unavoidable spherical aberration to a minimum.

These questions, however, are beyond the scope of this article. We can remark only that the adjustment for two rays, for which the refractive indices are μ and $\mu + \delta\mu$ in the first medium, and μ' and $\mu' + \delta\mu'$ in the second, requires the *one relation*

$$\frac{\delta\mu}{\mu - 1}\,\frac{1}{f} + \frac{\delta\mu'}{\mu' - 1}\,\frac{1}{f'} = 0,$$

which involves only the ratio of the focal lengths of the two lenses—leaving their forms absolutely undetermined. But, if both μ and μ' be greater than unity, the signs of f and f' must be different;—*i.e.*, in an achromatic combination of two lenses one must be convex and the other concave.

The reader must, however, be reminded that we are dealing with a first approximation only, and that spherical aberration does not come in till we reach a second. The details for a proper achromatic combination will be given in OPTICS (GEOMETRICAL).

Achromatic eye-pieces. Before leaving this subject, we must find the behavior of two thin lenses which are placed at a finite distance from one another. For the first lens we have, as before,

$$\frac{1}{w} - \frac{1}{u} = \frac{1}{f}.$$

If the second lens be placed at a distance a behind the first, the rays which fall on it appear to come from a distance $w + a$. Hence, for the light emerging from the second lens, we have

$$\frac{1}{x} - \frac{1}{w + a} = \frac{1}{f'}.$$

When u is infinite, we have from the last two equations

$$\frac{1}{x} = \frac{1}{f + a} + \frac{1}{f'}.$$

It is obvious that a combination of this nature offers the same kind of facilities for the partial cure of dispersion and of spherical aberration as when the lenses are in contact, with *one* additional disposable constant. Thus we have compound *achromatic eye-pieces*, which can be corrected for spherical aberration also.

Pure spectrum. *Formation of a Pure Spectrum.*—We may now go back to the formation of an image by a prism, and inquire how, by the use of an achromatic lens, we can project a pure spectrum on a screen. We have seen that a thin prism, for rays falling nearly perpendicular to it, forms a virtual and approximately rectilineal image of a luminous point, in which the colors are ranged in order of refrangibility. Suppose the light which passes through the prism to fall on an achromatic lens, placed at a distance greater than its focal length from the virtual image above mentioned. These rays after passing through the lens will proceed to form, at the proper distance, a real linear colored image of the luminous point, in which (as in the virtual image) the colors do not overlap. Instead of a luminous point, rays diverging from a very narrow slit parallel to the edge of the prism are employed. It is usual to place the lens at *double* its focal distance from the virtual image, and thus the real image is formed at an equal distance on the other side of it, and is of the same size. It may now, if required, be magnified by means of an achromatic eye-piece. Or, in other words, it may be examined by means of a telescope. In fact a telescope, whose object glass is covered by a thin prism, has been usefully employed during a total eclipse in examining the light of the solar corona. A similar arrangement, made to have an exceptionally large field of view, is employed to find the nature of the spectra of meteorites or falling stars.

Cylindrical refractor.

Refraction at a Cylindrical Surface.—A very simple, but interesting, case of refraction at a cylindrical surface is furnished by a thermometer tube. It is easily seen that the diameter of the bore appears, to an eye at a distance large as compared with the diameter of the tube, to be greater than it really is, in the proportion of the refractive index of the glass to unity. Thus in flint glass it appears magnified in about the ratio 5 : 3. Hence the mercury appears completely to fill the external surface of such a tube, if the bore be only $\frac{3}{5}$ths of the external diameter.

Rainbow.

But a far more interesting case is that of parallel rays falling on a solid cylinder of glass or water. Its interest consists in the fact that by its aid we can explain the phenomena of the *rainbow*. We, accordingly, devote special attention to it. The problem, without losing any of its applicability to the rainbow, is much simplified by supposing the rays to be incident in a direction perpendicular to the axis of the cylinder; for in this case the whole course of each ray is in a plane perpendicular to the axis. We need not treat here of rays which pass *close to* the axis of the cylinder. For such the cylinder acts as a lens, and its focal length (to the usual first approximation) can easily be obtained by methods such as those given above. What we are mainly concerned with is the behavior of the rays which escape into the air, after *one* or *two* reflections at the inner surface of the cylinder.

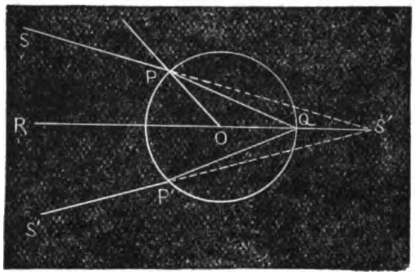

Fig. 21.

Suppose first that we consider a ray once reflected in the interior of the cylinder. Let SP (fig. 21) be one of the set of incident parallel rays, and let its path be SPQP′S′. This involves refraction at P, reflection at Q, and again refraction at P′. But it is obvious from the symmetry of the circular section, and from the laws of refraction and reflection, that this path is symmetrical about the line OQ which joins the axis of the cylinder to the point at which the ray is reflected. Hence SP, S′P′, meet OQ in the common point *s*; and the amount by which the direction of the ray has been turned round by the refractions and the reflection is twice the supplement of half the angle at *s*. But the angle POR is double OPQ the angle of refraction, while OP*s* is equal to the angle of incidence. Hence the half angle at *s* is the excess of twice the angle of refraction over the angle of incidence.

Turn now to fig. 22, in which we have two concentric circles whose radii are to one another as the refractive index of the cylinder is to unity. If A be any point on a diameter, and tangents A*p* and A*q* be drawn from it, we see at once that the sines of the angles at A are to one another as the radii of the circles. Hence, if OA*p* be the angle of incidence, OA*q* is the corresponding angle of refraction; and it is easy to see that the half angle at *s* (in fig. 21) will in fig. 22 be represented by the *excess* of OA*q* over *q*A*p*. Now when OA is large, both of these angles are small, and thus their difference is likewise small. As OA becomes less the difference of the angles becomes greater, but only up to a certain point, for when A is near the outer circle the angle OA*p* begins to increase much faster than does OA*q*. Hence there is a single definite position of A for which the difference is a *maximum*. In the first figure these changes in the angles of incidence and refraction, for the members of a group of parallel rays, correspond to the varying position of P in the circular section of the cylinder. Hence there is *one* position of P for which the angle at *s* is a maximum. Now one of the conditions of a maximum or minimum of any quantity is that, near it, the value of the quantity *changes very slowly*. Thus a number of issuing rays are crowded together near the direction corresponding to this maximum, the others being more widely scattered,—while for all of them the angle at *s* is smaller. Newton gives us as an illustration of this, the very slow change of length of the day when the sun is near one of the tropics.

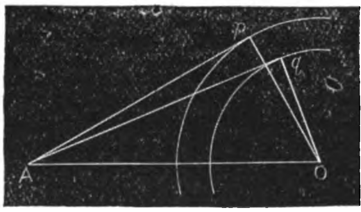

Fig. 22.

Crowding of rays about a position of maximum or minimum deviation.

To find this Maximum Angle.—If θ be the angle of incidence, ϕ that of refraction, and μ the refractive index, we have to find the maximum value of

$$\tfrac{1}{2}s = 2\phi - \theta \quad \ldots\ldots\ldots \quad (1),$$

with the condition

$$\sin\theta = \mu\sin\phi \quad \ldots\ldots\ldots \quad (2).$$

These give at once

$$2d\phi + d\theta,$$

and

$$\mu\cos\phi\, d\phi = \cos\theta\, d\theta.$$

Hence

$$\mu\cos\phi = 2\cos\theta \quad \ldots\ldots \quad (3).$$

From (2) and (3) we have

$$3\cos^2\theta = \mu^2 - 1;$$

which determines the requisite angle of incidence. The values of the other quantities are easily calculated from this; and we finally have, for the maximum value of the sine of the half angle at *s*, the expression

$$\frac{1}{\mu^2}\left(\frac{4-\mu^2}{3}\right)^{\frac{3}{2}} \quad \ldots\ldots\ldots \quad (4).$$

This is obviously smaller as μ is greater, at least up to the limit $\mu = 2$.

With the value $\frac{4}{3}$ for μ (which is nearly that for yellow rays refracted into water) we have

$$\text{L}\sin\tfrac{1}{2}s = 9{\cdot}55462,$$

which corresponds very nearly to

$$\tfrac{1}{2}s = 21^\circ\ 1'.$$

Now suppose the diameter of the cylinder to be small compared with the distance of the eye from it. In this case the point *s* may be considered as being in the axis of the cylinder.

Let S*s*E$_1$ (fig. 23) be made equal to the maximum value of *s*; then an eye placed anywhere in the line *s*E$_1$ will receive the rays which are congregated towards the maximum. An eye *within* the angle S*s*E$_1$ (as at E$_2$) will receive some of the straggling rays, while an eye outside that angle (as at E$_3$) will see nothing. Let there now be imagined a great number of parallel cylinders; let E$_1\sigma$ be drawn parallel to the incident rays.

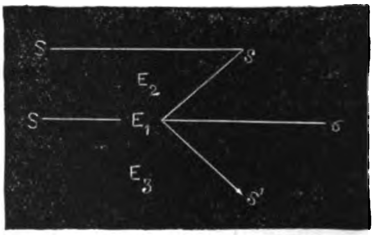

Fig. 23.

and make the angle $\sigma E_1 s'$ equal to $\sigma E_1 s$. Then the eye at E_1 will see the concentrated rays (already spoken of) in the directions $E_1 s$ and $E_1 s'$. From points within $sE_1 s'$ some straggling rays will reach it, from points outside that angle none.

Primary rainbow.

Homogeneous light.

Now suppose cylinders to be placed in great numbers *in all directions* perpendicular to the incident rays. The eye at E_1 will see a bright *circle* of light whose centre is in $E_1\sigma$. Inside that circle there will be feeble illumination; outside it, darkness. This is obviously the case of the rainbow, where we have spherical drops of water instead of the cylinders above spoken of. For each spherical drop is effective only in virtue of a section through its centre, containing the incident ray and the eye; and such sections are the same as those of the cylinders.

Thus far we have been dealing with *parallel* rays of *homogeneous* light; and the appearance (to the degree of approximation we have adopted) is that of a bright circle whose centre is diametrically opposite to the source of light, whose radius is (for raindrops) about 42° 2′, and whose area is slightly illuminated.

White light.

Finite disk of sun.

Introduce the idea of the different kinds of homogeneous light which make up sunlight, and we find a circular (almost pure) spectrum—the less refrangible rays being on the outside. Next we introduce the consideration of the finite disk of the sun, and we have an infinite series of such arrangements superposed on one another, the centre of each individual of the series being at the point diametrically opposite to the point of the sun's disk which produced it. This leaves the *general* aspect of the phenomenon unchanged, but altogether destroys the purity of the spectrum.

If we next consider light which has been twice reflected within the cylinder, we have a figure like the diagram fig. 24; where the lettering is as nearly as possible the same as that in fig. 23. Everything is still symmetrical about the line Os, which obviously cuts at right angles the ray QQ'.

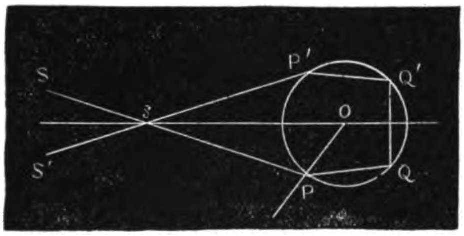

Fig. 24.

Reasoning precisely similar to that above given shows that the complement of half the angle at s is now equal to the excess of *thrice* the angle of refraction (OPQ) over that of incidence (the supplement of OPs), and that this also has a maximum value, *i. e.*, that s itself has a minimum value.

To find it, we have

$$\frac{\pi}{2} - \tfrac{1}{2}s = 3\phi - \theta,$$

with,

$$\sin\theta = \mu \sin\phi.$$

Differentiating, etc., as before, we find

$$8\cos^2\theta = \mu^2 - 1,$$

whence, finally,

$$\sin\tfrac{1}{2}s = \frac{\mu^4 + 18\mu^2 - 27}{8\mu^3}.$$

This quantity increases with μ, for its differential coefficient is

$$\frac{1}{8}\left(\frac{9}{\mu^2} - 1\right)^2,$$

which is necessarily positive. (It vanishes, no doubt, for $\mu = 3$, but then so does θ.)

For $\mu = \frac{4}{3}$ the value of $\sin\frac{1}{2}s$ is

$$0{\cdot}4303 \text{ nearly},$$

so that

$$s = 50°\ 58'.$$

Secondary rainbow.

Carrying out the same steps of reasoning as before, and applying the result to raindrops, we find a second rainbow concentric with the first, but with a greater radius, viz., about 51° (for yellow light). All the above remarks about the impurity of the spectrum, etc., apply to this bow also. In this bow the less refrangible rays are on the *inner* side, and the straggling rays illuminate feebly the space *outside* it. Hence the space between the red boundaries of the two bows has no illumination from rays reflected either once or twice within the water drops.

What we have now given is nearly all that geometrical optics can tell us about the rainbow. It seems that the first really important steps in the explanation, viz., (1) that the primary bow is due to rays falling on the outer portions of the drops, which suffer two refractions and one reflection before reaching the eye, and (2) that the secondary bow is due to rays falling on the inner side, and suffering two refractions and two reflections, are due to Theodorich, about 1311. His work was not published, and its contents were first announced by Venturi[1] in the present century. These results were, independently, discovered by De Dominis[2] in 1611. Neither of these writers, however, pointed out the concentration of the rays in particular directions. This was done by Descartes in 1637, by the help of Snell's law. He calculated with great labor the paths of each of 10,000 parallel rays falling on different parts of one side of the drop, and showed that from the 8500th to the 8600th the angle between the extreme issuing rays is measured in *minutes* of arc,—thus discovering by sheer arithmetic the maximum which, as we have seen above, is so easily found by less laborious methods. Newton's addition to this theory consisted mainly in applying his discovery of the different refrangibilities of the different homogeneous rays. The explanation was then thought to be complete. For a long time this was held to be one of Newton's most brilliant discoveries. It is well to notice that he himself speaks of it in its true relation to the work of his predecessors. He merely says:—"But whilst they understood not the true origin of colors, it is necessary to pursue it here *a little further*." And he said well; for a full investigation conducted on the principles of the undulatory theory introduces, as was first pointed out by Young, certain important modifications in the above statements. Of these we need mention only one, viz., that in each bow there is more than one maximum of brightness for each homogeneous ray.

Spurious bows.

Complete theory of rainbow.

The *spurious* bows, as they are called, which often appear like ripples, inside the primary and outside the secondary bow, and which depend upon the fact just mentioned, have no place in even Newton's theory. About them, in fact, geometrical optics has nothing to say. Young, in 1804, took the first step for their explanation. They were fully investigated, from the undulatory point of view, by Airy, in 1836–38; and his results were completely verified by the measurements of Hallows Miller in 1841.[3] Miller used a fine cylinder of water escaping vertically from a can. This is *one* of the reasons which induced us to treat the subject as a case of refraction and reflection in a right cylinder.

White bows.

The overlapping of the colors in the rainbow, due to the apparent size of the sun's disk, is occasionally so greatly exaggerated that only faint traces of color appear. This may happen, for instance, when the sun shines on raindrops in the lower strata of the atmosphere through clouds of ice-crystals in the higher strata. By reflection from the faces of these crystals, the source of light is spread over a much larger spherical angle, and there is no sharp edge to it as in the case of the unclouded disk. The rainbow is then much broader and fainter than usual, and nearly white. The size of the drops also produces modifications which are not indicated by the geometrical theory.

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[1] *Commentari sopra la storia e le teorie dell' Ottica*, Bologna, 1814.

[2] Newton, in his *Optics*, says the work of De Dominis was written twenty years before it was published.

[3] Airy's paper is in vol. vi. of the *Cambridge Phil. Trans.*, Miller's in vol. vii.

Lunar rainbow. When the moon is the source of light, the rainbow is so faint that it is often difficult to distinguish the colors; but with full moon, and other favorable circumstances, it is easy to assure one's self that the colors are really present.

Halos. The refraction of sunlight, or moonlight, through ice-crystals forming cirrhus clouds, gives rise to colored *halos*, *parhelia*, *paraselenæ*, etc. Their approximate explanation depends upon the behavior of prisms with angles of 60° or 90°, and therefore does not come within the scope of the present article. They must not, however, be confounded with

Corona. *coronæ*, those rings which encircle the sun or moon when seen through a mist or cloud. Halos have definite radii depending on the definite angles of ice-crystals; the size of a corona depends on the size of the drops of water in a mist or cloud, being smaller as the drops are larger. Thus their diminution in radius shows that the drops are becoming larger, and implies approaching rain. They are due to *diffraction*, and can only be explained by the help of the undulatory theory.

Non-homogeneous medium. *Refraction in a Non-Homogeneous Medium.*—The principles already explained are sufficient for the purpose of treating this question also. But they require, for their application, the artifice of supposing the medium to be made up of layers, in each of which the refractive power is the same throughout the layer, but finitely differs from one layer to another, and then supposing these layers to become infinitely thin and infinitely numerous. In this case there will of course be only an infinitely small difference in properties between contiguous layers; and the abrupt change of direction which accompanies ordinary refraction is now replaced by a *continuous curvature* of the path of the ray.

Hamilton's general investigations. Glimpses of a more general method had been obtained even in the 17th century; and in the 18th these had become a consistent process so far as application to the corpuscular theory is concerned. But it was reserved for Sir W. R. HAMILTON (*q. v.*) to discover the existence of what he called the *characteristic function*, by the help of which all optical problems, whether on the corpuscular or on the undulatory theory, are solved by one common process. Hamilton was in possession of the germs of this grand theory some years before 1824, but it was first communicated to the Royal Irish Academy in that year, and published in imperfect instalments some years later. The following is his own description of it. It is extremely important as showing his views on a very singular part of the more modern history of science.

"Those who have meditated on the beauty and utility, in theoretical mechanics, of the general method of Lagrange, who have felt the power and dignity of that central dynamical theorem which he deduced, in the *Mécanique Analytique* . . . , must feel that mathematical optics can only *then* attain a co-ordinate rank with mathematical mechanics . . . , when it shall possess an appropriate method, and become the unfolding of a central idea. . . . It appears that if a general method in deductive optics can be attained at all, it must flow from some law or principle, itself of the highest generality, and among the highest results of induction. . . . [This] must be the principle, or law, called usually the Law of Least Action; suggested by questionable views, but established on the widest induction, and embracing every known combination of media, and every straight, or bent, or curved line, ordinary or extraordinary, along which light (whatever light may be) extends its influence successively in space and time; namely, that this linear path of light, from one point to another, is always found to be such that, if it be compared with the other infinitely various lines by which in thought and in geometry the same two points might be connected, a certain integral or sum, called often *Action*, and depending by fixed rules on the length, and shape, and position of the path, and on the media which are traversed by it, is less than all the similar integrals for the other neighboring lines, or, at least, possesses, with respect to them, a certain *stationary* property. From this Law, then, which may, perhaps, be named the LAW OF STATIONARY ACTION, it seems that we may most fitly and with best hope set out, in the synthetic or deductive process and in the search of a mathematical method.

"Accordingly, from this known law of least or stationary action I deduced (long since) another connected and coextensive principle, which may be called by analogy the LAW OF VARYING ACTION, and which seems to offer naturally a method such as we are seeking; the one law being as it were the last step in the ascending scale of induction, respecting linear paths of light, while the other law may usefully be made the first in the descending and deductive way.

"The former of these two laws was discovered in the following manner. The elementary principle of straight rays showed that light, under the most simple and usual circumstances, employs the direct, and therefore the shortest, course to pass from one point to another. Again, it was a very early discovery (attributed by Laplace to Ptolemy), that, in the case of a plane mirror, the bent line formed by the incident and reflected rays is shorter than any other bent line having the same extremities, and having its point of bending on the mirror. These facts were thought by some to be instances and results of the simplicity and economy of nature; and Fermat, whose researches on maxima and minima are claimed by the Continental mathematicians as the germ of the differential calculus, sought anxiously to trace some similar economy in the more complex case of refraction. He believed that by a metaphysical or cosmological necessity, arising from the simplicity of the universe, light always takes the course which it can traverse in the shortest time. To reconcile this metaphysical opinion with the law of refraction, discovered experimentally by Snellius, Fermat was led to suppose that the two lengths, or *indices*, which Snellius had measured on the incident ray prolonged and on the refracted ray, and had observed to have one common projection on a refracting plane, are inversely proportional to the two successive velocities of the light before and after refraction, and therefore that the velocity of light is diminished on entering those denser media in which it is observed to approach the perpendicular; for Fermat believed that the time of propagation of light along a line bent by refraction was represented by the sum of the two products, of the incident portion multiplied by the index of the first medium, and of the refracted portion multiplied by the index of the second medium; because he found, by his mathematical method, that this sum was less, in the case of a plane refractor, than if light went by any other than its actual path from one given point to another, and because he perceived that the supposition of a velocity inversely as the index reconciled his mathematical discovery of the minimum of the foregoing sum with his cosmological principle of least time. Descartes attacked Fermat's opinions respecting light, but Leibnitz zealously defended them; and Huygens was led, by reasonings of a very different kind, to adopt Fermat's conclusions of a velocity inversely as the index, and of a *minimum time* of propagation of light, in passing from one given point to another through an ordinary refracting plane. Newton, however, by his theory of emission and attraction, was led to conclude that the velocity of light was *directly*, not *inversely*, as the index, and that it was *increased* instead of being *diminished* on entering a denser medium; a result incompatible with the theorem of the shortest time in refraction. This theorem of shortest time was accordingly abandoned by many, and among the rest by Maupertuis, who, however, proposed in its stead, as a new cosmological principle, that *celebrated law of least action* which has since acquired so high a rank in mathematical physics, by the improvements of Euler and Lagrange.

"Maupertuis gave the name of *action* to the product of space and velocity, or rather to the sum of all such products for the various elements of any motion,—conceiving that the more space has been traversed and the less time it has been traversed in, the more action may be considered to have been expended; and by combining this idea of action with Newton's estimate of the velocity of light as increased by a denser medium, and as proportional to the refracting index, and with Fermat's mathematical theorem of the minimum sum of the products of paths and indices in ordinary refraction at a plane, he concluded that the course chosen by light corresponded always to the *least possible action*, though not always to the least possible time. He proposed this view as reconciling physical and metaphysical principles which the results of Newton had seemed to put in opposition to each other; and he soon proceeded to extend his law of least action to the phenomena of the shock of bodies. Euler, attached to Maupertuis, and pleased with these novel results, employed his own great mathematical powers to prove that the law of least action extends to all the curves described by points under the influence of central forces; or, to speak more precisely, that if any such curve be compared with any other curve between the same extremities, which differs from it indefinitely little in shape and in position, and may be imagined to be described by a neighboring point with the same law of velocity, and if we give the name of action to the integral of the product of the velocity and element of a curve, the difference of the two neighboring values of this action will be indefinitely less than the greatest linear distance (itself indefinitely small) between the two near curves; a theorem which I think may be advantageously expressed by saying that the action is *stationary*. Lagrange extended this theorem of Euler to the motion of a system of points or bodies which act in any manner on each other; the action being in this case the sum of the masses by the foregoing integrals.

"Laplace has also extended the use of the principle in optics, by applying it to the refraction of crystals, and has pointed out an analogous principle in mechanics, for all imaginable connections between force and velocity."

Varying action. Corpuscular theory.

We give, first, a very brief indication of the nature of Hamilton's method, as applicable directly to the corpuscular theory. Here the *action* of a corpuscle is the quantity which possesses the stationary property. Let v be the velocity at any point x, y, z of the medium, ds an element of the path, α, β, γ the direction cosines of ds, which are supposed to enter linearly and homogeneously into the expression for v. Then the action V is given by

$$V = \int v ds.$$

Hence, for a path nowhere finitely distant from the first,

$$\delta V = \int (\delta v ds + v d\delta s).$$

But

$$\delta v = \frac{dv}{dx}\delta x + \frac{dv}{dy}\delta y + \frac{dv}{dz}\delta z$$
$$+ \frac{dv}{d\alpha}\delta\alpha + \frac{dv}{d\beta}\delta\beta + \frac{dv}{d\gamma}\delta\gamma,$$

the first three terms depending on the *translation* of the element ds, the others on its *change of direction*, and all the differential coefficients being partial. The homogeneity of v gives

$$\alpha\frac{dv}{d\alpha} + \beta\frac{dv}{d\beta} + \gamma\frac{dv}{d\gamma} = v.$$

Also

$$d\delta x = \delta dx = \delta.\alpha ds = \delta\alpha.ds + \alpha d\delta s,$$

with two similar equations in y and z.

By the help of these, and a partial integration of the factors $d\delta x$, etc., we have

$$\delta V = \frac{dv}{d\alpha}\delta x + \frac{dv}{d\beta}\delta y + \frac{dv}{d\gamma}\delta z$$
$$+ \int \left[\delta x\left(\frac{dv}{dx}ds - d\frac{dv}{d\alpha}\right) + \ldots\ldots\right],$$

where the integrated part is to be taken between proper limits.

If the initial and final points of the path be fixed, δx, etc., vanish in the integrated part, and the stationary condition shows that we must have

$$\frac{dv}{dx}ds - d\frac{dv}{d\alpha} = 0,$$

with other two similar conditions, only two of the three being independent because of the necessary relation

$$\alpha^2 + \beta^2 + \gamma^2 = 1.$$

These may be regarded as the differential equations of the ray, or path of the corpuscle.

But the essence of Hamilton's method of *varying action* depends upon a change of the terminal point of the ray, and leads at once to the three equations

$$\frac{\delta V}{\delta x} = \frac{dv}{d\alpha}, \quad \frac{\delta V}{\delta y} = \frac{dv}{d\beta}, \quad \frac{\delta V}{\delta z} = \frac{dv}{d\gamma},$$

which follow directly from the general value of δV above, by taking account of the vanishing of the unintegrated part in consequence of the stationary condition. We may now write d for δ everywhere in these expressions.

In any *isotropic* body, homogeneous or not, it is clear that

$$dV = v(\alpha dx + \beta dy + \gamma dz);$$

and then we have, to determine V, the partial differential equation

$$\left(\frac{dV}{dx}\right) + \left(\frac{dV}{dy}\right)^2 + \left(\frac{dV}{dz}\right)^2 = v^2.$$

The treatment of this equation is precisely the same as that of the corresponding one which will presently be derived from the undulatory view of the question.

Undulatory theory.

We will now illustrate the application of Hamilton's method to the undulatory theory, in which the *time* of passage from one point of the path to another is the characteristic which fulfils the stationary condition. For the sake of limitation, we will confine ourselves to its application to single refraction in a non-homogeneous medium. In such a medium the velocity of light, at any point, is the same whatever be the direction of the ray. Hence it depends only upon the co-ordinates of the point, and upon some characteristic (say the wave-length) of the light considered.

If τ be this time of passage, ds an element of the path, and v the velocity of light in that element, we must have

$$\tau = \int \frac{ds}{v},$$

a quantity fulfilling the stationary condition. This gives

$$\delta\tau = \int \frac{d\delta s}{v} - \int \frac{ds\delta v}{v^2}.$$

Now, by what has just been said, if λ be the wave-length, we have an equation expressing the data of the problem,

$$v = f(\lambda, x, y, z),$$

where the form of f depends on the arrangement of the parts of the medium. Hence

$$\delta\tau = \int \frac{dxd\delta x + dyd\delta y + dzd\delta z}{vds} - \int \frac{ds}{v^2}\left(\frac{dv}{d\lambda}\delta\lambda + \frac{dv}{dx}\delta x + \ldots\right)$$
$$= \left[\frac{1}{v}\left(\frac{dx}{ds}\delta x + \ldots\right)\right] - \delta\lambda \int \frac{1}{v^2}\frac{dv}{d\lambda}ds - \text{etc.}$$

The unwritten part consists of an integral which, by the stationary condition, vanishes if the ray be of a definite wave-length, and the terminal points through which it passes be given, *i. e.*, if $\delta x, \delta y, \delta z$, be each equal to 0.

The rest of the expression depends on the terminal points of the ray, and on the wave-length, only. It gives the equations

$$\frac{\delta\tau}{\delta x} = \frac{1}{v}\frac{dx}{ds}, \quad \frac{\delta\tau}{\delta y} = \frac{1}{v}\frac{dy}{ds}, \quad \frac{\delta\tau}{\delta z} = \frac{1}{v}\frac{dz}{ds},$$

and

$$\frac{\delta\tau}{\delta\lambda} = -\int \frac{1}{v^2}\frac{dv}{d\lambda}ds.$$

Squaring and adding the first three, we have

$$\left(\frac{\delta\tau}{\delta x}\right)^2 + \left(\frac{\delta\tau}{\delta y}\right)^2 + \left(\frac{\delta\tau}{\delta z}\right)^2 = \frac{1}{v^2}.$$

It is easily shown, by a process similar to that used for *varying action* (see MECHANICS), that, if we can find a complete integral of this equation, containing therefore two arbitrary constants, in the form

$$\tau = F(x, y, z, \lambda, \alpha, \beta),$$

then

$$\frac{d\tau}{d\alpha} = \mathfrak{A}, \quad \frac{d\tau}{d\beta} = \mathfrak{B}$$

are the equations of two series of surfaces whose intersections give the paths of the rays. $\mathfrak{A}$ and $\mathfrak{B}$ here are also arbitrary constants. (These four constants are necessary, and sufficient, for the purpose of making the two intersecting surfaces pass each through any two given points.)

Maxwell's fish-eye problem.

As an illustration, let us suppose the light to be homogeneous, and the medium to be arranged in concentric spherical shells such that the velocity at a distance r from their centre is expressed by

$$v = \frac{b^2 + r^2}{c},$$

where b and c are absolute constants. It is easy to see that, on account of the symmetry, the path of every ray is in a plane through the centre of the spheres. We may therefore restrict our work to the plane of x, y passing through that centre.

The equation is then

$$\left(\frac{d\tau}{dx}\right)^2 + \left(\frac{d\tau}{dy}\right)^2 = \frac{c^2}{(b^2 + r^2)^2};$$

or, by change to polar co-ordinates,

$$\left(\frac{d\tau}{dr}\right)^2+\frac{1}{r^2}\left(\frac{d\tau}{d\theta}\right)^2=\frac{c^2}{(b^2+r^2)^2}.$$

What we require is a sufficiently general solution. Assume, therefore,

$$\frac{d\tau}{d\theta}=\alpha,$$

and we have

$$\frac{d\tau}{dr}=\sqrt{\frac{c^2}{(b^2+r^2)^2}-\frac{\alpha^2}{r^2}}.$$

From these

$$\tau=\alpha\theta+\int dr\sqrt{\frac{c^2}{(b^2+r^2)^2}-\frac{\alpha^2}{r^2}}.$$

The equation of the path is therefore

$$\mathfrak{A}=\frac{d\tau}{d\alpha}=\theta-\alpha\int\frac{dr}{r^2\sqrt{\frac{c^2}{(b^2+r^2)^2}-\frac{\alpha^2}{r^2}}}$$

$$=\theta-\cos^{-1}\frac{b^2-r^2}{r\sqrt{\frac{c^2}{\alpha^2}-4b^2}},$$

or

$$\frac{b^2-r^2}{r}=\sqrt{\frac{c^2}{\alpha^2}-4b^2}\cos(\theta-\mathfrak{A}).$$

This is the equation of a series of circles, whose *one common characteristic* is that the rectangle under the segments of any chord which passes through the origin is b^2.

Hence every ray in any diametral plane describes a circle; and pairs of conjugate foci are situated on a line through the centre, the rectangle under their distances from the centre being b^2. The property holds therefore for all rays in the medium. This very singular ideal arrangement was suggested to Clerk Maxwell by the eye of a fish. He has given an investigation of it, by a totally different analysis, in the *Cambridge and Dublin Mathematical Journal*, vol. ix. As an illustration of those effects of want of homogeneity to which (as already stated) all the complex phenomena of *mirage*, etc., are due, it may be well to consider this simple case more closely. We will therefore consider how images are seen in such a medium. To get rid of the difficulty which would arise from finite change of density if an eye were supposed to be plunged in the medium, we will suppose it to be cut across by a crevasse whose surface is everywhere nearly at right angles to the rays by which the image is to be seen,—the eye being then placed (in air) close to such a cutting surface.

Let AB (fig. 25) be a small object, O the centre of the spherical layers of equal refractive index. Then every ray from A describes a circle which passes through A′, where AOA′ is a straight line, and

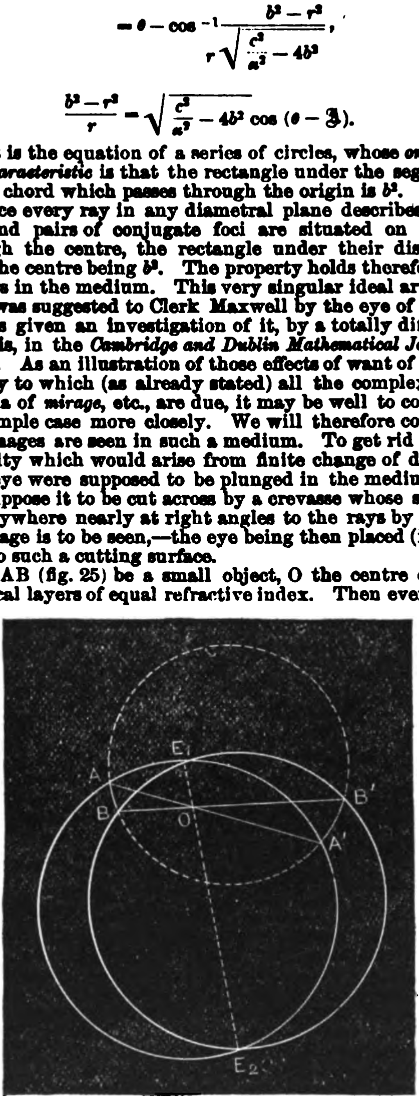

Fig. 25.

$$AO.OA'=b^2.$$

A similar construction gives B′ from B.

To an eye placed at E_1 (in a little crevasse as before explained), and looking towards the object, it will be seen erect,—A being seen in the direction of a tangent to the circle through AE_1A', and similarly for B. Here the rays have not passed through their conjugate focus. But if the eye be now turned away from the object, it (or rather its image) will be seen, A′ in the direction opposite to that in which A was seen, B′ in the opposite direction to B. The image will now be an *inverted* one, but it will easily be seen to possess a strange peculiarity. For what is now seen will be the *back* of the object, the side farthest from the eye. The reader may easily trace for himself the course of the rays which would fall on the eye in any other assigned position. Vision in such cases would usually be of a peculiar character from another point of view, viz., the amount of divergence in the plane of the figure will in general differ from that perpendicular to its plane, and therefore the rays would have different divergence for the height and for the breadth of the image. These would therefore appear at different distances from the spectator. This, however, could be cured by a proper cylindrical lens. It is clear from this example (which has been chosen for its special simplicity) that want of homogeneity in a refracting medium is capable of producing phenomena of the most extraordinary character.

Mirage.

It is difficult to ascertain exactly what is the condition of the atmosphere when multiple images, mirage, etc., are seen; and it is obvious from the remarks and illustrations already given that many very different arrangements will produce sensibly the same result to a spectator in a given position. Comparison of the appearances seen simultaneously by a great number of scattered observers is the only way in which we can expect to obtain definite information on such a point. But the following investigation suggests the general nature of the explanation.

If we suppose the refractive index of the air to depend only upon the vertical height above the earth's surface, rays will all travel in vertical planes, and Hamilton's equation (neglecting the curvature of the earth's surface) takes the very simple form

$$\left(\frac{d\tau}{dx}\right)+\left(\frac{d\tau}{dy}\right)^2=f(y),$$

x being measured horizontally, and the refractive index being proportional to $\sqrt{f(y)}$.

This equation gives, as before,

$$\tau=\alpha x+\int dy\sqrt{f(y)-\alpha^2},$$

and the equation of the path of a ray is

$$\frac{d\tau}{d\alpha}=\mathfrak{A}=x-\alpha\int\frac{dy}{\sqrt{f(y)-\alpha^2}}.$$

Here, on the corpuscular theory, α is the horizontal velocity of the light, and $\sqrt{f(y)-\alpha^2}$ the vertical velocity. If the form of f and the value of α be such that we can have $f(\eta)-\alpha^2=0$, it is clear that at $y=\eta$ the ray is for a moment horizontal. The form of the equation of the ray shows that it has a *vertex* at this point, and that it is symmetrical about a vertical axis passing through the vertex. If ξ, η be the co-ordinates of the vertex for a ray passing through the point 0, b, we have the relation

$$\xi=\sqrt{f(\eta)}\int_b^\eta\frac{dy}{\sqrt{f(y)-f(\eta)}}.$$

This is the equation of the locus of the vertices of all rays which, starting from a given point, return again to the same level. To find, then, the various rays by which a distant object near the horizon can be seen, all that we have to do is to draw the curve of vertices which passes through the eye of the spectator, and to find the points in which it is intersected by a vertical line situated midway between the object and the eye. Each of these points is the vertex of a ray by which the object can be seen. When the curve of vertices leans forward towards the eye at one of these points, two contiguous rays cross one another, and an inverted image is seen; when it leans from the eye, they do not cross, and the image is erect.

Now, when the curve of vertices is traced, from the above formula, for an arrangement of the air such that the refractive index falls off through a horizontal stratum of air from a greater value below the stratum to a smaller value above it, it is found that the curve of vertices in the stratum can in general be cut by a vertical line in one point only. But if the refractive index have a nearly *stationary* value at the upper boundary of the stratum the curve of vertices can be cut twice, or not at all, by a vertical line. When there is no intersection we have only the direct image; but when there are two intersections a distant ship will be seen as usual through the lower uniform air, while there will be seen above it an inverted image, and then a direct image, both due to the stratum. This is a form of mirage very commonly seen at sea.[1] When there is no *stationary* value of the index at the upper boundary, the upper erect image is not given by the stratum. This arrangement, however, turned upside down, explains the ordinary mirage of the desert—where we see objects directly through the nearly uniform air at some distance above the sand, but also an inverted image (suggesting reflection from a pool or lake) formed by the refraction in the hot layer of air near the sand.

Scattering and absorption.

ABSORPTION, FLUORESCENCE.—We must now take up the *third* and *fourth* of the categories under which light incident on the bounding surface of two media may fall—*scattering* and *absorption*. We take them together, because in the great majority of bodies, as we have already seen, scattering takes place not merely at the surface but within some distance below the surface, which in general is small, but in some cases considerable. And when the scattering takes place, even in part only, below the surface, the scattered light is usually modified by absorption.

Whiteness of froth, snow, clouds, etc.

An excellent instance of this scattering from below the surface is afforded by a mass of thin films or small particles of transparent bodies, such as glass, water, or ice. Thus pounded glass, froth or foam, snow, clouds, etc., appear brilliantly white in sunlight, and are, in consequence, opaque when in layers of sufficient thickness. Here the light is obviously scattered by reflection. What passes through one film, crystal, or particle is, in part, reflected from the next, and so on.

Even when the froth consists of bubbles of a highly colored liquid, such as porter, for instance, it usually shows but slight traces of color, for the great majority of the scattered rays have passed through very small thicknesses only of the liquid. In the same way, very finely pounded blue or red glass (unless it be exceedingly deeply colored when in mass) appears nearly white.

Color of the sea.

But when a mass of water is full of air bubbles, as, for instance, is the case in the neighborhood of a breaker, the light reflected from the surfaces of these bubbles suffers a double absorption by the water before it reaches the eye. This is one of the causes of the exquisite colors of the sea. Near shore, or in shoal water, another cause sometimes comes into play, viz., fine solid particles suspended in the water. When such particles, whether in air or in water, are exceedingly small, they may produce colors due to their minuteness alone, and not to their own color nor to the absorptive properties of the medium. This, however, is a question of physical optics.

In general, even the most highly colored opaque or translucent solids, such as painted wood or stained paper, are visible by scattered light whatever portion of the spectrum falls on them. This is very well seen with highly colored paper-hangings, when illuminated by homogeneous light, such as that of a sodium flame (a Bunsen flame, into which is thrust a platinum wire dipped in strong brine). The red, orange, and yellow parts usually appear very bright under such treatment, the blue parts appearing but slightly illuminated. The color of all is, of course, that of the incident light. It appears, therefore, that *some* of the light is scattered from the surface. It is by this, for instance, that the blue parts are feebly visible. But that which is scattered from the portions colored red, orange, etc., must come mainly from under the surface.

Mixtures of pigments.

An excellent proof of this is furnished by mixing, in proper proportions, a yellow and a blue powder, or yellow and blue paints. It is commonly imagined that the green color which is thus produced is a *mixture* of blue and yellow. Far from it! When a disk divided into alternate sectors, colored with the same blue and yellow pigments, is made to rotate rapidly in its own plane, it of course produces on the eye the true result of a mixture of these blue and yellow colors. This depends for its exact tint on the pigments employed, and on the angles of the sectors, but is usually a faint pink or a muddy purple,—utterly different from the green produced by mixing the powders or the paints. Helmholtz was the first to point out the true source of the green. It is the *one color* which is not freely absorbed either by the yellow or by the blue pigment. For the scattered light by which the mixture is seen comes chiefly from below the surface, and has thus suffered absorption by each of the component powders. The yellow powder removes the greater part of the blue, indigo, and violet rays; the blue the greater part of the reds, oranges, and yellows. Thus the light which finally escapes is mainly green.

Mixtures of colors.

Exact study of absorption.

For the accurate study of the absorptive power of a solid or liquid medium, it is necessary to compare the spectrum of white light which has passed through a plate or layer of it with a normal spectrum. This is easily effected by placing the absorbing medium (if a fluid, it must be in a glass trough with parallel sides) in front of the narrow slit through which the light passes, and in such a position that one half of the slit only is thus covered. We have then side by side, under precisely similar circumstances, two spectra to be compared (one altered by absorption, the other not); and very minute differences between them can thus be detected. When the medium produces a general weakening of the whole spectrum, as well as particular local absorptions, the white light passing through the other half of the slit may be weakened to any desired extent by reflection at the proper incidence from a plate of glass, before it falls on the slit.

Absorption spectra.

To give a satisfactory representation of the phenomena of absorption spectra by the help of a woodcut is not easy. The highest artistic skill could not adequately represent the ordinary solar spectrum by the use of the finest pigments. All optical *color* phenomena must be *seen*, they cannot be reproduced by painting. In such circumstances the simplest method of indicating the locality and amount of the absorption is the best. As we have already seen that we cannot by the eye judge of the relative intensities of lights which differ much in color, we shall represent the normal spectrum (for our present purpose) as equally bright throughout, and indicate the absorption at different parts by shading of various degrees of depth. A few of the Fraunhofer lines are introduced to indicate (in the absence of color) the parts of the spectrum which are attacked by the various absorbents. These lines are, of course, in the same absolute positions in all the various spectra; for the spectra are all supposed to be given by the same prism. The line B is in the red, D in the orange, E and F in the green, and G in the indigo. They correspond, as we have already said, to perfectly definite kinds of homogeneous light, and therefore adequately represent the distribution of colors in the spectrum, however much irrationality of dispersion may be shown by the material of the prism.

Absorption by blood.

In fig. 26 α represents the spectrum of light which has passed through diluted blood; β shows the spectrum when the blood has been acted on by a reducing agent; and γ the spectrum when the blood has been altered by acid-

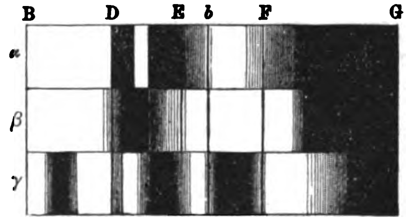

Fig. 26.

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[1] See especially Vince, in the Bakerian Lectures, *Phil. Trans.*, 1799

ulation with acetic or tartaric acid. These figures are taken from an important paper by Stokes (*Proceedings of the Royal Society*, 1864).

Absorption by cobalt glass.

Fig. 27 shows in a rude way the absorption by cobalt glass cut in wedge form, and corrected by an equal prism of clear glass.

The commonly received method of calculating the absorption by layers of gradually increasing thickness is to suppose that, if a layer of unit thickness weakens in any ratio the intensity of any particular homogeneous ray, another unit layer will farther weaken in the same ratio that which reaches it, and so on, Thus the amount which passes through a number of layers diminishes in geometrical progression, while the number of layers increases in arithmetical progression. This is certainly true (neglecting the amount reflected), unless the *intensity* of the light have an effect on the percentage transmitted. And fig. 27 shows, in a very striking manner, the difference between similar terms of different geometric series as the common ratio becomes less and less. This ratio is not much less than 1 for certain red and blue rays, is smaller for yellow, and is very small for the rest of the red, for orange, and for green. The latter colors are therefore rapidly got rid of with increasing thickness; then the yellow becomes too feeble to be seen; while, even after the blue becomes almost insensible, the specially favored red rays are still transmitted in sufficient quantity to be observed.

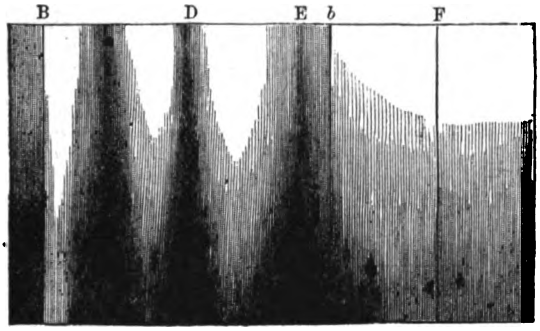

Fig. 27.

If r be the fraction of any species of homogeneous light which is transmitted by a layer of unit thickness, that transmitted by a layer of thickness x is r^x. The following little table will greatly assist the reader in understanding the relative rapidity of extinction of different rays passing through various thicknesses of an absorbing medium. It is a table of double entry, the first column giving various values of x, and the upper row various values of r, while the value of r^x is in the same column as that of r and in the same row as that of x.

1	1	0·99	0·9	0·5	0·1
2	1	0·98	0·81	0·25	0·01
5	1	0·951	0·59	0·03	0·00001
10	1	0·904	0·349	0·0009	...
100	1	0·366	0·00003	...	...

Thus a ray which loses 1 per cent. in unit thickness still preserves more than 90 per cent. after passing through ten units. But a ray which loses 10 per cent. in the first unit (and which, therefore, will thus far appear scarcely more weakened than the first) is reduced to 35 per cent. by passage through ten units. After passing through a hundred units the first ray has lost only 63 per cent., the second is practically invisible.

In thin plates cobalt glass is blue, because the particular red which it does not absorb freely forms only a small fraction of the whole transmitted rays; while in thick masses it is nearly red, for then little but this favored red is transmitted. For a similar reason Condy's fluid (permanganate of potash) changes its tint in a very singular manner (even when preserved from the action of the air) by gradual dilution with water.

Defect of achromatism in the eye.

The imperfection of the achromatism of the eye is readily proved by looking through a plate of cobalt glass at a small hole in the window-shutter of a dark room. The hole at first appears red with a blue space round it; but, by an effort of the muscles of the eye, we can see the hole blue, and then there is a red space surrounding it. Rays of so widely different refractive index cannot be seen in focus simultaneously.

Very curious effects are produced when we examine a landscape through such a glass. Foliage of certain kinds scatters scarcely any blue rays, and therefore appears reddish. Bluish-greens, again, which scatter very little red, appear blue. The effects may be exaggerated in a very striking degree by combining the absorptions of two or more media, so as to allow of the free transmission of a few, far detached, portions of the spectrum.

Brewster made the very singular discovery that a solution of oxalate of chromium and potash produces one solitary, narrow, absorption band, almost resembling one of the broader lines in the solar spectrum.

Abnormal dispersion.

Closely connected with intense local absorption in certain parts of the spectrum is the phenomenon of *abnormal dispersion*, one of the most singular discoveries of modern times. It seems to have been first observed by Fox Talbot, and he discovered its real nature. But the first published notice of such phenomena is due to Le Roux. Christiansen and others have since greatly extended our knowledge of the subject, and Helmholtz and Ketteler have given theoretical explanations of it. Fox Talbot's experiment, though the earliest on record, is one of the easiest to perform, and we therefore quote his own account. The experiment was made about 1840, and the following account is from the *Proc. Roy. Soc. Edin.*, 1870–71.

Talbot's experiment.

> "I prepared some square pieces of window glass, about an inch square. Taking one of these, I placed upon it a drop of a strong solution of some salt of chromium, which, if I remember rightly, was the double oxalate of chromium and potash, but it may have been that substance more or less modified. By placing a second square of glass on the first, the drop was spread out in a thin film, but it was prevented from becoming too thin by four pellets of wax placed at the corners of the square, which likewise served to hold the two pieces of glass together. The glasses were then laid aside for some hours until crystals formed in the liquid. These were necessarily thin, since their thickness was limited by the interval between the glasses. Of course the central part of each crystal, except the smallest ones, was bounded by parallel planes, but the extremities were bevelled at various angles, forming so many little prisms, the smallest of them floating in the liquid. When a distant candle was viewed through these glasses, having the little prisms interposed, a great number of spectra became visible, caused by the inclined edges. Most of these were no doubt very imperfect, but by trying the glass at various points, some very distinct spectra were met with, and these could with some trouble be isolated by covering the glass with a card pierced with a pin-hole. It was then seen that each prism (or oblique edge of crystal) produced two spectra oppositely polarized and widely separated. One of these spectra was normal; there was nothing particular about it. The colors of the other were very anomalous, and, after many experiments, I came to the conclusion that they could only be explained by the supposition that the spectrum, after proceeding for a certain distance, stopped short and returned upon itself."

Iodine vapor.

Le Roux in 1860[1] discovered that vapor of iodine, which allows only red and blue rays to pass, refracts the red more than the blue. He, like Talbot, did not at first venture to publish his result, and it appeared only in 1862. Among the many convincing proofs of its accuracy he shows that the dispersion by an iodine-vapor prism can be nearly achromatized by a glass prism which gives refraction in the *same* direction. He also states that the dispersion in iodine-vapor is less as the temperature is higher.

Fuchsine.

Christiansen's[2] earliest determinations were made in 1870 upon an alcoholic solution of fuchsine (one of the powerful aniline colors). This solution gives a dark absorption band in the green; and it was found that the refractive index rises (as in normal bodies) for rays from the red to the yellow. But all the rest of the transmitted light, consisting of the so-called "more refrangible" rays, is less refracted than the red. Kundt and others shortly afterwards greatly extended these observations.

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[1] *Comptes Rendus*, lv., 1862.

[2] *Pogg. Ann.*, cxli.

The explanation of this phenomenon, which has been advanced by Helmholtz,[1] depends upon an assumption as to the nature of the mutual action between the luminiferous ether and the particles of the absorbing medium, coupled with a further assumption connecting the absorption itself with a species of friction among the parts of each absorbing particle.

In 1879 De Klerker[2] made a very curious observation, which shows that the whole subject is still obscure. He employed two hollow prisms of equal angle, turned opposite ways, and filled with alcohol. Through such a combination light passes (as we have seen) without refraction or dispersion. When a few drops of the fuchsine solution were added to the contents of one of the prisms, the yellow, orange, and red rays (in the order named) began to separate themselves from the others. This process could be carried on until the solution was so strong that it transmitted no visible light. All this time the blue and violet rays remained apparently unrefracted—the yellow, orange, and red showing continually increasing refraction. The conclusion from this, on either theory of light, is that the addition of fuchsine to alcohol alters the velocity of propagation of the (so-called) less refrangible rays, but not perceptibly that of the more refrangible.

Fluorescence.

Fluorescence.—The singular surface appearances presented by "canary" glass, by some specimens of fluor spar, and by certain liquids, such as a solution of sulphate of quinine acidulated with sulphuric acid, had been the source of much speculation long before their true nature was traced by Stokes in 1852.[3] By a series of well-contrived experiments, one or two of which will presently be described, he put it beyond doubt that the cause of these phenomena lies in a change of refrangibility of the light which has been absorbed by the upper layers of the medium, and then given off again. In every case the fluorescent light appears to belong to a less refrangible part of the spectrum than does the incident light which gave rise to it, thus affording an instance of dissipation, or degradation of energy.

Change of refrangibility of light.

The yellowish-green surface-color of canary glass (colored with oxide of uranium) is well known, as the substance is, mainly on account of this property, very commonly used for ornaments. If we admit a ray of sunlight (or light from the electric lamp) into a dark room, through a cobalt glass so dark that the feeble violet-colored light it transmits is scarcely visible, we find that the canary glass shows its yellow-green color vividly when placed in the track of the ray. Striking as this experiment is, it is not quite conclusive as to the true cause of the appearance. But if we take another piece of glass, slightly tinged of a brownish-yellow (by oxide of gold), we find that it is quite transparent to the brilliant light from the canary glass; if, however, we place it in the track of the violet rays *before* they fall on the uranium glass, it prevents the production of the phenomenon altogether. That is, rays which cannot pass through the glass colored with gold are rendered capable of freely passing through it after incidence on the canary glass. That the phenomenon is due to rays which are stopped by the uranium glass itself is proved by the fact that a second piece of the glass, placed in the track of the rays which have passed through the first, does not show the phenomenon. Unless, indeed, the source of light be very bright, the appearance is confined to a mere surface-layer of the first piece of canary glass. The phenomenon is very well shown by an aqueous infusion of horse-chestnut bark. Some specimens of paraffin oil exhibit it most brilliantly.

Stokes's experiments.

To find the rays which are most effective in producing the fluorescence of any substance, we have only to place it in a pure spectrum of sunlight (or, preferably, of the electric light),—prisms and lenses of quartz being used for producing the spectrum, because that material is found to be far less opaque than glass is to the violet and ultra-violet rays. When this is done with uranium glass we find scarcely a trace of effect until the substance reaches the blue rays, and the effect persists through all the higher colors, and even very considerably beyond the bounds of the visible spectrum. Stokes in fact used it as a means of studying the otherwise invisible, but far extending, spectrum of the ultra-violet rays of the electric spark.

The mechanism of the process by which these extraordinary results are produced is still somewhat obscure, and we cannot attempt to explain it here.

Phosphoroscope.

The duration of fluorescence is so very short that it is only by specially devised methods that we can make certain that it persists for any measurable time after the exciting light is cut off from the fluorescent body. Becquerel's ingenious *phosphoroscope* was invented for the purpose of inquiries of this kind. It consists essentially of a shallow drum, in whose ends two eccentric holes, exactly opposite to one another, are cut. Inside it are fixed two equal metal disks, attached perpendicularly to an axis, and divided into the same number of sectors, the alternate sectors of each being cut out. One of these disks is close to one end of the drum, the other to the opposite end, and the sectors are so arranged that, when the disks are made to rotate, the hole in one end is open while that in the other is closed, and *vice versa*. If the eye be placed near one hole, and a ray of sunlight be admitted by the other, it is obvious that while the sun shines on an object inside the drum the aperture next the eye is closed, and *vice versa*. If the disks be made to revolve with great velocity by means of a train of toothed wheels, the object will be presented to the eye almost instantly after it has been exposed to sunlight; and these presentations succeed one another so rapidly as to produce a sense of continued vision. By means of this apparatus we can test with considerable accuracy the duration of the phenomenon after the light has been cut off. For such a purpose we require merely to know the number of sectors in the disks and the rate at which they are turned. To guard against deception by the persistence of impressions on the retina, the eye should not be directed fixedly on the object, but should be kept travelling slowly round the position in which it is seen to lie.

Uranium glass shows, with rapid turning, nearly as vivid an effect as when exposed to continuous light, but fades rapidly when the speed of the rotation falls off. A pinkish kind of ruby, exposed to concentrated sunlight in the phosphoroscope, is seen to glow with a bright red like a piece of live coal. With very rapid turning, feeble fluorescence can be detected in a great many substances in which the ordinary methods will not show it. This is due in great measure to the fact that the phosphoroscope entirely does away with the scattered light, which in the ordinary mode of examining these substances overpowers their feeble fluorescence.

Phosphorescence.

What is correctly termed phosphorescence has nothing to do with phosphorus (whose luminosity in the dark is due to slow oxidation), but it is merely a species of fluorescence which lasts for a much longer time after the excitation has ceased than does that just described. Pliny speaks of various gems which shine with a light of their own, and Albertus Magnus knew that the diamond becomes phosphorescent when moderately heated. But the first discovery of phosphorescent substances, such as are now so common, belongs to the early part of the 17th century. During that century the Bologna stone (sulphide of barium) and Homberg's phosphorus (chloride of calcium) were discovered. Canton's phosphorus (sulphide of calcium) dates from 1768. To the substances mentioned may now be added sulphide of strontium. Any of these sulphides, which must be carefully preserved from the air in sealed glass tubes, appears brilliantly luminous when carried from sunlight into a dark room, and for a long time after presents the general aspect of a hot body cooling. The rays which excite their luminosity are (as with the generality of fluorescent bodies) those of higher refrangibilities; but the colors of the phosphorescent light are of the most varied kind, even in specimens of almost precisely the same chemical composition, but prepared at different times. The causes of this strange diversity are as yet quite unguessed at; but the property has been taken advantage of for the production of what are called *luminous paints*. The behavior of these substances is one of the most singular phenomena in optics. How they manage to store up so large a supply of energy during a short exposure to bright light, and to dole it out continuously for so long a time and mainly in the form of light, is exceedingly puzzling,—especially as no other physical or chemical change has yet been found to accompany the process. Another curious fact connected with their behavior was discovered by Becquerel. He found that the less refrangible rays have in some cases the power of arresting the emission of light from these bodies when they have been previously excited by higher rays.

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[1] *Pogg. Ann.*, clv., 1874.

[2] *Comptes Rendus*, 1879.

[3] *Phil. Trans.*, "On the Change of Refrangibility of Light."

Luminous paint.

The chemical effects of light will be treated under PHOTOGRAPHY, so far as they are connected with decomposition. Its effects in causing combination, as of hydrogen and chlorine, have already been treated under CHEMISTRY.

UNDULATORY THEORY OF LIGHT.

The explanation of the fundamental laws of Geometrical Optics by the wave-theory requires some preliminary remarks. As the subject will be more fully discussed in a special article, we confine ourselves to what is strictly necessary for the immediate purposes of the present article.

Wave-motion.

(*a*) The essential characteristic of wave-motion is that a disturbance of some kind is handed on from one portion of a solid or fluid mass to another. In certain cases only, this disturbance is unaltered in amount and in kind as it proceeds.

Velocity of propagation.

(*b*) So far as light is concerned, the velocity with which each particular species of disturbance passes in any direction through a homogeneous isotropic medium is constant and is the same for all directions. When the medium is not homogeneous, the velocity may vary from point to point. If the medium be not isotropic, the velocity may depend upon the *direction* of propagation. Examples of each of these peculiarities will be met with presently.

Interference.

(*c*) When two or more separate disturbances simultaneously affect the same portion of a medium, the effect may be very complex. But, in the case of light, it has been found that a geometrical (or rather *kinematical*) superposition or composition agrees, at least to the degree of accuracy of the experiments, with all the observed facts. This would be the case, as a dynamical result, if the distortions due to wave-motion were always, even for the most powerful light, exceedingly small. On this is based the whole doctrine of *interference*, Young's grandest contribution to the wave-theory (1801).

Huygens's principle.

(*d*) The disturbance at any point of a medium, at any instant, is that due to the superposition of all the disturbances which reached it at that instant from the various surrounding parts of the medium. This is (in a somewhat generalized form) what is commonly known as Huygens's principle, first enunciated in 1678.

Wave-front.

(*e*) The *front* of a wave is defined at any instant as the continuous locus of all portions of the medium which, at that instant, are equally and similarly distorted. The word *continuous* is inserted because, in oscillatory wave-motion, such as that of light, a large number of successive waves are exactly equal and similar to one another. Thus we have a *series* of wave-fronts following one another, which are not to be considered as parts of one wave-front. The distance between two successive fronts in which the distortions are similar, measured in the direction in which the light is travelling, is called the *wave-length*.

Color.

(*f*) The *color* of homogeneous light depends entirely on the *period* of a wave, *i. e.*, on the time of passage from one wave-front to the next. This is obviously the same thing as the time of a complete vibration of any one particle of the medium—whatever be the velocity of light in the medium, or the consequent wave-length.

Wave-motion in homogeneous isotropic medium.

These being premised, let us take the propagation of homogeneous light from a luminous point in a homogeneous isotropic medium. Here we have simply a succession of concentric spherical wave-fronts, their radii differing by one or more whole wave-lengths. The disturbance in any portion of one of these fronts is propagated radially. But we may consider it from a different point of view, as hinted in (*d*) above. Simple as this particular case is, the reader will probably find that it will greatly assist him in understanding the more complex ones which follow.

Every disturbed portion of the medium may be looked upon as a centre of disturbance from which a new set of spherical waves is constantly spreading. Take then, as common radius, the space described by a disturbance in any very short interval; and, with centres at every point of any one wave-front, describe a series of spheres. The ultimate intersections of these spheres will lie on a surface which is the *envelop* of them all. In the case considered, it is obviously a sphere whose radius exceeds that of the wave-front from which we started by the common radius of the set of spheres. This is shown in a central section in fig. 28 below, which suffices to prove that we arrive *by this mode of construction* at the result which we know in this simple case to be the correct one. It will be seen that the centres of the construction-spheres lie on a certain part of one wave-front, while their ultimate intersections lie on the *corresponding* part of the future wave-front. This holds for spheres of all radii, and for continually increasing radii shows that a *plane* wave moves perpendicularly to its front. This is so important a part of Huygens's work that we give it in his own words (*Traité de la Lumiere*, 1690, pp. 18–20):—

> "Pour venir aux proprietez de la lumiere; remarquons premierement que chaque partie d'onde doit s'étendre en sorte, que les extremitez soient tousjours comprises entre les mesmes lignes droites tireés du point lumineux. Ainsi la partie de l'onde BG, ayant le point lumineux A pour centre, s'étendra en l'arc CE, terminé par les droites ABC, AGE. Car bien que les ondes particulieres, produites par les particules que comprend l'espace CAE, se repandent aussi hors de cet espace, toutesfois elles ne concourent point en mesme instant, à composer ensemble une onde qui termine le mouvement, que precisement dans la circonference CE, qui est leur tangente commune.
>
> "Et d'icy l'on voit la raison pourquoy la lumiere, à moins que ses rayons ne soient reflechis ou rompus, ne se repand que par des lignes droites, en sorte qu'elle n'éclaire aucun objet que quand le chemin depuis sa source jusqu'à cet objet est ouvert suivant de telles lignes. Car si, par exemple, il y avoit, une ouverture BG, borneé par des corps opaques BH, GI; l'onde de lumiere qui sort du point A sera tousjours termineé par les droites AC, AE, comme il vient d'estre demonstré: les parties des ondes particulieres, qui s'étendent hors de l'espace ACE, estant trop foibles pour y produire de la lumiere.
>
> "Or quelque petite que nous fassions l'ouverture BG, la raison est tousjours la mesme pour y faire passer la lumiere entre des lignes droites; parce que cette ouverture est

tousjours assez grande pour contenir un grand nombre de particules de la matiere etherée, qui sont d'une petitesse inconcevable ; de sorte qu'il paroit que chaque petite partie d'onde s'avance necessairement suivant la ligne droite qui vient du point luisant. Et c'est ainsi que l'on peut prendre des rayons de lumiere comme si c'estoient des lignes droites.

"Il paroit au reste, par ce qui à esté remarqué touchant la foiblesse des ondes particulieres, qu'il n'est pas necessaire que toutes les particules de l'Ether soient égales entre elles, quoique l'égalité soit plus propre à la propagation du mouvement. Car il est vray que l'inégalité fera qu'une particule, en poussant une autre plus grande, fasse effort pour reculer avec une partie de son mouvement, mais il ne s'engendrera de cela que quelques ondes particulieres en arriere vers le point lumineux, incapables de faire de la lumiere : & non pas d'onde composeé de plusieurs, comme estoit CE.

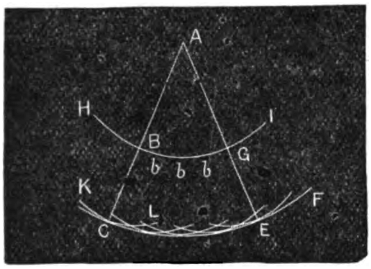

Fig. 28.

"Une autre, et des plus merveilleuses proprietez de la lumiere est que, quand il en vient de divers costez, ou mesme d'opposez, elles font leur effet l'une à traverse l'autre sans aucun empéchement. D'ou vient aussi que par une mesme ouverture plusieurs spectateurs peuvent voir tout à la fois des objets differens, et que deux personnes se voyent en mesme instant les yeux l'un de l'autre. Or suivant ce qui a esté expliqué de l'action de la lumiere, et comment ses ondes ne se détruisent point, ny ne s'interrompent les unes les autres quand elles se croisent, ces effets que je viens de dire sont aisez à concevoir. Qui ne le sont nullement à mon avis selon l'opinion de Des-Cartes, qui fait consister la lumiere dans une pression continuelle, qui ne fait que tendre au mouvement. Car cette pression ne pouvant agir tout à la fois des deux costez opposez, contre des corps qui n'ont aucune inclination à s'approcher ; il est impossible de comprendre ce que je viens de dire de deux personnes qui se voyent les yeux mutuellement, ni comment deux flambeaux se puissent éclairer l'un l'autre."

We will now, for the purposes of this elementary article, assume that something similar holds in all cases, and will not trouble ourselves with the fact that our construction, if fully carried out, would indicate a retrograding wave as well as a progressive one. The obvious fact that a *solitary* wave can be propagated in water, or along a stretched string, may assist the reader in taking the bold step which we have proposed to him. And we will also assume that this mode of representation leads to correct results even when we do not choose a wave-front as the locus of the centres of disturbance,—that in fact we may choose for our purpose *any* surface through which the rays pass, provided always that the radii of the spheres are so chosen that the length of each ray from some definite wave-front to the centre of the sphere, together with the radius of that sphere, always corresponds to a path described in a given time.

Undulatory explanation of reflection.

We are now prepared to explain the reflection of light, and we need do so for a plane reflecting surface alone because the length of a wave, as we shall soon see, is an almost vanishing quantity in comparison with the radius of curvature of any artificial mirror, be it even the smallest visible drop of mercury.

Let a plane wave-front be approaching a plane mirror, and at any instant let fig. 29 represent a section by a plane perpendicular to each, cutting the wave-front in AB and the mirror in AC. From what has been already said, the motion of every part of AB is perpendicular to that line, and in the plane of the figure. During the time that the disturbance at B takes to reach C, the disturbance which had reached A will have (in part, for there is usually a refracted part also) spread back into the medium in the form of a spherical wave whose radius, AD, is equal to BC. Its section is of course a circle. That from any other point P will have reached Q, and then (in part) diverged into a spherical wave whose centre is Q and radius $QT (= QT) = BC - PQ$. Obviously all the circles which can be thus drawn ultimately intersect in the straight line CD. This is a section of the reflected wave-front. A plane wave, therefore, remains a plane wave after reflection; each part of it obviously moves in the plane of incidence, and the similarity of the triangles ABC and CDA proves the equality of the angles of incidence and reflection, for the ray is everywhere perpendicular to the wave-front. It is to be particularly noted that this is independent of the velocity of the light, so that all rays are reflected alike. In this, as in the preceding and the immediately following instances, the diagram has been taken (with but slight change) from Huygens.

This being true of any *plane* wave-front, large or small in area, is necessarily also true of any wave-front of finite curvature. Thus, if a set of rays be drawn perpendicular to any wave-front, they will after reflection be perpendicular to a new wave-front; and the lengths of all the rays, from wave-front to wave-front, will be equal.

This is merely another way of stating that if a set of rays can be cut at right angles by a surface (of finite curvature) they will always be capable of being cut at right angles by such a surface, even after any number of reflections at surfaces of finite curvature, provided they move in a homogeneous isotropic medium.

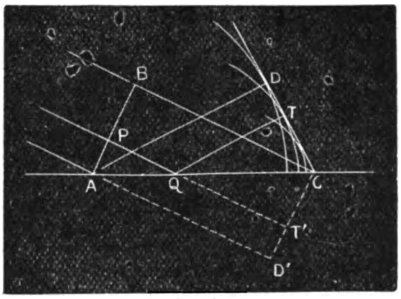

Fig. 29.

Undulatory explanation of refraction.

This proposition will be seen to be capable of extension to refraction, provided always that both media are homogeneous and isotropic. For a plane wave, falling on a plane refracting surface, our construction (fig. 30) is as follows:—

Let AB be, as before, a plane wave-front in the first medium, and AC the plane surface of the second medium. As before, let BC be perpendicular to AB. Also let CD′ be drawn parallel to BA. With centre A and radius AD equal to the space described in the second medium while BC is described in the first, let a sphere be described. The disturbance at A will have diverged in this sphere, while that at B has just reached C. The disturbance at any other point, as P, will have passed to Q, and then have diverged into a sphere of radius QT such that

$$QT : QT' :: AD : BC.$$

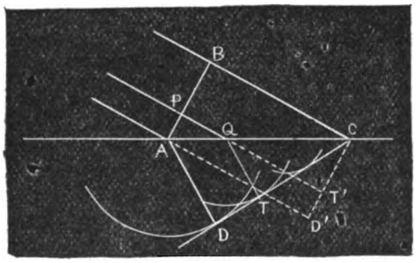

Fig. 30.

Obviously all spheres so drawn ultimately intersect along OD, which is therefore the front of the refracted wave. The angles of incidence and refraction, being the inclinations of the incident and refracted rays to the normal, are the inclinations BAC and DCA of the incident and refracted wave-fronts to the refracting surface. Their sines are evidently in the ratio of BC to AD, *i. e.*, they are *directly* as the velocities of propagation in the two media.

Hence the law of refraction also follows from this hypothesis. But there will now be separation of the various homogeneous rays, because the ratio of their velocities in the two media is not generally constant.

Besides, it is clear from the investigation above that, in the refracting medium, the rays are still perpendicular to the wave-front. Thus the proposition lately given may now be extended in the following form:—

If a series of rays travelling in homogeneous isotropic media be at any place normal to a wave-front, they will possess the same property after any number of reflections and refractions. And it is clear from the investigations already given that the *time* employed by light in passing from one of these wave-fronts to another is the same for every ray of the series.

Test of theory.

We now see how crucial a test of theory is furnished by the simple refraction of light. On the corpuscular theory the velocity of light in water is to its velocity in air as 4 : 3 nearly; on the undulatory theory these velocities are as 3 : 4, since, as we have seen, the refractive index of water is about $\frac{4}{3}$. But Foucault's experimental method showed at once that the velocity is less in water than in air. This finally disposed of the corpuscular theory. Though it had been conclusively disproved long before, by certain interference experiments whose nature will presently be described, the argument from these was somewhat indirect and not well suited to convince the large non-mathematical class among optical students and experimenters. The true author of the undulatory theory is undoubtedly Huygens. Grimaldi, Hooke, and others had expressed more or less obscure notions on the subject, but Huygens in 1678 first gave it in a definite form, based to a great extent upon measurements of his own. It was read to the French Academy, but not published till 1690, when it appeared with the title *Traité de la Lumière*. Huygens gives the explanation of the double refraction of Iceland spar, which had been described by Bartholinus in 1670. Unfortunately the remarkable step taken by Newton in explaining the law of refraction on the corpuscular theory—the earliest solution of a problem connected with molecular forces—had for some time been before the scientific world. The authority of Newton was paramount in such matters, and the work of Huygens produced no effect at the time. Even the genius of Young, who at the commencement of the present century recalled attention to this all-but-forgotten theory, and enriched it by the addition of the principle of interference, as well as by many important applications, failed to secure its recognition. It was not till 1815 and subsequent years that, in the hands of Fresnel, the undulatory theory finally triumphed, and, even then, the battle was won against determined resistance on the part of the upholders of the corpuscular theory. Witness what Laplace[1] said, in 1817, in the following excerpt from a letter to Young:—

Opposition to the undulatory theory.

> "J'ai reçu la lettre que vous m'avez fait l'honneur de m'écrire, et dans laquelle vous cherchez à établir que, suivant le système des ondulations de la lumière, les sinus d'incidence et de réfraction sont en rapport constant, lorsqu'elle passe d'un milieu dans un autre. Quelque ingénieux que soit ce raisonnement, je ne puis le regarder que comme un aperçu, et non comme une démonstration géométrique. Je persiste à croire que le problème de la propagation des ondes, lorsqu'elles traversent différens milieux, n'a jamais été résolu, et qu'il surpasse peut-être les forces actuelles de l'analyse. Descartes expliquoit ce rapport constant, au moyen de deux suppositions; l'une, que la vitesse des rayons lumineux parallèlement à la surface du milieu refringent ne changeoit point par la réfraction; l'autre, que sa vitesse entière dans ce milieu étoit la même, sous toutes les incidences; mais comme il ne rattachoit aucune de ces suppositions aux lois de la mécanique, son explication a été vivement combattue et rejettée par les plus grand nombre des physiciens jusqu' à ce que Newton ait fait voir que ces suppositions résultoient de l'action du milieu refringent sur la lumière; alors on a eu une explication mathématique du phénomène dans le système de l'émission de la lumière: système qui donne encore l'explication la plus simple du phénomène de l'aberration, que n'explique point le système des ondes lumineuses. Ainsi les suppositions de Descartes, comme plusieurs aperçus de Kepler sur le système du monde, ont été vérifiées par l'analyse: mais le mérite de la découverte d'une vérité appartient tout entier à celui qui la démontre. Je conviens que de nouveaux phénomènes de la lumière sont jusqu' à présent très difficiles à expliquer; mais en les étudiant avec un grand soin, pour découvrir les lois dont ils dépendent, on parviendra peut-êtres un jour à reconnaître dans les molecules lumineuses des propriétés nouvelles qui donneront une explication mathématique de ces phénomènes. Remonter des phénomènes aux lois et des lois aux forces, est, comme vous le savez, la varie marche des sciences naturelles."

Poggendorff remarks that there is no other instance, in the whole history of modern physics, in which the truth was so long kept down by authority. Poggendorff further remarks that of the six chief phenomena of light known in Huygens's time he fully explained three—reflection, refraction, and the double refraction of Iceland spar—at least so far as concerns the *direction* of the reflected or refracted rays. Phenomena such as diffraction, and the colors of thin plates, required the principle of interference for their explanation, which was first given by Young; and dispersion (not yet quite satisfactorily disposed of) was first accounted for in comparatively recent times by Cauchy. Huygens himself was the discoverer of polarization, but he could not account for it. Even Young also, because like Huygens he supposed the undulations to be in the direction of the ray, failed to account for it; and it was not explained till Fresnel reintroduced with the most brilliant success a guess of Hooke's (of date 1672), that the vibrations of light in an isotropic medium are *perpendicular* to the direction of the ray.

Classes of waves.

Taking the undulatory theory as the only one left possible by the experiments of Foucault, we will now consider the explanation it offers of various phenomena. It will be remembered that *we have as yet made no assumption whatever as to the precise nature of a wave;* and it will be found that a large class of important phenomena can be explained by it without our making any such assumption, but that other classes of phenomena compel us to adopt certain limitations of the very general hypothesis with which we started. As long as we deal with the first class of phenomena, we may take for granted those properties which are common to all ordinary forms of wave-motion, such as those in water or air. In ordinary water-waves the motion of a particle is partly to and fro in the direction in which a wave is travelling, partly up and down and therefore perpendicular to that direction. This is obvious to every one who watches a floating cork. In sound-waves, whether in air or in water, the displacement of each particle of the medium is wholly in the direction in which the wave is travelling. Directly connected with this there is another distinction between these classes of waves. In ordinary water-waves the water-elements change only their *form* as the wave passes; in sound-waves there is change of *volume* also. A third distinction, also directly connected with the first, is that sound-waves in water travel at a much greater rate than the swiftest, *i. e.*, the longest, of surface waves. But, in either case, when two similar and equal series of waves arrive at a common point they *interfere*, as it called, with one another,

Interference.

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[1] Young's *Works*, ed. by Peacock, vol. i. p. 874. It is matter for curious remark that Laplace refers to Descartes only, and not to Huygens.

Tides of Batsha.

so that the actual disturbance of the medium at any instant is the resultant of the disturbances which it would have suffered at that instant from the two series separately. Thus if crests, and therefore troughs, arrive simultaneously from the two series, the result is a doubled amount of disturbance. If, on the contrary, a crest of the first series arrive along with a trough of the second, the next trough of the first series will arrive along with the next crest of the second, and so on. One series is then said to be half a wave-length behind the other. In this case, the portion of the medium considered will remain undisturbed. Thus, at the port of Batsha, in Tong-king, the ocean tide-wave arrives by two different channels, one part being nearly six hours, or half a wave-length, behind the other. As a result, there is scarcely any noticeable tide at Batsha itself, though at places not very far from it the rise and fall are considerable. This was known to Newton, and is noticed by him in the *Principia*, iii. 24. See also *Phil. Trans.*, vol. xiv. p. 677, for the observed facts and Halley's comments. Thus also (see ACOUSTICS) two sounds of the same wave-length and of equal intensity produce silence if they reach the external ear with an interval of half a wave-length, or any odd multiple of half a wave-length.

Young's discoveries.

It is not remarkable that Young's Bakerian Lecture (1801), in which the principle of interference is for the first time described and applied, should consist in great part of extracts from the *Principia*. For there are many passages in Newton's works which might have been written by an upholder of the wave-theory. Unaccountably, however, Newton in the context almost always brings in a reference to the "rays of light" as something different from the vibrations of the ether, yet capable of being acted on by them so as to be put into "fits of easy reflection or of easy transmission." These allusions are the most obscure parts of all Newton's scientific writings; and it is very difficult to form a precise conception of what he meant to express in them.

The following passage, extracted from Young's temperate reply (*Works*, vol. i. p. 202) to the violent but ignorant assault on him by Lord Brougham in the *Edinburgh Review*, is chosen as showing his own estimate of his own work and of its relation to what was already known:—

"It was in May, 1801, that I discovered, by reflecting on the beautiful experiments of Newton, a law which appears to me to account for a greater variety of interesting phenomena than any other optical principle that has yet been made known. I shall endeavor to explain this law by a comparison.

"Suppose a number of equal waves of water to move upon the surface of a stagnant lake, with a certain constant velocity, and to enter a narrow channel leading out of the lake. Suppose then another similar cause to have excited another equal series of waves, which arrive at the same channel with the same velocity, and at the same time with the first. Neither series of waves will destroy the other, but their effects will be combined; if they enter the channel in such a manner that the elevations of one series coincide with those of the other, they must together produce a series of greater joint elevations; but if the elevations of one series are so situated as to correspond to the depressions of the other, they must exactly fill up those depressions, and the surface of the water must remain smooth; at least I can discover no alternative, either from theory or from experiment.

"Now I maintain that similar effects take place whenever two portions of light are thus mixed; and this I call the general law of the interference of light. I have shown that this law agrees, most accurately, with the measures recorded in Newton's Optics, relative to the colors of transparent substances, observed under circumstances which had never before been subjected to calculation, and with a great diversity of other experiments never before explained. This, I assert, is a most powerful argument in favor of the theory which I had before revived; there was nothing that could have led to it in any author with whom I am acquainted, except some imperfect hints in those inexhaustible but neglected mines of nascent inventions, the works of the great Dr. Robert Hooke, which had never occurred to me at the time that I discovered the law; and except the Newtonian explanation of the combinations of tides in the port of Batsha."

Interference experiments.

Young's first application of the principle of interference was made to the colors of *striated surfaces*, the next to the colors of *thin plates*. These, however, are not so easily intelligible as the application to an experiment devised by Fresnel several years later. We therefore commence with Fresnel's experiment, which gives the most simple arrangement yet contrived, but it must be understood that the explanation is really due to Young.

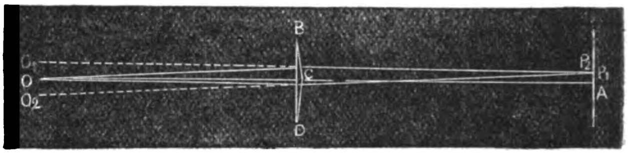

Fig. 31.

Fringes in homogeneous light.

Measure of wave-lengths.

BCD (fig. 31) is an isosceles prism of glass, with the angle at C very little less than two right angles. A luminous point is placed at O, in the plane through the obtuse edge of the prism and perpendicular to its base. If homogeneous light be used, the light which passes through the prism will consist of two parts, diverging as if from points O_1 and O_2 symmetrically situated on opposite sides of the line CO. Suppose a sheet of paper to be placed at A with its plane perpendicular to the line OCA, and let us consider what illumination will be produced at different parts of this paper. As O_1 and O_2 are images of O, crests of waves must be supposed to start from them simultaneously. Hence they will arrive simultaneously at A, which is equidistant from them, and there they will reinforce one another. Thus there will be a bright band on the paper parallel to the edges of the prism. If P_1 be chosen so that the difference between P_1O_2 and P_1O_1 is half a wave-length (*i. e.*, half the distance between two successive crests), the two streams of light will constantly meet in such relative conditions as to destroy one another. Hence there will be a line of darkness on the paper, through P_1, parallel to the edges of the prism. At P_2, where O_2P_2 exceeds O_1P_2 by a whole wave-length, we have another bright band; and at P_3, where O_2P_3 exceeds O_1P_3 by a wave-length and a half, another dark band; and so on. Hence, as everything is symmetrical about the bright band through A, the screen will be illuminated by a series of bright and dark bands, gradually shading into one another. If the paper screen be moved parallel to itself to or from the prism, the locus of all the successive positions of any one band will (by the nature of the curve) obviously be an hyperbola whose foci are O_1 and O_2. Thus the interval between any two bands will increase in a more rapid ratio than does the distance of the screen from the source of light. But the intensity of the bright bands diminishes rapidly as the screen moves farther off; so that, in order to measure their distance from A, it is better to substitute the eye (furnished with a convex lens) for the screen. If we thus measure the distance AP_1 between A and the nearest bright band, measure also AO, and calculate (from the known material and form of the prism, and the distance CO) the distance O_1O_2, it is obvious that we can deduce from them the lengths of O_1P_1 and O_2P_1. Their difference is the *length of a wave* of the homogeneous light experimented with. Though this is not the method actually employed for the purpose (as it admits of little precision), it has been thus fully explained here because it shows in a very simple way the possibility of measuring a wave-length.

The difference between O_1P_1 and O_2P_1 becomes greater as AP_1 is greater. Thus it is clear that the bands are *more widely separated the longer the wave-length of the*

Effect of white light.

homogeneous light employed. Hence when we use white light, and thus have systems of bands of every visible wave-length superposed, the band A will be red at its edges, the next bright bands will be blue at their inner edges and red at their outer edges. But, after a few bands are passed, the bright bands due to one kind of light will gradually fill up the dark bands due to another; so that, while we may count hundreds of successive bright and dark bars when homogeneous light is used, with white light the bars become gradually less and less defined as they are farther from A, and finally merge into an almost uniform white illumination of the screen.

In this example, and in all others of a similar character which will be introduced into this elementary article, the solution is only *approximate.* The utmost resources of mathematics are in most cases required for the purpose of complete solution.

Additional proof that light moves slower in glass than in air.

We are now in a position to prove that light moves slower in glass than in air, by the process which was merely *indicated* while we were discussing the velocity of light. For, if we could slightly lengthen the paths of the rays which come from O_1, leaving those from O_2 unaltered, the system of bands would obviously be shifted in the direction from A to P in the figure. This happens if a very thin film of glass be interposed in the path of the rays which appear to come from O_1. The best mode of making the experiment is to put a piece of very uniform plate glass, cut into two parts, between the prism and the screen, so that rays from O_1 pass through one part and those from O_2 through the other. So long as these pieces are parallel, no shifting takes place. But if *one* be slightly turned, so as to give the rays a longer path through it, the system of bands is at once displaced to the side at which it is situated.

Also, we can now see how it is possible to discover whether light has its velocity affected by that of the medium in which it is travelling. We know that sound travels faster *with* the wind, and slower *against* it, than it does in still air. We may therefore suppose a disposition of the interference apparatus such that the two rays which interfere have each passed through a long tube full of water. A rapid current may be established, in either direction, in one or other of the tubes, or in opposite directions in the two, and the shifting of the interference-bands will at once indicate the nature of the effect. We cannot describe the details of the process. The result, however, is analogous to that of wind on sound, but of course very much smaller; and it seems that the actual change of the velocity of light is *less* than the velocity of the current. See ETHER.

Interference-grating.

Let us next consider the effect of a *grating*, a series of fine parallel wires placed at small equal intervals, or a piece of glass or of speculum metal on which a series of equidistant parallel lines have been ruled by a diamond point. We take only the case in which plane waves of homogeneous light are incident in a direction perpendicular to the plane of the grating, and when the bars and openings of the grating are all equal in breadth.

Consider the effect on an eye or screen at a considerable distance, in the direction BE (fig. 32). If there were no grating, practically no light would reach the eye from the aperture AD unless ABE were very nearly a right angle. This is, of course, the statement of Huygens already quoted. But Young's principle enables us to say *why* this is the case. Let us divide AD into a series of equal parts by lines perpendicular to BE, and distant from one another by half a wave-length of the homogeneous light employed. The portions coming to the eye from any two adjacent parts AB, BC will be practically of the same intensity, and will exactly neutralize one another's effects on the eye. For if we take points *a* and *b* similarly situated with regard to A and B respectively, the distances of *a* and *b* from the eye differ by half a wave-length, and rays from *a* neutralize those from *b*. This is true wherever *a* be taken between A and B. Hence, under the conditions assumed, no light reaches the eye.

Now suppose the alternate parts AB, CD, etc., to be opaque. Similar reasoning will show that the remaining rays conspire to strengthen one another. Thus, when homogeneous light from a distant point falls perpendicularly on a grating in which the breadth of the bars is equal to that of the interstices, it will be seen brightly in a direction inclined at an angle θ (ABE) to the plane of the grating,—the angle θ being such that

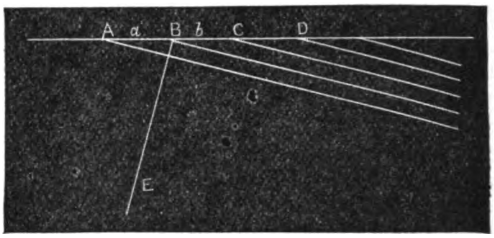

Fig. 32.

$$AC \cos\theta = \text{wave length.}$$

Similar reasoning shows that the light is reinforced whenever θ is such that

$$AC \cos\theta$$

is an integral multiple of the wave-length. The appearance presented when a long narrow slit is the luminous object, and the bars of the grating are placed parallel to it, is therefore (with homogeneous light) a central image with others equidistant from it on each side—their angular distances from it being the values of the angle corresponding to the sines

$$\frac{\lambda}{a},\ \frac{2\lambda}{a},\ \frac{3\lambda}{a},\ \text{etc.}$$

Here λ is the wave-length, and a is the sum of the breadth of a bar and an interstice. It is found in practice, and it is also deducible from the complete theory, that the *ratio* of the breadths of the bar and interstice has but little effect on the result, unless it be either very large or very small. Hence if λ be expressed as a fraction of an inch, and n be the number of lines per inch in the grating, the angular deviations of the bright bands have the sines

$$n\lambda,\ 2n\lambda,\ 3n\lambda,\ \text{etc.}$$

The mean wave-length of visible rays in air is about $\frac{1}{50000}$th of an inch. Thus a grating with 5000 equidistant lines per inch will give with such light an angular deviation of about 6° for the first bright diffraction line.

If we notice that the sine of the deviation is proportional to the wave-length, it will be obvious that when white light is used the result will be a series of spectra on each side of the central white image, their more refrangible ends being turned towards that image. When the grating is a very regular one, and the appearances are examined by means of a telescope adjusted for parallel rays, the spectra formed in this way show the Fraunhofer lines with as great perfection as do the best prisms.

Interference spectrum.

And they have one special advantage, which prisms do not possess. The relative angular separation of the various colors depends solely on their wave-lengths, and thus the spectra formed by different gratings are practically similar to one another. There is, in fact, almost no *irrationality* in this kind of dispersion. In glass prisms, and especially in those of flint glass, the more refrangible part of the spectrum is much dilated, while the less refrangible part is compressed.

Wave-lengths for different homogeneous rays.

The counting of the number of lines per inch in a grating is not difficult, nor is the accurate measurement of the angle of deviation of any particular Fraunhofer line. Hence, by the help of the very simple formula given above, the wave-lengths of light correspond ing to the various Fraunhofer lines have been determined with very great accuracy from the defraction spectra of gratings. The following are, according to Ångström,[1] a few of the chief values. λ is expressed in ten-millionths of a millimetre.[2]

A	Atmospheric	7604	. . . .
B	Atmospheric	6867	1·3309
C	Hydrogen	6562	1·3317
D (double)	Sodium	5895 5889	1·3336
E	Calcium and Iron	5269	1·3358
F	Hydrogen	4861	1·3378
G	Iron	4307	1·3413
H (double)	Calcium and Iron	3968 3933	1·3442

For the sake of a discussion to be entered on later, we have appended the refractive index from air into water for each of these rays, as given by Fraunhofer himself.[3]

Complementary gratings. If now we suppose AB, CD, etc., to be transparent, while BC, etc., become opaque, it is obvious that the new grating will be the *complement* of the old one, and will give precisely the same appearances at points outside the course of the direct beam. For when there is no grating there is practically no illumination at such points. This statement of course is equally true of any grating, whatever be the ratio of the breadths of the bars to those of the interstices.

Shadow of circular disk. Another very curious result of the theory of interference, fully verified by experiment, is furnished by the fact that the *central* spot of the shadow of a small circular disk, cast by rays diverging from a distant point in its axis, is as brightly illuminated as if the disk had not been interposed.

Reflection from thin plates. The final example of interference which we can give here is noteworthy on account of a peculiarity which it presents. Let us consider the case of homogeneous light reflected by a thin plate or film of a transparent material.

Let AB (fig. 33) be the direction of the incident ray, BdE the direction in which part of it is reflected to an eye E at a considerable distance; and let DE be the direction in which another part escapes after refraction into the plate at B and partial reflection at the second surface of the plate at C. Then if Dd be drawn perpendicular to BE, the retardation of the wave in DE as compared with that in BE will be $(2\mu \mathrm{BC} - \mathrm{B}d)/\lambda$ wave-lengths, where μ is the refractive index into the plate.

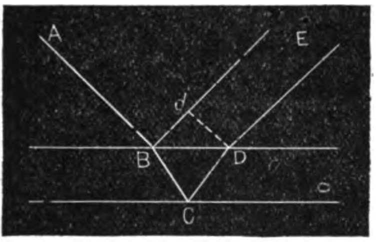

Fig. 33.

If α' be the angle of refraction, and t the thickness of the plate, it is easily seen that

$$\mathrm{BC} \cos \alpha' = t,$$

and

$$\mathrm{BD} = 2\mathrm{BC} \sin \alpha' = 2t \tan \alpha'.$$

Hence

$$2\mu \mathrm{BC} - \mathrm{B}d = 2\mu t \cos \alpha'.$$

Hence whenever, for a given thickness of plate, α' is such that

$$2\mu t \cos \alpha'$$

is an integral multiple of λ, the two rays should reinforce one another at E. The same will happen for a given angle of incidence when the thickness of the plate is such that

$$2\mu t \cos \mu'$$

is an integral multiple λ. When, on either account $2\mu t \cos \alpha'$ is an odd integral multiple of $\lambda/2$; the rays at E will weaken (perhaps destroy) one another.

Colors of thin plates. Hence, in homogeneous light, a thin plate, turned about, alternately reflects and does not reflect to an eye in a given position. And a fixed plate of non-uniform thickness reflects light from some parts and not from others. When white light is used there will in general be colors seen which vary with the angle of incidence, and also with the thickness. If the plate is infinitely thin, it would appear that there should be infinitely slight retardation only, and the plate should thus be bright in homogeneous light (and of course white in white light) at all incidences.

Blackness. In general this is *not* the case. Thus when a soap bubble, or a vertical soap-film, is screened from currents of air, and allowed to drain, the uppermost (*i.e.*, the thinnest) part becomes *perfectly black*. It can, in fact, be seen only by the feeble light scattered by little drops of oil or particles of soap or dust on its surface. Here, again, Young's sagacity supplied the germ at least of the explanation. It is given in the following extract from his *Theory of Light and Colors*, the Bakerian Lecture for 1801 already referred to:—

Loss of half wave-length.

"PROPOSITION IV.—*When an undulation arrives at a surface which is the Limit of Mediums of different Densities, a partial Reflection takes place, proportionate in Force to the Difference of the Densities.*

"This may be illustrated, if not demonstrated, by the analogy of elastic bodies of different sizes. 'If a smaller elastic body strikes against a larger one, it is well known that the smaller is reflected more or less powerfully, according to the difference of their magnitudes; thus, there is always a reflection when the rays of light pass from a rarer to a denser stratum of ether, and frequently an echo when a sound strikes against a cloud. A greater body striking a smaller one propels it, without losing all its motion; thus, the particles of a denser stratum of ether do not impart the whole of their motion to a rarer, but, in their effort to proceed, they are recalled by the attraction of the refracting substance with equal force; and thus a reflection is always secondarily produced, when the rays of light pass from a denser to a rarer stratum.' But it is not absolutely necessary to suppose an attraction in the latter case, since the effort to proceed would be propagated backwards without it, and the undulation would be reversed, a rarefaction returning in place of a condensation; and this will perhaps be found most consistent with the phenomena."

This idea, of a rarefaction returning by reflection when a condensation is incident, is equivalent to a loss or gain of half a wave-length when light in a denser body is reflected at the surface of a rarer body. Whether, then, the plate be denser or rarer than the medium surrounding it, one or other of the two interfering rays loses half an undulation more than the other in the mere act of reflection. This completely removes the difficulty. But Young went further, and pointed out that if a thin plate be interposed between two media, one rarer, the other denser than the plate, this half wave-length effect should disappear. He verified this conjecture by direct experiment, founded on a modification of a process due to Newton.

Newton's rings. Newton had, long before, devised and carefully employed an excessively ingenious (because extremely simple and effective) method of studying the colors of thin plates. It consisted merely in laying a lens of long focus on a flat plate of glass. The film of air or other fluid between the spherical surface and its tangent plane has a thickness which is directly proportional to the square of the distance from the point of contact. When such an arrangement is looked at in homogeneous light, the lens having been pressed into contact with the flat plate, there is seen a central black spot, surrounded by successive bright and dark rings, whose number appears to be practically unlimited. The radii of the successive bright rings were found by Newton to be as the square roots of the odd numbers 1, 3, 5, etc. Hence the thicknesses of the film of air are directly as these numbers. When rays of higher refrangibility are used the rings diminish in diameter. Hence when white light is employed we have a superposition of colored rings of all sizes, but it is no longer possible to trace more than four or five alternations of *bright* and *dark* rings—the colors being then more and more compound. This series of colored rings is named after Newton, and the successive colors, gradually more and more composite, form Newton's *scale of colors*. Thus we read, in books more than thirty years old, of a red or blue of the *third order*, meaning those colors as seen in the third bright ring round the central dark spot.

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[1] *Spectre Solaire*, 1868.

[2] As there are nearly 25 millimetres in an inch, these numbers each multiplied by 4 give the wave-lengths approximately in thousand-millionths of an inch.

[3] Gilb *Annalen*, lvi., 1817.

Colors of grooved surfaces.

Thin plates.

Many of the most vivid colors of natural and artificial bodies are due to one or other of the forms of interference we have roughly explained. Thus Barton's *buttons* (once employed for ornament as they produce an effect very similar to that of diamonds) were simply polished metal plates stamped by a die of hardened steel, on whose surface a pattern had been engraved consisting of small areas ruled in different directions with close equidistant parallel grooves. That the colors of a pearl and of mother-of-pearl are due to a similar surface corrugation was proved by Brewster, who took impressions from such substances in black wax, and found that it was thus rendered capable of giving the same play of colors. The scales from the wings of butterflies owe their bright colors to a delicate ribbed structure. On the other hand, the thin transparent wings of the house-fly, earwig, etc., owe their colors to their thinness. The same is true of the temper color of steel, Nobili's rings, etc. Very beautiful examples of thin plates scaled off from decayed glass (found in Roman excavations) have been figured, with their play of colors, by Brewster.[1]

Refractive index in terms of wave-length.

Here we can only say a word or two about the probable relation between the wave-length of homogeneous light and its refractive index for any isotropic medium. The existence of dispersion was attributed by Cauchy to the fact that even the most homogeneous media, such as water, have grained a heterogeneous structure of dimensions not incomparably smaller than the average length of a wave of light. This grained structure has been recently proved to exist, by several perfectly independent processes arising from totally unconnected branches of physics; and its dimensions have been assigned, at least in a roughly approximate manner. See ATOM, and CONSTITUTION OF BODIES.

It appears from the theory of disturbances in such a medium that the velocity of a ray depends upon its wave-length in a manner which is expressed by a series of even inverse powers of that wave-length. Hence we have a relation such as

$$\mu = \alpha + \frac{\beta}{\lambda^2} + \frac{\gamma}{\lambda^4} + \dots\dots$$

in which, from our present ignorance of the precise connection between matter and ether, we must be content to find the multipliers of the various terms by direct measurement. If we neglect all but the first two terms, we may determine α and β from the known wave-lengths of two of Fraunhofer's lines, and their refractive indices for a particular medium. We can then test the accuracy of the formula by its agreement with the corresponding numbers in the same medium for others of the fixed lines. Thus, taking the data for water given above, we have, from the numbers for the two hydrogen lines C and F, the values

$$\alpha = 1{\cdot}3243,$$
$$\beta = 0{\cdot}00000000319.$$

Calculating from these, and the wave-length of H, we have for its refractive index 1·3447, instead of 1·3442 as determined by Fraunhofer. So far as we may trust this theory, which certainly accords fairly with the experimental data for substances of moderate dispersive powers, though by no means well with those for substances of high dispersive power such as oil of cassia, the value of the quantity α is the refractive index for the *longest possible waves; i. e., it is that of the inferior* limit of the spectrum.

Double refraction.

DOUBLE REFRACTION.—We now come to phenomena which cannot be even roughly explained by processes based on the vague analogies of sound and water waves which have hitherto sufficed for our elementary treatment of the subject

Iceland spar.

Wave-surface of extraordinary ray.

These phenomena were first observed in Iceland spar. They were described in a general way by Bartholinus, who showed that one of the two rays into which a single incident ray is divided by this substance follows the ordinary law of refraction. Huygens, who studied the subject only eight years later, verified the greater part of the results of Bartholinus, and added many new ones. From his point of view it was of course obvious that the ordinary ray is propagated by spherical waves, i. e., its velocity is the same in all directions inside the crystal. To explain the extraordinary ray, he assumed that it was propagated in waves of the form of an ellipsoid of revolution, the simplest assumption he could make. To test its accuracy he first noticed that a rhombohedral crystal of Iceland spar behaves in precisely the same way whichever pair of parallel faces light passes through. Hence he acutely concluded that the axes of the ellipsoids of revolution (if such were the form of the waves for the extraordinary ray) must be symmetrically situated with regard to each of these planes. The only such lines in a rhombohedron are parallel to that which joins those corners which are formed by the meeting of three equal plane angles. In the case of Iceland spar these equal angles are obtuse. Huygens then verified, by experiments well contrived, though carried out by a very rough mode of measurement, the general agreement of his hypothesis with the fact; and he further tested it by comparing its indications as to the position of the two images for any position of the crystal with the results of direct observation. There can be no question that the whole investigation was, for the age in which it was made, of an exceedingly high order. But it must not be left unsaid that far more accurate measurements than those of Huygens were necessary before it could be asserted that the form of the extraordinary wave is an ellipsoid of revolution, and not merely a surface closely resembling such an ellipsoid. These improved measurements were made 1802 by Wollaston, and they have recently been repeated with far more perfect optical means by Stokes, Mascart, and Glazebrook. The result has been the complete verification of Huygens's conjecture. The generating ellipse of the extraordinary waves is found to have its minor axis, which is that of revolution, equal to the diameter of the corresponding sphere for the ordinary ray. Its major axis is to the minor nearly in the ratio 1·654 : 1·483.

We are now in a position to trace the paths of the two rays into which a ray falling in any direction on a surface of the crystal is divided by refraction.

Refraction by Iceland spar.

Let fig. 34 represent a plane wave-front AB (in air) falling on the surface AC of a piece of Iceland spar cut in any way. The figure is a section perpendicular to the surface, and parallel to the incident ray. The wave-front AB cuts the surface of the spar in a line (not shown) at right angles to the plane of the paper. Draw from A the axis $A\alpha$ (not necessarily in the plane of the paper) and the sphere and ellipsoid of revolution which have $A\alpha$ for a common axis. Then, if C be taken such that BC is to $A\alpha$ as the velocity of light in air is to that of the ordinary ray in the crystal, the wave-front of the ordinary ray is found by drawing a tangent plane to the sphere, passing through C and perpendicular to the plane of the paper. This touches the sphere in a point o (in the plane of the paper) and A*o*O is the ordinary ray.[1] To find the direction of the extraordinary ray, a plane perpendicular to the paper, and passing through C, must be drawn so as to touch the ellipsoid. Let *e* be the point of contact, which will in general not be in the plane of the paper unless A*e* is in or perpendicular to that plane; then A*e*E is the extraordinary ray.

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[1] *Trans. Roy. Soc. Edin.*, 1861.

Thus, in general, the extraordinary ray is not in the plane of incidence. Also the ratio of the sines of the angles of incidence and refraction is generally different for different directions of incidence, in the case of the extraordinary ray.

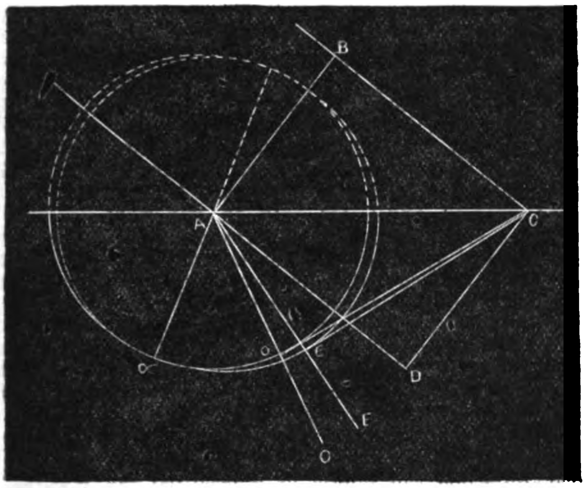

Fig. 34.

Images seen through Iceland spar.

In an elementary article we cannot attempt more fully to study these phenomena; so we merely state that all the observed appearances, so far as the *directions* of the refracted rays are concerned, are explained by supposing the wave-surface in the crystal to be made up of the sphere and the ellipsoid of revolution above described. Thus, when both eyes are used, the two images of a plane object seen through a crystal of Iceland spar appear in general to be situated at different distances above the plane. One of them maintains its apparent position as the crystal is made to rotate about a perpendicular to the two faces employed; the other's position varies as the crystal is turned.

Polarization of light.

But we have now to inquire *why* the incident ray is divided into two, and why one of them follows the ordinary law of refraction. Here another experimental result of Huygens comes to our assistance. We paraphrase the author's description:—

Huygens's discovery.

"I will, before concluding, mention another remarkable phenomenon which I discovered after the above was written. For, although I have not yet been able to find the cause of it, I do not wish on that account to refrain from pointing it out, in order that others may have an opportunity of seeking to explain it. It appears that it will be necessary to make hypotheses additional to those already given,—though these will lose none of their probability, confirmed as they have been by so many tests. The phenomenon is that, taking two fragments of the crystal (Iceland spar) and laying them on one another, or even holding them apart, if all the faces of the one be parallel to those of the other, a ray of light divided into two by the first fragment will not be farther subdivided by the second. The ordinary ray from the first will be refracted ordinarily by the second, the extraordinary ray extraordinarily. And the same thing happens not only in this arrangement but in all others in which the principal sections[2] of the two fragments are in the same plane, whether the surfaces turned towards one another be parallel or not. It is, in fact, marvellous that these rays, falling on the second fragment, do not divide like the ray incident on the first. One would say that the ordinary ray from the first fragment *had lost* what is necessary for the production of extraordinary refraction, and the extraordinary ray that which is necessary *for* ordinary refraction; but there is something else which upsets this view. For when one places the fragments so that their principal sections are at right angles, whether the opposed surfaces be parallel or not, the ordinary ray from the first suffers only extraordinary refraction by the second, and *vice versa*.

"But in all the infinite number of positions other than those named, both rays from the first fragment are divided into two by the second. Thus the single incident ray is divided into four, sometimes equally sometimes unequally bright, according to the varying relative position of the crystals. But all together do not seem to have more light than has the single incident ray.

"When we consider that, the two rays given by the first crystal remaining the same, it depends upon the position of the second crystal whether they shall be divided into two or not, while the incident ray is always divided, it appears that we must conclude that the waves of light which have traversed the first crystal have acquired a form or disposition which in some positions enables them to excite the two kinds of matter which give rise to the two kinds of refraction, in other positions to excite only one of them. But I have not yet been able to find any satisfactory explanation of this."

Newton's conjecture.

So far Huygens. His statements are perfectly in accordance with fact; and they were reproduced by Newton[3] in very nearly the same form. Newton adds:—"The unusual refraction is, therefore, performed by an original property of the rays. And it remains to be enquired, whether the rays have not more original properties than are yet discovered. Have not the rays of light several sides, endued with several original properties?"

It is very curious to notice how near each of these great men came to the true explanation, and yet how long time elapsed before that explanation was found. The date of Huygens's work is 1690, that of Newton's 1704. It was not till 1810 that farther information on the subject was obtained. *Then* one brilliant observation opened the way for a host of discoveries in a new and immense field of optics.

Polarization by reflection.

In the last-mentioned year Malus, while engaged on the theory of double refraction, casually examined through a doubly refracting prism of quartz the sunlight *reflected* from the windows of the Luxembourg palace. He was surprised to find that the two rays alternately disappeared as the prism was rotated through successive right angles,—in other words, that the reflected light had acquired properties exactly corresponding to those of the rays transmitted through Iceland spar. Even Malus was so imbued with the corpuscular theory of light that he named this phenomenon *polarization*, holding it as inexplicable on the wave theory, and as requiring a species of polarity (akin to the magnetic) in the light-corpuscles—a close reproduction of one of Newton's guesses.

Transverse vibrations.

But after a short time Hooke's old guess was independently reproduced, and in the hands of Young and others, but most especially of Fresnel, the consequences of the assumption, that the vibrations of the luminiferous medium take place *perpendicularly* to the direction of the ray, were the almost complete explanation of the cause of double refraction, and the discovery (often the prediction) of a long series of the most gorgeous phenomena known to science.

The real difficulty in the way of this conception probably lay in the fact that most of the familiar forms of wave-motion—such as sound-waves in air or in water, and ordinary water waves—are not of this character. In sound-waves the vibrations are wholly in the direction of the ray, while in surface-waves in water they are partly parallel to and partly perpendicular to the direction in which the wave is travelling. That a body may transmit waves in which the vibration is perpendicular to the direction of a ray, it must have the properties of an elastic *solid* rather than of a fluid of any kind. And our experience of the almost entire absence of resistance to the planetary motion seems, at first sight at least, altogether incompatible with the idea that the planets move in a jelly-like solid, filling all space through which light can be propagated.

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[1] This is merely a repetition of the construction we have already given for singly refracting bodies.

[2] Defined as passing through the shorter diagonal of one of the rhombic faces of the crystal, and through the edge formed by the two adjacent faces.

[3] *Optics*, Queries 25, 26.

Analogies.

Without going into difficult dynamical details, we may obtain a notion of the nature of the motion now to be considered, by observing the propagation of a wave when a long stretched wire or string is struck or plucked near one end. Here the line of motion of each part of the wire is almost exactly perpendicular to the direction of the wire, *i. e.*, to the line along which the wave travels. (When the string is extensible there may be another wave, due to extension; but this, which is analogous to sound, has its vibrations *along* the string, and it usually travels at a very different rate from the other, so that the two are not in any way associated.)

Interference of polarized rays.

Now it is clear that waves of this wholly transverse character can have, in Newton's language, *sides*. And it is also clear that they cannot interfere so as mutually to destroy one another, unless their corresponding sides are parallel to one another; nor can they interfere *at all* if their sides are perpendicular to one another. Hence a very severe test of the theory will be furnished by examining various cases of interference of polarized light, which ought to present in general marked differences from those of ordinary light. It was by experiments of this kind that Fresnel and Arago first firmly established the bases of the theory of polarization. The important fact discovered by Malus was soon generalized into the following statement:—

Polarizing angle.

Light reflected from the surface of substances so different as water, glass, polished wood, etc., at a certain definite angle, which depends on the nature of the substance, is found to possess all the properties of one of the rays transmitted through Iceland spar. If the plane of reflection is parallel to the axis of the spar, the properties of the reflected light are those of the *ordinary* ray; if perpendicular to it, those of the *extraordinary* ray.

It was reserved for Brewster to discover, as the result of an extraordinary series of experimental measurements, the very simple law which follows:—

Brewster's law.

The tangent of the polarizing angle is equal to the refractive index of the reflecting substance.

This may be put in another form, in which its connection with theory is a little more evident:—

When the reflected ray is completely polarized, it is perpendicular to the refracted ray.

Bearing in mind Huygens's observations on light which has passed through two crystals of Iceland spar, we can now see that a ray of light polarized by reflection is in general divided into two by a crystal of Iceland spar. But there is only one ray when the principal plane of the crystal is parallel to the plane of reflection, and none when these planes are perpendicular to one another.

Polarizer and analyzer.

We may now much simplify matters by suppressing the Iceland spar, and using two reflecting plates of glass, so placed that a ray meets each of them in succession at the polarizing angle. It is then found that when the planes of reflection are parallel the ray is reflected (almost without loss) from the second plate, but when they are perpendicular to one another there is complete extinction. In intermediate positions the intensity was found by Arago to be as the square of the cosine of the inclination of these planes.

This very simple experiment, which any one may easily make for himself, by putting two pieces of glass at the proper angle in the ends of two wooden tubes which fit into one another, enables us to form a general notion of the modification which is called polarization. The "sides" of the reflected ray are obviously in, and perpendicular to, the plane of incidence; for a ray can be reflected over and over again if the successive planes of incidence are parallel, but is stopped at once if one of them be perpendicular to the others.

Difficulties in the theory.

Here, however, two new difficulties come in at once:—(1) Are the vibrations of the reflected ray in, or perpendicular to, the plane of reflection? (2) As ordinary sun or lamp light, reflected at the proper angle from a polarizing surface, shows no variation of intensity when the azimuth of the plane of reflection is changed, what can be then the direction of *its* vibrations? These questions have not yet been answered in a thoroughly satisfactory manner.

Plane of vibration and plane of polarization.

Many important phenomena are explained in terms quite independent of the proper answer to (1); and, in others which do depend on the answer, the theoretical differences between the results of the two hypotheses are so small as to have hitherto remained undetected. In an important test, suggested by Stokes, the experimental results have been at variance in a way not yet explained. It is quite possible that, as is required by Clerk Maxwell's *electromagnetic theory* of light (see ETHER), there may be simultaneous displacements, but of different characters, in each of these planes, and then the question would be reduced to—Which of these displacements is the luminous one? But on this theory, *both* are probably essential to vision.

Nature of common light.

As to the second question, it may be said—*first*, that so far as the test of double refraction can inform us, a polarized ray *whose plane of polarization is made to rotate rapidly* produces precisely the same effects as a ray of ordinary light; and, *secondly*, that so great is the number of vibrations even of red light in one second, it would be impossible to make the plane of polarization rotate fast enough to affect the circumstances of any of the phenomena of interference, even when they take place between two portions of the same ray, one of which is retarded thousands of wave-lengths more than the other. But, *thirdly*, the fact that, when homogeneous light is used, Newton's rings have been *counted* up to the 7000th shows that, whatever be the actual nature of the vibrations of unpolarized light, they must for at least 7000 waves in succession be almost precisely similar to one another. Then, for other 7000 waves or so, we may have a totally different type of vibration. But, *fourthly*, in the course of $\frac{1}{8}$th of a second, at the very utmost, the vibrations must have been almost uniformly distributed over all directions perpendicular to the ray. Again, however, *fifthly*, another quite different view may be suggested. All common light has its origin from a practically infinite number of sources, consisting of the vibrating particles of the luminous body. The contributions from each of these sources (so far as one definite wave-length is concerned) may be and probably *are* at any one point as different in direction of vibration as they certainly must be in phase.[1] From this point of view, which we cannot develop here, the uniformity of optical phenomena becomes quite analogous to the statistical species of uniformity which is now found to account for the behavior of the practically infinite group of particles forming a cubic inch of gas. The reader need only think of the fact that, so numerous are those particles, it is practically (though not theoretically) impossible that even a cubic millimetre of air should, even for $\frac{1}{10000}$th of a second, contain oxygen particles alone.

Reflection not at the polarizing angle.

When light is reflected at an incidence either less or greater than the polarizing angle, it behaves as if part of it only were polarized and the rest ordinary light; and s said to be *partially polarized.* Tested by a crystal Iceland spar, it gives two images in all positions of crystal; but their brightness is unequal except in special positions where they would be of equal ghtness were the ray wholly polarized.

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[1] A curious exception occurs in the case of light radiated from a body which polarizes by absorption. See RADIATION.

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From the fourth of the remarks made above regarding common light, and the facts of double refraction, it follows at once that, when light is to any extent polarized reflection, there must be an exactly equal amount polarized light in the refracted ray, and its plane of larization must be perpendicular to that of refraction. is was established by experiment soon after Malus's covery. But as the reflected ray from glass, water, ., is in general much weaker than the refracted ray, percentage of polarized light is generally much ater in the former. It was found, however, by ex- riment that refraction at a second glass plate parallel the first increases the proportion of polarized to com- n light in the transmitted ray, and thus that light y be almost completely polarized by transmission, at proper angle, through a number of parallel plates. e experimental data of this subject were very care- ly obtained by Brewster. He has found, for instance, w the angle of incidence for the most complete polari- ion varies with the number of plates. The plane of larization of such a bundle is *perpendicular* to the ne of refraction.

This, however useful on many occasions, is at best a gh arrangement for producing polarized light. By the most perfect polarizer for a broad beam of light a crystal of Iceland spar, sufficiently thick to allow the complete separation of the two rays. But such ecimens are rare and costly, so that the polarizer in practical use is now what is called *Nicol's*

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prism, invented in 1828 (*Jameson's Journal*, p. 83). By cutting a rhomb of Iceland ar in two, and cementing the pieces together with nada balsam (after carefully polishing the cut faces), col produced an arrangement in which one only of e two rays is transmitted, the other being totally re- cted at the surface of the balsam. The reason is nply that the refractive index of Canada balsam is ermediate to those of the ordinary and extraordinary ys in the spar. The ordinary ray, falling very liquely on a medium of a smaller refractive index, is tally reflected; the extraordinary ray, falling on a edium of greater, but very little greater, refractive wer, is almost wholly transmitted. The only defect the Nicol's prism is that, to secure the total reflec- n, its length must be considerably greater than its eadth; and thus it necessarily limits the divergency the beam it allows to pass.

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Certain doubly refracting crystals exert considerable absorption on one of the two rays they produce, and can therefore, when plates of sufficient thickness, be employed as polari- rs. This is the case with some specimens of tourma- ie when cut into plates parallel to the axis of the ystal. It is also found in the flat crystals of several tificial salts, such as, for instance, iodo-sulphate of inine.

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Let us now suppose that by one or other of these pieces of apparatus, say a Nicol's prism, light has been polarized. If we ex- nine this ray by means of a second Nicol, placed in a milar position to the first, it passes practically unal- red. As the second Nicol is made to rotate, more d more of the light is stopped, till the rotation amounts a right angle. Two well-constructed Nicols, placed this position, are practically opaque to the strongest nlight. During the next quadrant of rotation the ansmitted ray gradually increases in brightness, until 180° of rotation it passes practically unaltered. Pre- sely the same phenomena occur in the same order uring the next half of a complete rotation. The reader ill observe that this is merely Huygens's original state- ent, limited to one of the four rays which are produced by passing common light successively through two crystals of Iceland spar.

Symmetry of polarised ray.

Whatever be the true mechanism of polarized light, there can be no doubt that its vibrations are *symmetrical* with respect to the ray, and also with respect to the plane of polarization. Hence we may, for many important purposes, symbolize them by simple harmonic vibrations taking place either in or perpendicular to the plane of polarization. But, if they be supposed to take place simultaneously in these two planes, their quality or nature must be essentially different in the two, else the symmetry above referred to would be violated. Hence it will be sufficient for the present to assume that they take place perpendicular to the plane of polarization. The nature of the resulting effects, so far as the eye is concerned, will not be different for the different hypotheses. Also, as no instance has yet been observed, even with the most intense beams of light, in which the joint effects observed are not those due to simple superposition, we may assume that the elastic force of the luminiferous medium, called into play by a displacement, is directly proportional to the displacement, and therefore that the vibrations for each wave-length follow the *simple harmonic law*, that of the cycloidal pendulum.

The subject of the composition of simple harmonic motions of equal period falls to be discussed as an important branch of *kinematics* (see MECHANICS). We will therefore here assume the following results,—referring to the above-quoted article for their proof:—

Properties of simple harmonic motion.

1. Two simple harmonic motions of the same period, in lines perpendicular to one another, give, in general, elliptic motion, which may be in the positive or negative direction of rotation.

2. The ellipse becomes a straight line, and the resultant motion therefore simple harmonic, when the phases of the components are the same, or differ by an integral multiple of π.

3. It becomes a circle when the amplitudes of the components are equal, and their phases differ by an odd multiple of $\frac{1}{2}\pi$. The motion takes place in one direction (say right-handedly) in the circle when this multiplier is 1, 5, 9, 13, etc., and in the opposite (left-handed) when it is 3, 7, 11, 15, etc. . .

Effect of a plate of doubly refracting material.

Now suppose a plane polarized ray to fall on a plate of a doubly-refracting crystal (a thin plate of mica or selenite, for instance). Within the plate it will in general be divided into two, which are polarized in planes at right angles to one another.

Homogeneous light.

The directions of vibration in these rays are determined by the physical properties of the material. Let them be represented by the lines Ox, Oy in fig. 35. Then, if OA represents the semiamplitude of vibration in the incident ray, it may be looked on by (2) above as the resultant of two simple harmonic motions of the same period, whose semiamplitudes are OM and ON, and which are in the same phase. Each of these will pass through the plate of crystal *unchanged.* But one will, in general, travel faster than the other; for the essential cause of double refraction is the difference of velocities of the two rays. The portions of the two rays which simultaneously escape from the crystal, and which travel together outside it, will therefore *differ in phase.* Hence, to find the nature of the transmitted light, we must recombine the vibra-

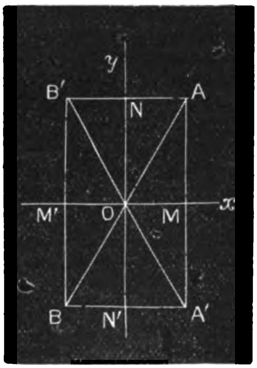


Fig. 35.

Elliptically and circularly polarized light.

tions in OM, ON, taking account of this difference of phase. By (1) above the result will be in general elliptic motion. The ellipse will necessarily be one of the infinite number which can be inscribed in the rectangle AA′BB′, whose construction is obvious. We have then, in general, what is called *elliptically polarized light.* This degenerates (by (2) above) into plane polarized light, whose vibrations are alone OA or OA′ according as the difference of phase is 0, 2π, 4π, etc., or π, 3π, 5π, etc. And it will become *circularly polarized light* if $OM = ON$ (*i. e.*, if $AOx = \frac{1}{4}\pi$) and the difference of phase be an odd multiple of $\frac{1}{2}\pi$. By (3) above this will be right or left handed, according to the value of the odd multiplier.

This conclusion from the assumption above made is fully borne out by experiment. When a plate of mica, of such a thickness as to retard one of the two rays a quarter of a wave-length more than the other, is interposed between two Nicols, we observe the following phenomena:—

If the Nicols were originally placed so as to extinguish the light, the introduction of the mica plate in general partially restores it. Now, let the mica plate be made to rotate in its own plane. The light vanishes for successive positions, differing by a quadrant of rotation, *i. e.*, whenever the directions of vibration in the crystal coincide with the principal planes of the Nicols. In each of these positions the light from the first Nicol passes unchanged through the mica, and is therefore entirely stopped by the second Nicol. Half-way between these positions the light transmitted through the system is at its brightest; and in these cases it is not altered in brightness by rotating the second Nicol. It is then circularly polarized, and in whatever direction the second Nicol is placed, the component of the circular motion which is ready to pass through it is of the same amplitude. Here, then, is a case in which a Nicol (the second) cannot enable us to distinguish between common light and light very seriously modified.

White light. In what precedes, we have assumed that *homogeneous* light was used. In general, a doubly-refracting plate produces a difference of phase in its two rays which will depend on their wave-length; and thus when white light is used we have a display of color, sometimes extremely gorgeous, and we may distinguish light thus circularly polarized from common light by slight changes of color and intensity as the second Nicol is turned.

Effect of total reflection. Hitherto we have spoken of the polarizing angle for light reflected in air from bodies such as glass, water, etc., which have a higher refractive index than air, and we have seen that an equal amount of light is polarized in the refracted beam. But what if there be no refracted beam? This is the case of total reflection inside the denser body. Fresnel discovered that in this case the two kinds of polarized light (in planes at right angles to one another) co-exist in the totally reflected ray, but that they differ in phase, and therefore in general recombine into elliptically polarized light. Guided by peculiar theoretical considerations, he was led to construct a piece of glass (*Fresnel's rhomb*), inside which light is twice totally reflected at a certain angle with the result that, if it be originally polarized in a plane inclined at 45° to the plane of reflection, the emergent light is circularly polarized.

Fresnel's rhomb.

Metallic reflection. Reflection from the surface of metals, and of very highly refractive substances such as diamonds, generally gives at all incidences elliptically polarized light. Attempts have been made to determine from such effects the refractive indices of metals and other opaque substances. These are all based upon theory, and cannot as yet command much confidence. With certain doubly-refracting substances the light reflected at a definite angle is differently polarized, and sometimes even differently colored, for different azimuths of the plane of incidence.

Rings and cross in plate of uniaxal crystal When a thin plate of doubly-refracting crystal, which gives a bright color when placed between two Nicols, is slightly inclined to the ray, the color changes as the difference of phase of the two refracted rays is increased. If, now, we take a plate of Iceland spar cut perpendicularly to the axis, no color will be produced by parallel rays passing through it perpendicularly, because both rays have a common velocity parallel to the axis; but, if divergent light be used, there is a gorgeous display of circular colored rings surrounding the axis, which depends upon the increasing retardation of the ordinary ray behind the extraordinary as their inclination to the axis increases. When the principal planes of the Nicols are at right angles, this system of rings is intersected by two black diameters, in these planes respectively. When the second Nicol is turned through a right angle, we have exactly the *complement* of the former appearance, *i. e.*, a figure such that, if superposed on the former, it would give an uniform field of white light.

It is to be noticed that none of these phenomena can be observed without the use of the second Nicol. This arises from the fact that, where the vibrations in any direction interfere so as to destroy one another, those in the direction perpendicular to the former interfere so as to strengthen one another. The second Nicol enables us to select one of these portions, and examine it independently of the other.

Biaxal crystals. The only double refraction we have considered particularly is that of Iceland spar, where everything is symmetrical about the axis of the crystal. Such crystals, and they include as a rule all those of the second and third systems in CRYSTALLOGRAPHY (*q. v.*), are called *uniaxal*. Crystals of the first system are not doubly refractive. But it was one of the most valuable of Brewster's discoveries that the great majority of non-isotropic substances are doubly refracting, and in general are *biaxal*, *i. e.*, have two equally important axes inclined to each other at angles of all values from 0° to 90°. The form of the *wave-surface* in such bodies was, at least very approximately, assigned by Fresnel. This forms one of the most brilliant of his many grand discoveries; and it led to Hamilton's prediction of the existence of the two species of *conical refraction*, which was experimentally verified by Lloyd.

Fresnel's wave.

Conical refraction.

Double refraction due to stress. Fresnel also made the striking discovery that glass and other simply refracting bodies are rendered doubly refracting when in a state of strain. To this Brewster added the observation that the requisite strain might be produced by unequal heating instead of by mechanical stress, and also that unannealed glass is usually doubly refractive. Clerk Maxwell in 1873 (*Proc. Roy. Soc.*) showed that shearing stress in viscous liquids, such as Canada balsam, renders them temporarily doubly-refractive. This subject has been elaborately investigated by Kundt (*Pogg. Ann.*, 1879).

The details of these subjects, with those of the polarization of light reflected from small particles, the *rotatory polarization* produced by quartz, sugar, transparent bodies under the influence of magnetism, etc., must be deferred to OPTICS (PHYSICAL).

There is, however, one elementary point which must not be omitted here, as it is intimately connected with the wave-theory,—that is, the alteration which light undergoes in consequence of the relative motion of the source and spectator in the line of vision.

Döppler's principle. When a steamer is moving in a direction perpendicular to the crests of the waves, she will encounter more of them in a given time if her course is towards them than if she were at rest, while, if she be moving in the same direction as the waves, fewer of them will overtake her in a given time than if she were at rest. The same thing is true of sound-waves. When an express train passes a level crossing at full speed, the pitch of the steam whistle is higher during the approach to and lower during the recess from the listener at the gate than it would be if the engine were at rest. The successive sound-pulses are emitted at the same intervals as before, but from points successively nearer to or farther from the listener. Hence more or fewer reach his ear in a given time. The principle is precisely the same as that of Römer's observation of the frequency of eclipse of Jupiter's satellites, which we have already given: the number of light-waves which reach the eye per second is increased if the source is approaching, and diminished if it be receding. We are now dealing with a phenomenon which occurs some 600,000,000,000,000 times per second instead of once every forty-two hours. Now, increased wave-frequency, with unaltered velocity of light, certainly implies shorter wave-length and most probably greater refrangibility, and *vice versa*. There is, undoubtedly, a weak link in this reasoning, due to our ignorance of the true nature of the luminiferous medium and of the species of vibration on which light depends. If we knew something definite about the nature of the ether, and the mechanism of its vibrations, this weakness would be at least in part got rid of. Observation has not yet settled the question of the relative motion of bodies, the ether they contain, and the ether in free space.

This principle has been applied with success by Huggins and others to find the rate at which we are approaching to or receding from different fixed stars, and the rate of motion in solar cyclones; and it may even be applied, as was ingeniously suggested by Fox Talbot (*B. A. Report*, 1871), to determine (from the relative velocities of the components of a double star in the line of sight, measured by its aid) the distance of the star itself from our system.

The reader is advised to consult, in connection with the whole of the second part of this article, the previous article ETHER. (P. G. T.)

LIGHTFOOT, JOHN (1602–1675), an eminent rabbinical scholar, was the son of Thomas Lightfoot, vicar of Uttoxeter, Staffordshire, and was born at Stoke-upon-Trent in that county, on March 29, 1602. His school education was received at Morton Green near Congleton, Cheshire, and in June, 1617, he entered Christ's College, Cambridge, where he made great progress in Latin and Greek, and was reckoned the best orator among the undergraduates. After taking his bachelor's degree, he became for some time assistant master at Repton in Derbyshire; at the canonical age he received ordination, and shortly afterwards was appointed curate of Norton-under-Hales in Shropshire. There he attracted the notice of Sir Rowland Cotton, an amateur Hebraist of some attainments it would seem, who made him his domestic chaplain at Bellaport, and was the first to awaken his taste for rabbinical learning. Shortly after the removal of Sir Rowland with his family to London, Lightfoot followed him thither, but for some unexplained reason soon left the capital again, and, visiting his parents at Uttoxeter, took a solemn leave of them, having resolved "to travel beyond the seas." An unexpected and pressing invitation induced him to change his determination, and to accept a charge at Stone in Staffordshire, where he continued for about two years, and where, on May 21, 1628, he married Joyce, daughter of William Crompton of Stone Park, and widow of George Copwood of Delverne, Staffordshire. From Stone he removed to Hornsey near London, for the sake of the library of Sion College, which he often had occasion to consult; his first published work, entitled *Erubhin, or Miscellanies, Christian and Judaical, penned for recreation at vacant hours*, and dedicated to Sir R. Cotton, appeared at London in 1629. During the summer and autumn of 1630 he lived at Uttoxeter, and in September of that year he was presented by Sir R. Cotton to the rectory of Ashley in Staffordshire, where he continued to discharge his pastoral duties, and to prosecute his rabbinical studies, for the next twelve years. For the more uninterrupted pursuit of the latter he is said to have bought a small piece of land near his parsonage, and to have built upon it a small house "containing a study and with drawing room below, and a lodging chamber above." "Here he closely followed his said studies with great delight and unwearied diligence, and did choose to lodge here very often, though it were so near to his family and parsonage house." In June, 1642, he left Ashley for London; the precise occasion of the removal is not known, but probably it arose out of the necessity for personal superintendence of the publication of his next work, *A few and new Observations upon the Book of Genesis: the most of them certain; the rest, probable; all, harmless, strange, and rarely heard of before*, which appeared at London in that year with a dedication to "my dear and loving countrymen of the county of Stafford, and other my friends residing in the city of London." Soon after his arrival in the capital he became minister of St. Bartholomew's church, near the Exchange; and in 1643 he was appointed to preach the sermon before the House of Commons on occasion of the public fast of March 29. It was afterwards published under the title of *Elias Redivivus*, the text being Luke i. 17; in it a parallel is drawn between the Baptist's ministry and the work of reformation which in the preacher's judgment was incumbent on the parliament of his own day. Lightfoot was also one of the original members of the Westminster Assembly, which held its first formal meeting on Saturday, July 1, 1643; his "Journal of the Proceedings of the Assembly of Divines from January 1, 1643, to December 31, 1644," now printed in the thirteenth volume of the 8vo edition of his *Works*, is a valuable historical source for the too brief period to which it relates. He was assiduous in his attendance from the first, and, though frequently standing almost or even quite alone, especially in the Erastian controversy, exercised a material influence on the result of the discussions of the Assembly. In 1643 Lightfoot published *A Handful of Gleanings out of the Book of Exodus*, dedicated to the inhabitants of Bartholomew Exchange, and in the same year he was made master of Catherine Hall by the parliamentary visitors of Cambridge, and also, on the recommendation of the Assembly, was promoted to the rectory of Much Munden in Hertfordshire; both appointments he retained until his death. In 1644 was published in London the first instalment of the laborious but never completed work of which the full title runs *The Harmony of the Four Evangelists among themselves, and with the Old Testament, with an explanation of the chiefest difficulties both in Language and Sense: Part I. From the beginning of the Gospels to the Baptism of our Saviour.* The second part *From the Baptism of our Saviour to the first Passover after* followed in 1647, and the third *From the third Passover after our Saviour's Baptism to the second* in 1650. On August 26, 1645, he again had the honor of preaching before the House of Commons on the day of their monthly fast; in the discourse, which was afterwards published (*A Fast Sermon*, on Rev. xx. 1, 2), after controverting as erroneous and false the doctrine of the Millenaries, he goes on to urge upon the parliament various practical suggestions for the repression with a strong hand of current blasphemies ("I do hold it a truer point in divinity that 'errans conscientia liganda' than 'ligat'"), for a thorough revision of the authorized version of the Scriptures, for the encouragement of a learned ministry, and for a speedy settlement of the church. "I rejoice to see what you have done in platforming classes and presbyteries, and I verily and cordially believe it is according to the pattern in the mount." In the same year appeared *A Commentary upon the Acts of the Apostles, chronical and critical; the Difficulties of the text explained, and the times of the Story cast into annals. From the beginning of the Book to the end of the Twelfth Chapter. With a brief survey of the contemporary Story of the Jews and Romans* (down to the third year of Claudius); and in 1647 he published *The Harmony, Chronicle, and Order of the Old Testament,* which was followed in 1655 by *The Harmony, Chronicle, and Order of the New Testament,* inscribed to Cromwell, with an epistle dedicatory to his highness's honorable council. In the last-named year Lightfoot, who in 1652 had commenced doctor of divinity, was chosen vice-chancellor of the university of Cambridge, but continued to reside by preference at Munden, in the rectory of which, as well as in the mastership of Catherine Hall, he was confirmed, through the influence of friends, at the Restoration. The remainder of his life was principally devoted to the production of the work by which his name now chiefly lives, the *Horæ Hebraicæ et Talmudicæ,* in which the volume relating to Matthew appeared in 1658, that relating to Mark in 1663, and those relating to 1 Corinthians, John, and Luke, in 1664, 1671, and 1674 respectively. Towards the close of 1675, while travelling from Cambridge to Ely (where he had been collated by Sir Orlando Bridgman to a prebendal stall), he caught a severe cold, upon which, by an indiscretion in diet it is said, fever supervened; falling afterwards into a lethargy which continued for about a fortnight, he died at Ely on December 6, 1675. The *Horæ Hebraicæ et Talmudicæ impensæ in Acta Apostolorum et in Ep. S. Pauli ad Romanos* were published posthumously.

The *Works* of Lightfoot were first edited, in 2 vols. fol., by Bright and Strype in 1684; the *Opera Omnia, cura Texelii,* appeared at Rotterdam in 1686 (2 vols. fol.), and again, edited by Leusden, at Franeker in 1699 (3 vols. fol.). A volume of *Remains* was published at London in 1700. The *Hor. Hebr. et Talm.* were also edited in Latin by Carpsov (Leipsic, 1675–79), and again, in English, by Gandell (Oxford, 1859). The most complete edition is that of the *Whole Works,* in 13 vols. 8vo, edited by Pitman (London, 1822–25). It includes, besides the works already noticed, numerous sermons, letters, and miscellaneous writings; and also *The Temple, especially as it stood in the Days of our Saviour* (London, 1650).

LIGHTHOUSE.

I. LIGHTHOUSE CONSTRUCTION.

THE primary and most important consideration relating to the design and construction of a lighthouse tower which is to be built within the tide mark is the force of the waves which may be expected to assail it, and the directions and heights at which that force will act on the building. The great waves which are found in the open ocean cannot be generated in smaller seas, and, with a due regard to economy in construction, ought not therefore to be provided against. What is wanted is to ascertain in such shorter seas the height of waves in relation to the length of "fetch" in which they are generated, and next to determine their energy when on reaching the shore or a sunken rock, and so ceasing to be waves of oscillation, they enormously increase their destructive force by becoming waves of translation. Full information as to these points and as to the marine dynamometer—an instrument used for ascertaining the force of the waves on an exposed surface—will be found in the article HARBORS, to which the reader is referred. It is enough here to state that the law of increase in the height of waves was found by Mr. T. Stevenson to be proportional to the square root of the distance from the windward shore, and that the greatest force recorded on rocks exposed to the ocean was 3½ tons per square foot. The relative forces of summer and winter gales were found to be as 1 to 3, and the vertical force, after acting on a curved sea wall, was eighty-four times greater than the horizontal force at a height of 23 feet above high water.

The history of the ancient lighthouses is of so scanty a nature that we may pass at once to more modern works, commencing with Winstanley's Eddystone light.

Winstanley's Eddystone Light.—The Eddystone Rocks, which lie about 14 miles off Plymouth, are fully exposed to the south-western seas. The lighthouse was completed by Winstanley in four seasons. In 1698 it was finished at a height of 80 feet and the light exhibited; but in 1699, in consequence of damage by storms, the tower was increased by an outer ring of masonry 4 feet thick, and made solid from the foundation to nearly 20 feet above the rock. The height was increased to nearly 120 feet, and completed in 1700. During the well-known hurricane of 20th November, 1703, the tower was destroyed. In general design as well as in details this work must be placed among the *vetanda* of maritime engineering. For example, in plan it was polygonal instead of circular. In his blind devotion to ornamentation Winstanley violated throughout the principles of uniformity of outer profile so as to present great obstructions to the action of the waves.

Rudyerd's Eddystone Tower.—This work was commenced in 1706 and completed in 1709, in the form of a frustum of a cone 92 feet high. The work consisted principally of timber, the lower part being oak carefully bolted together, and also to the rock. Above the lower structure of oak courses of stone, cramped together and fixed to the timber work and to the rock, were added in order to give weight to the structure. This lighthouse stood for forty-six years, and was destroyed by fire in 1755. In every respect the simplicity of the structure and the judicious character of the details of the design may be regarded as models of engineering. First, it rested upon a stepped level base, was circular in plan, did not wholly depend upon fixtures but upon weight, preserved a uniform external surface devoid of outside projections and ornamentation; and, above all, the engineer did not by splaying out the base needlessly throw away the small diameter which the rock afforded, but with much judgment adopted the conical form.

Smeaton's Eddystone Tower.—This justly celebrated work, which consisted entirely of stone, was commenced in 1756, and the masonry was finished in 1759. Smeaton was the first engineer who adopted a structure of masonry for a sea tower and dovetailed joints for the stones, which averaged a ton in weight. This work cannot be regarded as a safe model for general imitation in exposed situations, and Rudyerd's earlier tower was certainly as successful in resisting the forces to which it was exposed. Rudyerd unquestionably selected for so small a rock as the Eddystone a preferable form to that adopted by Smeaton. The sharply curved profile in Smeaton's design greatly reduced the diameter of the building at a small height above the rock, and so reduced its strength. Smeaton's reasoning about the similarity of a tower exposed to the surf and an oak tree resisting the wind was very conclusively shown to be fallacious by the late Mr. Alan Stevenson. The

Fig. 1.

arching of the floors, as shown in fig. 1, was also a source of weakness which the introduction of the iron chains, shown black in the diagram, was intended to counteract. Mr. Douglass, in 1878, stated that "for several years the safety of the Eddystone had been a matter of anxiety and watchful care to the corporation of the Trinity House, owing to the great tremor of the building with each wave stroke." He also stated that the projecting cornice at the top had been lifted, and that the rock itself had been considerably undermined. A new tower has now (1882) been erected in place of Smeaton's by Mr. Douglass.

Bell Rock Lighthouse Tower.—The Bell Rock, which lies 12 miles off the coast of Forfarshire, is fully exposed to the assaults of the German Ocean. The rock is of considerable extent but of a low level, the tower being covered about 16 feet at high water of spring tides. Mr. R. Stevenson, of Edinburgh, when he first landed on the rock, decided to adopt a stone tower as Smeaton had done at the Eddystone, but he deviated largely from that design in the thickness of the walls, in raising the tower to 100 feet instead of 68 feet, and the level of the solid to 21 feet above high water instead of 11 feet. Instead of employing arched floors as at the Eddystone, he adopted lintel stones for the floors which formed part of the outward walls, and were feathered and grooved as in carpentry, besides having dovetailed joggles across the joints where they formed part of the walls. It will be seen on fig. 2 that the floors instead of being sources of weakness, as in Smeaton's tower, were converted into effective bonds tying the walls together. He also used a temporary beacon or barrack on the rock for the engineer and his workmen to live in while the tower was in progress. The bill introduced into parliament for this work in 1802 was not passed in consequence of financial difficulties. As the Bell Rock was scarcely dry at low water, while the Eddystone was scarcely covered at high water, the commissioners, in order to fortify Mr. Stevenson's views, consulted Mr. Telford, and before going to parliament for the second time they also, on Mr. Stevenson's suggestion, obtained for the scheme the support of Mr. Rennie, with whom he could afterwards advise in case of emergency during the progress of the work. The second bill was passed in 1806, and the works, which were begun in 1807, were finished in 1810, and the light was exhibited in 1811. The total weight of the tower is 2076 tons.

Fig. 2.

Skerryvore Lighthouse.—The Skerryvore Rocks, 12 miles off the island of Tyree in Argyllshire, which is the nearest land, are wholly open to the Atlantic. The works, designed and carried out by the late Mr. Alan Stevenson, were commenced in 1838 and finished in 1843. The first temporary barrack was destroyed in 1838, and another erected on a more sheltered part of the rock. The tower, which is of a hyperbolic curve, is 138 feet high, 42 diameter at the base, and 16 at the top. Its weight is 4308 tons.

Bishop Rock.—The Bishop Rock, lying off the Scilly Islands, is fully exposed to the Atlantic. It was designed by the late Mr. James Walker, and carried out by Mr. J. N. Douglass. It is 100 feet above high water, 34 feet in diameter at the base, and 17 at top. The lowest part of the foundation of tower is covered about 19 feet at high water springs; the solid is 20 feet above high water, where the walls are 9 feet thick, and decrease to 2 feet at the top. Owing to the great tremor in this building, it has lately been found necessary to strengthen it by an internal structure of ironwork.

Wolf Rock.—This much exposed rock is about midway between Scilly and the Lizard Point, and is submerged to the depth of about 2 feet at high water. The first design for a lighthouse was in 1823, by Mr. R. Stevenson, but it was not till 1862 that a lighthouse was commenced under the superintendence of Mr. Douglass, from a design by the late Mr. Walker. It is 116½ feet high, 41 feet 8 inches diameter at the base, decreasing to 17 at the top, and the walls are 7 feet 9½ inches thick, decreasing to 2 feet 3 inches. The shaft is a concave elliptic frustum, and contains 3296 tons. The lower part of the tower has projecting scarcements in order to break up the sea, but, as has been already stated in the case of the Eddystone, such projections are not in accordance with the principle of uniformity of external surface, and are, therefore, more likely to produce disturbance of the masonry than to add to its stability.

Dhu Heartach Rock Lighthouse.—The Dhu Heartach Rock, which is 35 feet above high water, is 14 miles from the island of Mull, which is the nearest shore. The maximum diameter of the tower, which is of parabolic outline, is 36 feet, decreasing to 16 feet; the shaft is solid for 32 feet above the rock; the masonry weighs 3115 tons, of which 1810 are contained in the solid part. The temporary barrack for the workmen was made of malleable iron bars with an iron drum on the top in which the workmen lived. This tower was designed by Messrs. D. & T. Stevenson, and occupied six years in erection, the length of the working season being only about two and a half months in each year.

Chickens Rock Lighthouse.—The Chickens Rock lies 1 mile off the Calf of Man. The curve of the tower, which is 123 feet 4 inches high, is hyperbolic, the diameter varying from 42 feet to 16 feet. The tower is submerged 5 feet at high-water springs. The solid is 32½ feet in height, weighing 2050 tons, the whole weight of the tower being 3557 tons. The walls decrease from 9 feet 3 inches to 2 feet 3 inches in thickness. The work was designed by Messrs. D. & T. Stevenson, and was begun in 1869 and completed in 1874.

Great Basses Lighthouse near Ceylon.—Great Basses lighthouse lies 6 miles from the nearest land, and was designed by Mr. Douglass. The tower has a cylindrical base 32 feet in diameter, above which is a tower 67 feet 5 inches high and 23 feet in diameter. The walls vary in thickness from 5 feet to 2 feet. The tower, including the base, contains about 2768 tons, and the work was finished in three years.

There are several other lighthouses in Ireland, India, and America, which merit more attention than our space admits of, and we shall therefore conclude with directing the attention of the engineer to the important influence of the configuration of rocks in modifying the breaking of waves. It cannot but excite surprise that some of the structures which were erected on the Eddystone should have withstood the waves so long as they did. This fact seems to lead to the conclusion that the Eddystone Rock, at one time at least, acted to some extent as a shelter to the structures which were built on it. During a summer gale when Dhu Heartach lighthouse was being erected fourteen stones each of 2 tons weight, which had been fixed on the tower by joggles and Portland cement at the level of 37 feet above high water, were torn out and swept off into deep water, as shown on Plate VII. At the Bell Rock stones of 2 tons weight were several times swept away during the construction of the tower, while it is a remarkable fact that no stones were ever moved at the Eddystone. But what is more striking, the thin glass panes of Winstanley's first tower stood successfully through a whole winter's storms at the same level above the water as that at which the fourteen heavy blocks were swept away at Dhu Heartach, where it was found necessary from the experience acquired when constructing the lighthouse to raise the solid base of the tower to nearly the same height above the water as the glass panes in Smeaton's tower, which have hardly ever been broken during the storms of more than a hundred years.

The conclusion then which seems fairly deducible from these facts is that the level of the plane of dangerous impact of the waves above high water depends upon the relation subsisting between their height and the configuration of the rocks above and below high water, as well as perhaps on the configuration of the bottom of the sea near the lighthouse. Thus, while the rock at Dhu Heartach, from its height above high water, forms a great protection against the smaller class of waves, it operates as a dangerous conductor to the largest waves, enabling them to exert a powerful horizontal force at a much higher level than they would had the rock been lower. The lighthouse engineer must therefore beware of taking it for granted that Smeaton's Eddystone tower is a model for general imitation, and must carefully consider as best he can in what way the configuration of the rock may affect the stability of the tower which he has to design. Unfortunately in the present state of our information no specific directions can be laid down for his guidance in this matter, but the following general rules of construction may be given:—

(1) The tower should have a low centre of gravity, and sufficient mass to prevent its being upset by the waves. (2) It should be throughout circular in the horizontal plane, and either straight or continuously curved in the vertical plane, so as to present no abrupt change of outline which would check the free ascent of the rising waves, or the free descent of the falling waves, or the free vent of those passing round the tower. All external scarcements in the vertical plane, or polygonal outline in the horizontal plane, are therefore objectionable. (3) Its height, *cæteris paribus*, should be determined by the distance at which the light requires to be seen by the sailor. The rule for determining this height will be afterwards given. (4) Where the rock is soft, or consists of ledges which are easily torn up, the tower should spring from the foundation-course at a low angle with the surface of the rock, so as to prevent its being broken up by reaction of the waves from the building; or, in other words, the tower must have a curved profile. But special care should be taken to sink the foundation-courses below the surface of the rock, as the superincumbent weight decreases with the sine of the angle of inclination of the wall. If the rock overhangs, owing to the wearing action of the waves, the tower should, if possible, be built at a distance from the place where this dangerous action is in progress. (5) Where the rock is hard and of ample area, the tower may be of such a curved form as will best suit the economic arrangement of the materials, so as to avoid an unnecessary thickness of the upper walls. (6) When the rock is hard, but of small dimensions, the diameter above the base should not be suddenly reduced by adopting a curved profile, but a conical outline should be adopted; and if the rock be hard, but of yet smaller dimensions, a cylindric form of greater height should be adopted so as to thicken the walls, and to increase the weight and therefore increase the friction, which is directly proportional to the weight of the blocks of masonry. In all cases where the rock is small the thickness of the walls should be decreased by steps or scarcements *internally*, but never *externally*. (7) The level of the top of the solid part of the tower, and the thickness of the walls above it, should, in different towers having the same exposure, be determined in each case by the level and configuration of the rock and of the bottom of the sea. (8) The best position for the tower is not necessarily the highest part of the rock. It should, in each case, be selected so as to secure the greatest protection in the direction of the maximum fetch and deepest water near the reef. (9) The tower should not, if possible, be erected across any chasm which divides the rock, or in the direction of any gully which projects into it, especially if it be of converging form, which would concentrate wave action. (10) No permanent fixture of the tower to the rock is required for increasing the stability of the structure. The foundation-course (unless where a curved profile is adopted) becomes, indeed, in the end the most stable of all, because it has the greatest weight above it, to keep it in its place. (11) The stones should, however, be sufficiently connected together, and fixed to the rock, in order to prevent their being washed away during the construction of the work, when they have no superincumbent weight to keep them in their beds. (12) The tower should rest on a truly level base, or on level steps cut in the rock. (13) The pressure of all the materials within the tower should act vertically, so as not to produce a resolved force acting laterally as an outward thrust. (14) The tower should be of such height and diameter, with walls of such thickness, as to prevent the masonry being disturbed by the impact of the waves. (15) The entrance door should be placed on that side of the tower where the length of fetch is shortest, or where from the configuration of the reef and the depth of water, the force of the waves is least. This was determined at the Bell Rock by the distribution of the *fucus* which grew on the lower parts of the tower during the first winter, the vegetation being least where the waves were heaviest. (16) The materials should be of the highest specific gravity that can be readily obtained, and, in some special cases, lead, or dove-tailed blocks of cast iron set in cement, might perhaps be employed.

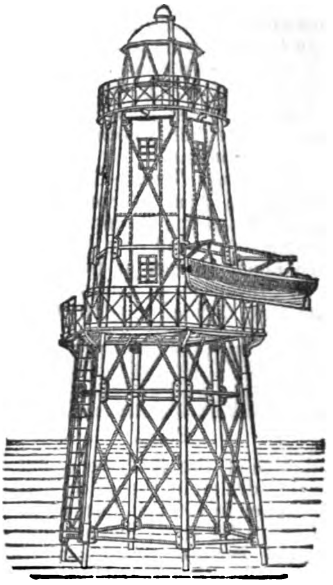


Fig. 3.

Plate VII. shows sections on the same scale of a number of the more remarkable lighthouse towers.

Fig. 3 shows an iron pile light erected at Haneda, in the Bay of Yedo, Japan.

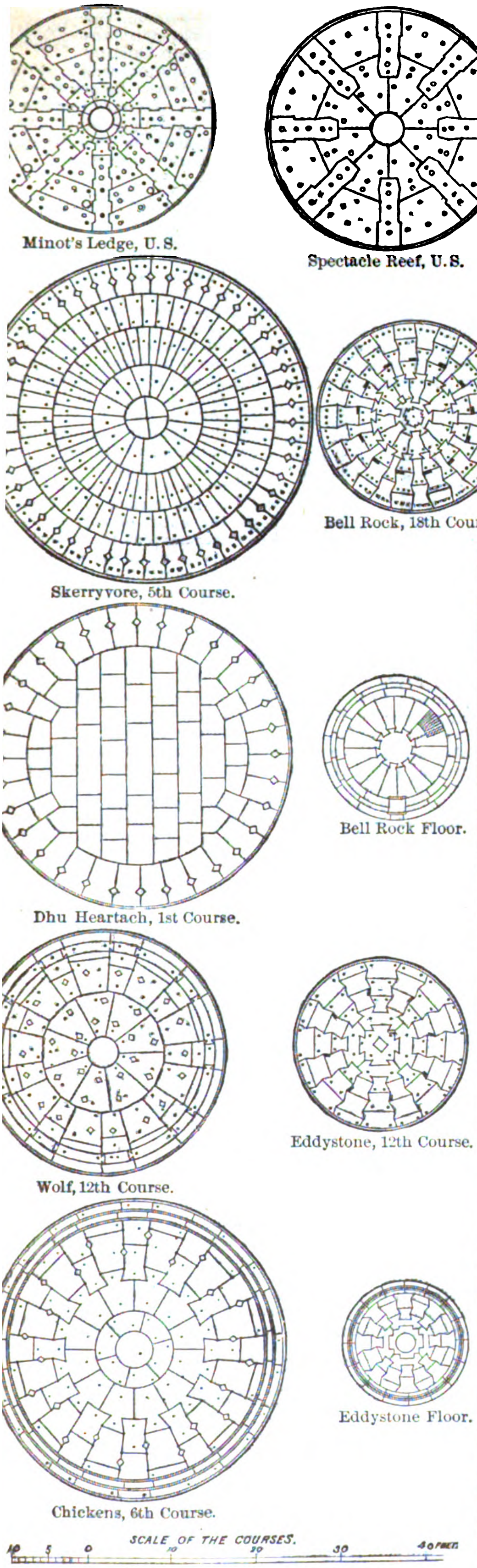
Modes of Uniting the Stones and Courses of Masonry.—Fig. 4 (p. 623) shows the mode of combining the stones during construction at different lighthouses in the United Kingdom and in America.

II. LIGHTHOUSE ILLUMINATION.

What is required of every lighthouse apparatus is either the equal distribution of the rays constantly or periodically over the whole horizon, or else their unequal distribution over certain azimuths only.

The first of these two cases, viz., the equal distribution of the light, will be best understood by explaining the different manner in which the rays are operated on by the apparatus for a fixed light and by that for a revolving light. The characteristic of a *fixed* light, which is that of being seen constantly and always of the same power round the whole horizon, might no doubt be perfectly produced by a naked flame without any apparatus, but then all the rays which did not fall on the navigable track of shipping would be lost to the sailor. In order then to intercept and utilize those rays which, instead of falling on this navigable track, would either go upwards to the sky or downwards on the shore close to the lighthouse tower, and on that part of the sea which is very near the shore, we must have recourse to optical agents both for bending down the rays which naturally point too high, and for bending up those which point too low. It thus appears that the apparatus for a fixed light should bend the rays in the vertical plane only, but should not interfere with their natural horizontal divergence in azimuth.

The demands which are made on a light that has to *revolve* are not nearly so great as on one that is fixed,



Minot's Ledge, U.S. Spectacle Reef, U.S. Skerryvore, 5th Course. Bell Rock, 18th Course. Dhu Heartach, 1st Course. Bell Rock Floor. Wolf, 12th Course. Eddystone, 12th Course. Chickens, 6th Course. Eddystone Floor.

FIG. 4.—Courses of various Lighthouse Towers.

for the revolving light does not, like the fixed, require to illuminate the whole horizon simultaneously, but only each point of it at successive intervals of time. When the dark intervals occur, the rays from the flame which are then pointing in the direction of the dark spaces should therefore have their directions so altered laterally as to pass into the adjoining light spaces and thus to increase the power of the luminous flashes. A revolving light, though supplied by a flame of the same power as a fixed, will thus necessarily be far more intense, as it does not lose its power by diffusing the rays constantly over the whole horizon, but gathers them up into a number of separate bundles or beams of great intensity. The apparatus of a revolving light has consequently more optical work to do than that of a fixed, for the rays must be bent not only in the vertical plane but laterally in the horizontal and in all intermediate planes as well.

In the construction of lighthouse apparatus either metallic or glass agents may be employed, but it has been found by experiments that a great saving of light (about 25 per cent.) is effected when glass only is used. All kinds of apparatus may conveniently be ranged either under the *catoptric system*, where metallic reflection only is used, the *dioptric*, where the material employed is wholly glass, producing refraction and total reflection, or the *catadioptric*, in which both glass and metal are employed.

CATOPTRIC SYSTEM *of Illuminating every Azimuth with Light of equal Power either Constantly or Periodically.*

Catoptric system.

Passing over the early and rude expedients of such night marks as open coal fires or naked candles placed in glazed lanterns, we shall confine our attention to the gradual development of those optical designs which are now or were lately adopted for lighthouse apparatus.

Parabolic reflectors.

Parabolic Reflectors.—In 1763, or at latest before 1777, parabolic reflectors were first used for lighthouse illumination by Mr. Hutchinson, dockmaster of Liverpool. In his work on *Practical Seamanship*, published in 1777, he states that the Mersey lights were fitted with reflectors (figs. 5 and 6) formed of small facets of silvered glass, and made, as he says "as nearly as they can be to the parabolic curve." This is unquestionably the earliest published notice of the use of parabolic reflectors for lighthouse illumination. Up to 1782 the wicks of the lamps were of a flat form, but in that year Argand introduced wicks and burners of a hollow cylindric form which admitted a central current of air through the burner so as to ignite the cone of gas issuing from the wick both within and without. Rumford afterwards split up the cone of gas into several concentric shells.

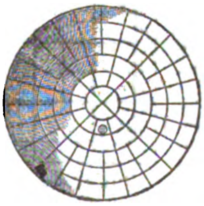


Fig. 5.

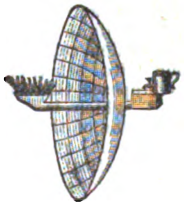


Fig. 6.

"It is remarkable," says Mr. J. T. Chance in his excellent memoir (*Min. Ins. Civil Eng.*, vol. xxvi.), "how many inventors have contributed their respective parts to the multiple burner:—Argand, the double current; Lange, the indispensable contraction of the glass chimney; Carcel, the mechanism for an abundant supply of oil; and Count Rumford, the multiple burner, an idea made feasible by these contrivances, and finally realized by Arago and Augustin Fresnel."

Optical Properties of the Parabolic Reflector.—In the parabolic reflector all rays diverging strictly from the focus and falling on the paraboloid emerge in one beam of parallel rays. But as an oil light is not a mathematical point, but an object of considerable magnitude, the rays from the outside of the flame being exfocal will, after reflection, emerge as a cone whose divergence is directly proportional to the radius of the flame and inversely to the focal distance of the reflector. Its intensity must consequently vary as the squares of the distances from the lighthouse. Optical apparatus does not then prevent that divergence which is due to the flame being of sensible magnitude.

Defects of the Paraboloid.—It will be seen from fig. 7 that the parabolic mirror *a* is at best but a very imperfect instrument, for even if the radiant were strictly a mathematical point, the cone of rays (shown undotted) escaping past the lips of the mirror must be lost.

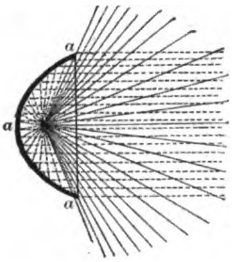


FIG. 7.—Vertical Section.

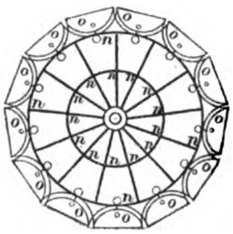


FIG. 8.—Plan.

Arrangement of reflectors.

Mode of Employing Reflectors for Fixed and Revolving Lights.—In order to produce, on the catoptric system, a fixed light showing all round the circle, a number of reflectors (*o*, *o*, *o*, fig. 8) are fixed round the outside of a stationary chandelier *n*. As the ordinary paraboloid has about 14° of divergence, twenty-five reflectors were needed to light up continuously (though not equally) the whole horizon. If again the light was to revolve, then a revolving chandelier (figs. 9 and 10) was employed having a certain number of flat faces, on each of which was fixed a number of separate lamps and reflectors with their axes parallel to each other. When the chandelier revolved, and one of the flat sides was turned towards the sailor, he would, when at some distance from the shore, receive a flash at once from each of the mirrors which were on that face, but when the face was turned away from him a dark period would intervene until the next face came round again.

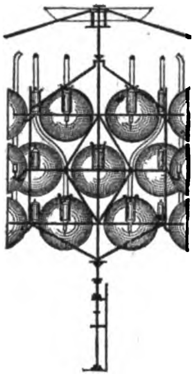


FIG. 9.—Elevation.

Fanal sidéral.

Bordier Marcet's Fanal Sidéral, 1819.—In order strictly to equalize a fixed light over the whole horizon, which could not possibly be done with separate reflectors, Marcet proposed this ingenious instrument, which is generated by the revolution of the parabolic profile *pp'* (fig. 11) round its parameter as a vertical axis, instead of round a horizontal axis, as in all former reflectors. The vertices of the parabola are cut off, so as to permit of a common focus for the flame. The rays will therefore be reflected parallel to the horizontal axis in the vertical plane, while the natural divergence of the light in azimuth will not be interfered with. By this excellent contrivance the light was for the first time spread equally round the horizon in one continuous zone. But even though the radiants were reduced to a mathematical point, very many of the rays (shown in hard lines in the elevation, fig. 11) are allowed to escape past the lips of the reflector, and this loss takes place all round the circle.

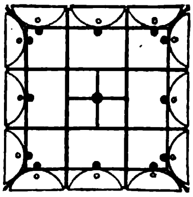


FIG. 10.—Plan.

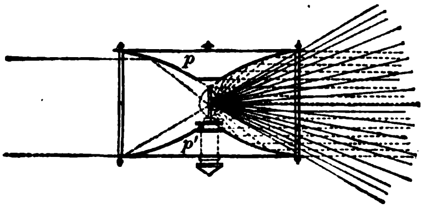


Fig. 11.

DIOPTRIC SYSTEM.

Dioptric system.

Beginning in 1822, Augustin Fresnel, the eminent physicist and mathematician, entirely revolutionized the previously existing lighthouse system by means of his annular lenses, cylindric refractors, and totally reflecting prisms. Before describing these and their combinations, it is necessary to state that the size of the flame produces divergence with lenses as well as with reflectors. The measure of this divergence for any point of the lens is the angle whose sine is

$$\frac{\text{Radius of flame}}{\text{Distance of point from centre of flame}}$$

Fresnel's Optical Agents.

Fresnel's annular lens.

Annular Lens, 1748–1822.—Buffon in 1748 suggested a new form of lens for burning purposes in order to save the loss of heat by absorption of the sun's rays in passing through a thick lens of large size whose outer profile is continuously spherical. He proposed to grind out of a solid piece of glass a lens in steps or concentric zones in order to reduce the thickness to a minimum (figs. 12 and 13). Condorcet, in his *Éloge de Buffon*, in 1773 (Paris edition, 1804, p. 35) proposed the capital improvement of building up Buffon's stepped lens in separate rings, and pointed out that the cutting of the surface into steps had the effect of correcting to a large extent the spherical aberration, or divergence from the parallel, of the rays emitted by any continuously spherical lens. Sir D. Brewster, in 1811, also described the same plan. But both these writers designed their lenses for burning purposes only, and not for operating on light, while all the surfaces of their lenses were spherical. In 1822 Fresnel constructed a built-up lens for lighthouse purposes, in which the centres of curvature of the different rings receded from the axis according to their distance from the centre, so as practically to eliminate spherical aberration, the only spherical surface left being the small central part *a* (fig. 13). These lenses are used for revolving lights only.

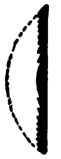


FIG 12.—Section.

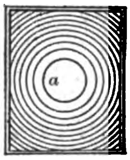


FIG. 13.—Elevation.

Cylindric refractor.

Cylindric Refractor.—This instrument was introduced by Fresnel for effecting dioptrically by refraction in front of the flame what had been done before catoptrically by Marcet's reflector by reflection from behind the flame. It consisted of a zone or hoop of glass (figs. 14 and 15) generated by the revolution round a vertical axis of the middle section of the annular lens just described, which lens, on the other hand, being generated by the same profile round a horizontal axis, parallelized the rays in every plane, whereas the cylindric refractor does so in the vertical plane only.

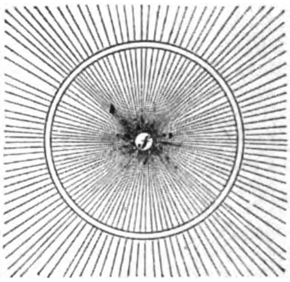


FIG. 14.—Plan.

Prisms.

Totally Reflecting Prisms.—Fresnel next conceived the admirable improvement of employing the principle of "total" or internal reflection by glass prisms. The ray Fi (fig. 16) falling on a prismoidal ring, ABC, is refracted and bent in the direction iR, and falling on the side AC, at an angle of incidence greater than the critical, is totally reflected in the direction Re, and, im-

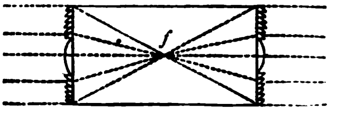


FIG. 15.—Vertical Section.

;ing on the side BC at *e*, it undergoes a second refrac- , and emerges horizontally. The highest ray FA after ıction by AB and reflection by AC must (in order to d superfluous glass) pass along AB, and after a second ıction at B emerge horizontally. The lowest ray FB r refraction by AB must, for like reason, pass along BC, after reflection by AC and a second refraction by BC emerge horizontally.

ry other ray incident he prisms between A B is, after one reflec- ı and two refractions, tted horizontally.

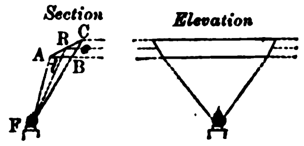


Fig. 16.

raight Refracting m.—Fresnel's straight acting prism which acts the rays that fall it, but in one plane only, requires no further explana- ı, as it is simply a straight prism of the same horizontal s section as one of the prisms of his cylindric refractor, s when placed in front of his fixed apparatus to produce eam of parallel rays like a lens.

tral
p.

Great Central Lamp—We will now go on to describe the manner in which Fresnel utilized the four new optical agents which he originated, first referring to his central burner system. In all ıthouses prior to 1822 the mode of getting up the re- red power was by employing a sufficient number of sep- te reflectors, each of which (unless we except Bordier rcet's mirror) required its own separate lamp. Instead numerous independent lamps and reflectors, Fresnel d a single lamp which had four concentric wicks, and s fed with oil by a pump worked by clock work. Sur- ınding this burner was a stationary cylindric refractor a fixed light, and annular lenses revolving outside of it a revolving light.

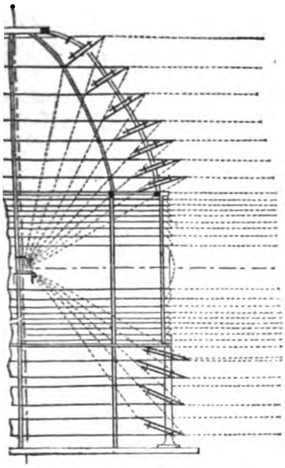


FIG. 17.—Section.

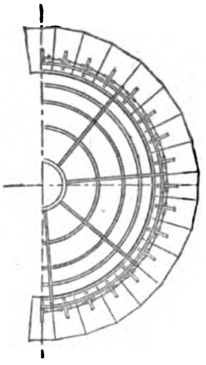


FIG. 18.—Plan.

Fresnel's Combinations of his Optical Agents.

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Catadioptric Fixed Light.—This apparatus (figs. 17 and 18), in which a central burner is used, consists of a dioptric cylindric refractor with zones of silvered mirror above and below

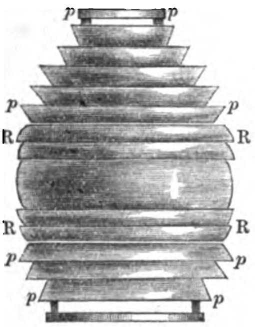

FIG. 19.—Elevation.

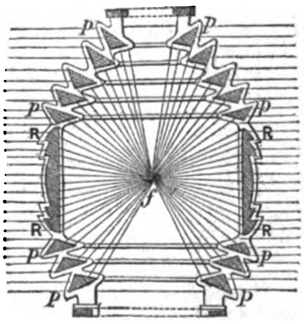

FIG. 20.—Vertical Section.

dmilar in profile to Bordier Marcet's reflector. By the ıdoption of the refractor the whole of the wasteful divergence which occurs in Marcet's reflector is prevented. We have here a geometrically perfect combination, but it is not so physically, because metallic reflection is used. This physical defect Fresnel obviated in his next design.

Dioptric fixed light.

Dioptric Fixed Light.—First Application of Total Reflection to Fixed Lights.—In this apparatus Fresnel substituted his totally reflecting prism *p* and lens R for Marcet's reflector, and thus distributed the whole light equally over the horizon by means of dioptric agents alone. This was the first application of total reflection to lighthouse apparatus, and this beautiful instrument continues till now in universal use. Figs. 19 and 20 represent an elevation and section of this apparatus.

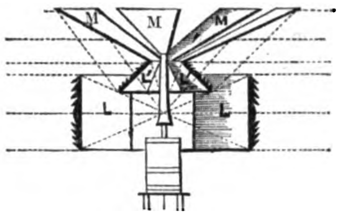

FIG. 21.—Vertical Section.

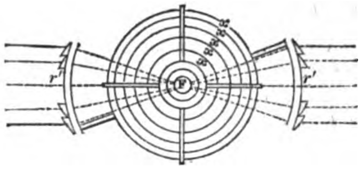

FIG. 22.—Plan.

Revolving light.

Fresnel's Revolving Light.—In this form of revolving light (fig. 21) the central burner is surrounded by annular lenses L, and a compound arrangement of inclined trapezoidal lenses L' and plane silvered mirrors M. The inclined lenses fit closely to each other and form a pyramidal dome, and the light, intercepted by them, is sent upwards in inclined beams until, falling upon the plane mirrors M, it is sent outwards in horizontal parallelized beams. All these optical agents are made to revolve round the central lamp, and the sailor receives a full flash when the axis of one of the emerging beams passes his eye, and as soon as it passes him he is in darkness until the next beam comes round. This design, unlike that of his fixed light, is imperfect on account of the employment of metallic reflection, and because two agents are employed for all except the central portion of the rays.

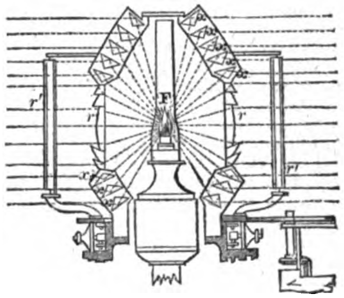

FIG. 23.—Vertical Section.

Fixed light with flashes.

Fixed Light varied by Flashes.—This distinction (figs. 22 and 23) Fresnel produced by placing his straight refracting prisms *r'* on a revolving frame outside of his fixed light apparatus *rr*, so that when the upright prisms come in line with the observer the light is increased to the power of the revolving light, a broad flash as in the annular lens being produced in place of a narrow strip of rays as in the unassisted fixed light.

Alan Stevenson's Improvements.

Alan Stevenson's improvements

Mr. Stevenson was the first to introduce the dioptric system into Britain, and in doing so he made the following improvements.

1. *Refractor of a Truly Cylindrical Form.*—Owing to difficulties in construction, Fresnel adopted a polygonal instead of a cylindric form for his refractor, but Mr. Stevenson succeeded in getting Messrs. Cookson of Newcastle to construct a first order refractor of a truly cylindric form.

2. *Helical Glass Joints for Fixed Lights.*—Mr. Stevenson further improved the apparatus by constructing the refractor in rhomboidal instead of rectangular pieces (figs. 24 and 25), thus producing helical joints and preventing serious obscuration of the light in any azimuth.

3. *Helical Metallic Framings.*—The internal metallic framework for supporting the upper cupola of prisms was also, for the same reason, made by him of a helical form.

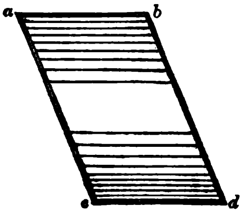

FIG. 24.—Elevation.

FIG. 25.—Vertical Section.

4. *Diagonal Framed Lantern.*—The astragals or sash bars of the lantern were likewise made diagonal and constructed of bronze instead of iron in order to reduce their sectional area. A small harbor light with inclined astragals was made in 1836 by Mr. E. Sang. Mr. Stevenson also prepared a design in 1846 for Star Point, Orkney, in which he extended the helical arrangement to the astragals, but it was never carried out. Mr. Douglass independently designed and afterwards carried into practice this form of lantern.

Alan Stevenson's Improved Revolving Light for Skerryvore.—In 1835 Mr. Stevenson, in a report to the Northern Lighthouse Board, proposed to add fixed reflecting prisms *p* (fig. 26) below the lenses of Fresnel's revolving light, and he communicated this proposal to M. L. Fresnel, who approved of his suggestion, and assisted in carrying out the design in 1843. This combination added, however, but little to the power of the flash, and produced both a periodically flashing and constantly fixed light; but it must be remembered that the prism for fixed lights was the only kind of reflecting prism then known. The combination of trapezoidal lenses and mirrors was also, for the same reason, still used. The prisms for Skerryvore were the first that were made of the large size (first order), and were constructed by M. Soleil at Paris under the superintendence of Leonor Fresnel, the successor of his brother Augustin, then deceased.

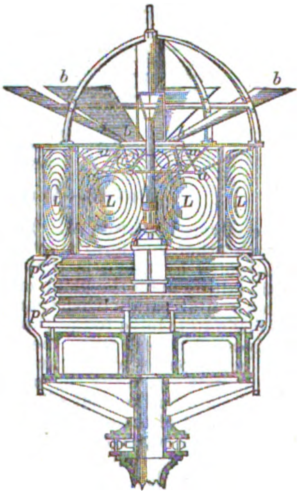

FIG. 26.—Vertical Section.

Besides the designs which have been described for improving Fresnel's revolving light, there were many others, among which may be mentioned those of Leonor Fresnel, Sir David Brewster, W. H. Barlow, F. R. S., A. Gordon, Lepaute, Letourneau, Reynaud, and Tabouret; but in all these, as well as in those which have been described, the rays were either not parallelized in every plane or else unnecessary agents were resorted to for that purpose.

T. Stevenson's HOLOPHOTAL *System.*

Holophotal system.

It was not till 1849-50 that the problem was first solved of condensing the whole sphere of rays diverging from a flame into a single beam of parallel rays without any unnecessary reflections or refractions.

Catadioptric holophote.

Catadioptric Holophote.—In figs. 27 and 28 part of the anterior hemisphere of rays is intercepted and at once parallelized by the lens L, whose principal focus (*i. e.*, for parallel rays) is in the centre of the flame, while the remainder is intercepted and made parallel by the paraboloid *a*, and thus the double agents in Fresnel's design are dispensed with. The rays of the posterior hemisphere are reflected by the spherical mirror *b* back again through the focus, whence passing onwards one portion of them falls on the lens and the rest on the paraboloid, so as finally to emerge in union with and parallel to the front rays. This was the first instrument which intercepted and parallelized all the rays proceeding from a focal point by the minimum number of agents. It is therefore geometrically perfect, and was called by Mr. Stevenson a holophote, but it is not physically so, for it employs metallic reflection, and with an ordinary oil flame and burner some of the rays reflected by the spherical mirror would fall upon the burner and be lost. This instrument was first employed at the North Harbor of Peterhead in 1849.

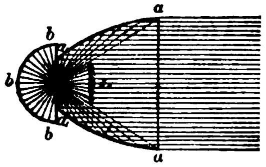

FIG. 27.—Vertical Section.

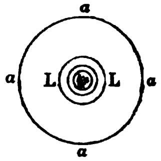

FIG. 28.—Front Elevation.

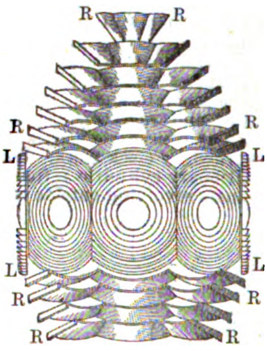

FIG. 29.—Vertical Section.

Holophotal Catadioptric Apparatus Revolving round a Central Flame.—If in place of Fresnel's compound arrangement of trapezoidal lenses and plane mirrors there are substituted mirrors R, R (fig. 29) generated by the revolution of a parabolic profile round a *horizontal* axis, all the light will be at once sent out in parallel beams by them and the lenses L, and the apparatus is therefore geometrically perfect, but metallic instead of glass agents are still employed.

T. Stevenson's Holophotal Dioptric Agents.

The agents for rendering the holophote purely dioptric fall next to be described.

Holophotal prisms.

Holophotal Prisms, 1850.—If prisms are generated by the revolution of sections of Fresnel's prisms round a horizontal instead of a vertical axis, as shown in fig. 30, rays incident upon them will be made parallel in every plane instead of in the vertical plane only as in Fresnel's prisms.[1]

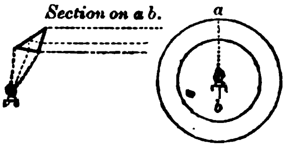

Fig. 30.

In 1852 it was stated that A. Fresnel, in 1826, tried prisms of this kind on lamp-posts for the quays of a canal in Paris, but their use was discontinued. They were not so arranged as to be applicable to lighthouses, and no account of them was published.

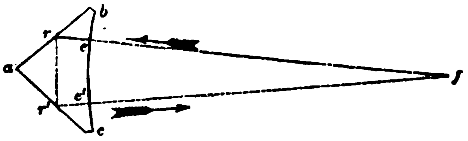

FIG. 31.—Vertical Section.

Double Reflecting Prisms giving Two Internal Reflections instead of One, 1850.—The object of these prisms is to reflect the rays back through the focus. The rays from *f* (fig. 31) pass normally through the surface *bc* and fall upon the surfaces *ab*, *ac*, by which they are totally reflected and sent back to the flame.[2]

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[1] *Trans. Roy. Scot. Soc. of Arts*, 1850.

[2] *Ibid.*

Optical Combinations of Dioptric Holophotal Agents.

ric
hote
c.

Dioptric Holophote with Dioptric Spherical Mirror.—If rings of holophotal prisms *p*, *p* (fig. 32), combined with a central refracting lens L subtending together 180°, be placed before a , the whole of the front half of the diverging sphere ys will be at once condensed by refraction and total tion into one beam of parallel rays. Next, if there be d behind the flame a dome of s formed of zones generated e revolution of the cross secof the double reflecting prisms l a horizontal axis, the back phere of rays will, after the e reflection, be returned by it gh the flame so as to diverge with the front rays; for this is a perfect mirror, not only he faint light that is superly reflected by the first consurface, but also for the main n of the rays which enter the ance of the glass and are there y reflected. Thus the whole is parallelized entirely by agents. This combination should therefore produce ght of *maximum intensity*, being both geometrically and cally perfect when the radius is a luminous point. some of the rays reflected by the upper and lower of the mirror will not clear the burner of an oil light, alling on it will be lost.

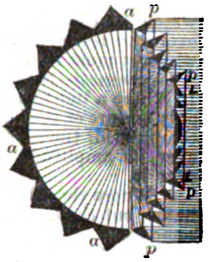

FIG. 32.—Vertical Section.

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Dioptric Holophotal Revolving Light.—Application of Total Reflection to Revolving Lights, 1850. —If sections of the front half of the diopolophote be arranged as lygonal cage round a central flame and made calate round that flame, olving light with its pe: flashes will be produced 33), which is therefore etrically and physically t, and the double agents in Fresnel's revolving are thus wholly disd with. Mr. J. T. Chance "On the whole the modplan (holophotal) must light five or six times intense than that of the r (Fresnel's) arrange." The greater simpliand compactness of this may be seen in compargs. 21 or 26 with fig. 33. e holophotal revolving is now the only one s employed for all new . It was first introl in 1850 on the small by Messrs. Stevenson at Horsburgh Rock, Singapore, m the larger scale at North Ronaldshay in Orkney, risms of which were most successfully made in 1851 tourneau of Paris.

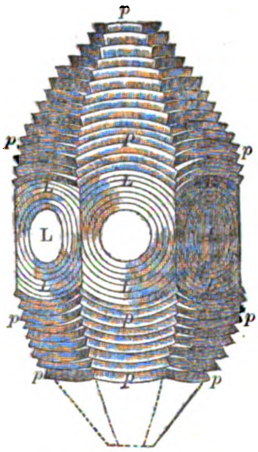

FIG. 33.—Elevation.

light
s.

Holophotal Fixed Light varied by Flashes.—Fresnel's double agents (figs. 22, 23) are here also dispensed with by the agency of panels of light apparatus *p′*, *p′* 4) and cylindrical reors L′, L′, alternating panels of holophotal atus *p*, *p*, L, L, both hich revolve together l the central burner.

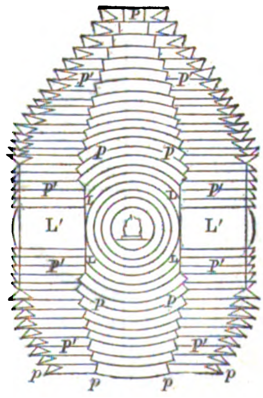

FIG. 34.—Vertical Section.

s.

Back Prisms. —It will be noticed that, perfection was atd by single agency in el's *fixed* apparatus lso in the holophotal ving apparatus, a cal defect still atd to every form of hote which compresse light into a single where the rays reto be sent back through the flame. The defect is not a geometric one, and would be non-existent were the luminant a mathematical point. In order to remedy this objection, Mr. T. Stevenson and Mr. Brebner designed what they termed "back" prisms capable of deviating the rays through an angle of 130°, so that the engineer becomes virtually independent of the critical angle. Professor Swan of St. Andrews also independently proposed the same kind of prism, accompanied by general formulæ for its construction. The ray *ab* (fig. 35) is refracted at *b*, totally reflected at *c*, and again refracted at *d*, so as to pass out parallel to the horizontal axis. These prisms may be formed by the revolution of the generating section round either a vertical or horizontal axis, or they may be made straight as shown in elevation and section in the diagram. The "back prisms" which were first used in Islay, Argyleshire, were made by Messrs Chance in accordance with Professor Swan's formula.

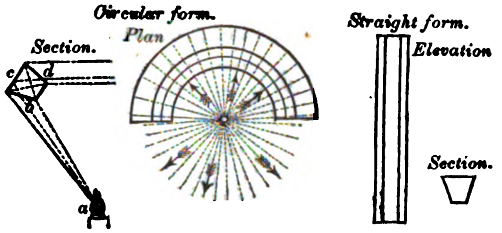

Fig. 35.

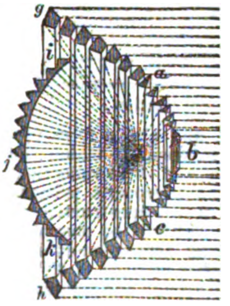

FIG. 36.—Vertical Section.

Perfect form of holophote.

Perfect Form of Dioptric Holophote for an Oil Flame.—By combining the back prisms *ga*, *hc* (fig. 36) just described with a semi-holophote *abc* subtending 180° and a portion of the dioptric spherical mirror *ijk*, no light is lost on the burner, and all the rays are parallelized, so that this apparatus, being all of glass, is both geometrically and physically perfect.

Chance's improvement.

J. T. Chance's Improvement of 1862 on Stevenson's Dioptric Spherical Mirror.—Mr. Chance says, "The plan of generating zones round the vertical axis (instead of the horizontal) was introduced by the author, who adopted it in the first complete catadioptric mirror which was made and was shown in the exhibition of 1862 by the Commissioners of Northern Lighthouses, for whom it was constructed, in order to further the realizing of what Mr. T. Stevenson had ingeniously suggested about twelve years previously. During the progress of this instrument the idea occurred to the author of separating the zones (fig. 37) and also dividing them into segments like the ordinary reflecting zones of a dioptric light; by this means it became practicable to increase considerably the radius of the mirror and thereby to render it applicable to the largest sea light without overstepping the limits of the angular breadths of the zones, and yet without being compelled to resort to glass of high refractive power."

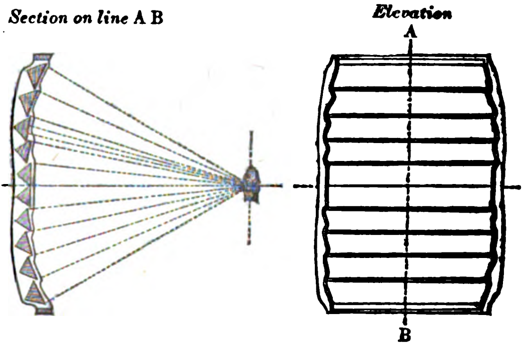

Fig. 37.

Mr. Stevenson states (*Min. Civ Eng.*, vol. xxvi.) that he originally intended to generate the prisms round a vertical axis, but adopted the horizontal as more practicable where flint glass which was taken out of the melting pot on the end of a rod had to be employed for the most important and smaller central parts of the apparatus, which at that date were the only ones that could be constructed.

Swan's designs.

Professor Swan's Designs.—Among several ingenious arrangements and new forms of agents proposed by Professor Swan[1] is the mode of sending rays from prisms through interstices left between other prisms placed in front, and also a form of agent which he termed the triesoptric prism, in which the rays would undergo two refractions and three reflections. In fig. 38 *a* are the front and *b* the triesoptric prisms. The two upper and lower prisms *a* are constructed of flint glass of high refractive power. It will be observed from the drawing that this ingenious arrangement is nevertheless open to objection, for cones of light of 30° in front and of 65° at the back are lost through the interstices.

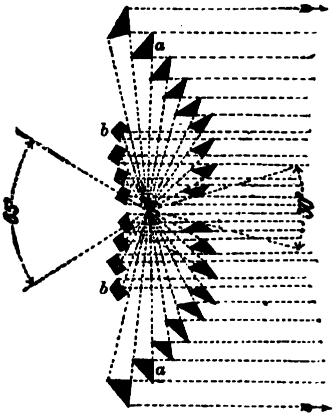

FIG. 38.—Vertical Section.

T. Stevenson's Azimuthal CONDENSING SYSTEM *for Distributing the Light Unequally in Different Directions either Constantly or Periodically.*

Condensing system.

Previous to 1850 all apparatus was designed to emit light of equal power in every azimuth either constantly or periodically, so that when applied to illuminate seas extending farther in some directions than in others, such, for example, as long narrow sounds, the power was either needlessly great in some azimuths or not nearly strong enough in others. The only exception was where a tower was placed on a long straight coast, when a spherical mirror was fixed behind the flame to prevent the light passing landward. The light that would have been lost on the land was, in this way, sent seawards, but no attempt was ever made to condense the light over a given arc or to allocate this auxiliary light in proportion to the varying lengths of the different ranges and the amplitudes of the arcs over which it had to be seen, nor, where a light had to show all round the horizon, to weaken its intensity in one arc and with the rays so abstracted to strengthen some other arc which from its range being longer ought to be of greater power. As the optical agents which we have described were insufficient for this purpose, it became necessary to devise new agents possessing special optical properties for distributing the rays not equally but equitably. Some of the more important of these agents and their combinations will be described, but before doing so it is necessary to make some preliminary explanations.

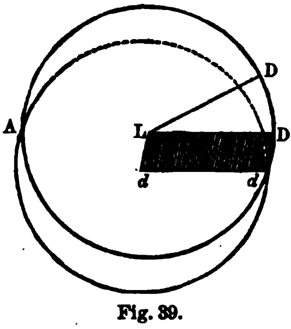

Fig. 39.

The form of the emergent light from condensing apparatus is neither a solid beam of parallel rays like that from an annular lens nor yet a zone of rays diverging naturally in azimuth all round like that from an ordinary fixed apparatus, but is intermediate between these, being a solid angle or wedge of light strengthened by those rays which would naturally diverge in other directions, but which are diverted and spread over the given sector as shown perspectively in plan in fig. 39, in which L represents the position of the lighthouse, LD′ the range, or distance at sea from which the light can be seen, and D′*dd*LD the solid horizontal angle that is to be illuminated and into which all the light DAD′ which would naturally diverge over the rest of the circle must be compressed, and over which it must be uniformly spread.

Fixed condensing lights.

Requirements for FIXED *Condensing Lights.*—

1. Where a light has to be seen constantly over only one arc of the horizon, the apparatus must compress all the rays within that one arc whatever its amplitude may be, and spread them uniformly over it.

2. Where the whole horizon has to be constantly illuminated, but the light has to be seen at greater distances over some parts of the sea than over others, as much light must be abstracted as can be spared from the shorter ranges and diverted to the longer so as to allocate the rays in the compound ratio of the number of degrees and the squares of the distances from which the light has to be seen in each arc; and the light thus diverted from one arc to strengthen another must be spread uniformly over the one that has to be strengthened. By this mode of abstraction and addition there is produced a constant equitable distribution over the whole horizon of all the rays from any single flame. Where the whole horizon has not to be lighted, and where more than one arc has to be strengthened, the rays which would be lost on the land or can be spared in some other direction must be diverted to and spread uniformly over these arcs in proportion to their amplitudes and ranges.

Revolving condensing lights.

Requirements for REVOLVING *Condensing Lights.*—1. Where a light has to give its flashes periodically over only one arc of the horizon, all the rays must be collected and sent out periodically in solid beams of equal power over that arc.

2. Where the whole horizon has to be periodically illuminated, but where its flashes have to be seen at greater distances over some parts of the sea than over others, the apparatus must be made (as in number 2 of the fixed condensing light) to vary proportionally the power of the flashes whenever they begin to pass over those parts of the sea where the ranges are of different lengths so as to produce an equitable periodic distribution of all the rays.

3. Where the whole horizon has not to be lighted, and where more than one arc has to be strengthened, the rays which would be lost on the land or can be spared in some other direction must be diverted to and spread uniformly over these arcs so as to strengthen the flashes in proportion to their amplitudes and ranges.

If n be the number of degrees in an arc to be illuminated, and d the distance in miles to be traversed by the light, then, neglecting atmospheric absorption, the quantity of light to be allocated to that arc will be proportional to nd^2; but if we take account of atmospheric absorption, supposing q to be the quantity out of a unit of transmitted light which escapes absorption after passing through a mile of air, then the whole light needed by the arc to be illuminated will be proportional to $m = nd^2q^d$. Supposing now that L is the whole 360° of available light from the apparatus, the quantity to be apportioned to the given arc will be $mL/\Sigma m$, where Σm denotes the sum of the several numbers m computed for the respective arcs of the horizon.

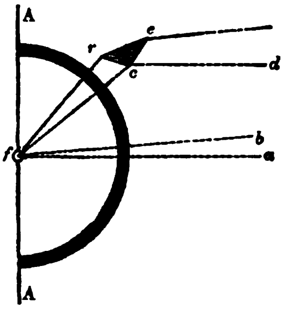

Fig. 40.

The Principal Optical Condensing Agents.

Condensing straight prisms.

Condensing Straight Prisms.—These, either by reflection or refraction, or both, cause a ray *fr* (fig. 40) proceeding in any compass bearing from a fixed light apparatus AA to emerge in the direction, *e. g.*, parallel to the corresponding ray *fb*, which proceeds in the same compass bearing from another part of the apparatus and so of any other ray *fc* which is bent parallel to the ray *fa*.

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[1] "Professor Swan's Designs," *Trans. Roy. Scot. Soc. of Arts*, 1867-68.

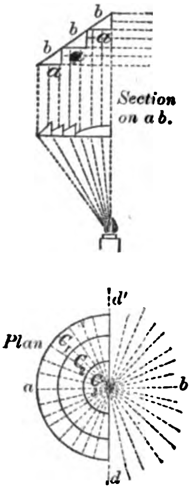

Fig. 41.

Right-angled prisms. *Right-Angled Expanding Prisms.*—These (fig. 41) are right-angled vertically, while *in plano* two of them C_1C_2 are semi-rings, and the third C_3 a semi-cone. A semi-cylindric beam of parallel rays passing vertically upwards and falling normally on the bases *a* of the prisms enter the glass, are reflected by the sides *b*, and pass out horizontally and normally to the other sides; but, as the prisms are bent through a circular segment *d'ad in plano*, the emergent rays will be spread over the same angle in azimuth, and this will be true of any angle in azimuth subtended by the prisms. As those in the diagram subtend 180°, the light will in this case be spread over half the horizon *d'ad*.

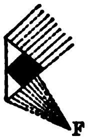

FIG. 42.—Section.

Twin prisms. *Twin Prisms.*—These are for carrying out Professor Swan's mode of causing light coming from prisms behind to pass through spaces left for the purpose between others in front. The twin prisms (fig. 42) are formed by cutting out the apex (shown black on diagram) of a straight prism so as to leave a sufficient space between it and the next prism for the passage of rays coming from behind. The length of glass traversed by the rays is lessened by this arrangement, and the size of the apparatus and lantern can at the same time be very greatly reduced.

Differential lens and refractor. *Differential Lens.*—Horizontal divergence may be obtained to any required amount by varying the radius of curvature of the inner face of an annular lens. The outer face (fig. 13) is the same as that of an ordinary annular lens, while the other face (fig. 44), though straight in the vertical, is ground to the required curve in the horizontal plane. The rays *f'fc* (fig. 45) falling upon the lens *x* converge to the vertical focal plane *ff'* and afterwards diverge through the smaller horizontal angle *x'f'x'*, and so for any other case.

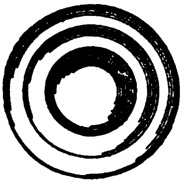
Fig. 43.

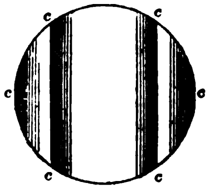

Fig. 44.

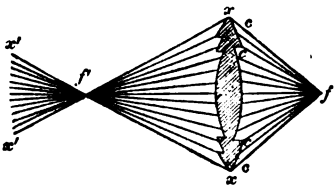

FIG. 45.—Horizontal Section.

Differential Refractor.—This is the application to the cylindric refractor of the same principle which has been described above for the ordinary annular lens.

Spherical mirror. *Condensing Catoptric Spherical Mirror.*—If a large arc of a spherical mirror be cut opposite to a short range of sea, and a smaller arc be cut in the mirror opposite to the longer range which has to be strengthened, then the light passing through the larger cut is received on an elliptic reflector placed behind, so as, with the help of an additional reflector and lens, to cause the larger cone of rays to be compressed into the smaller arc which has to be strengthened.

Spherical Mirror of Unequal Area.—This mirror is cut down in height in such a way that its different heights represent inversely the different distances of the neighboring land from the lighthouse, so as to reflect less light in the shorter and more in the longer ranges.

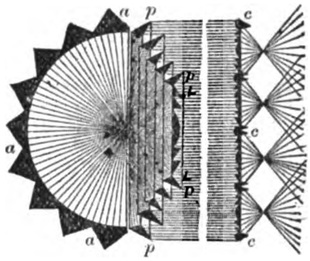

FIG. 46.—Vertical Section.

Application to Fixed Condensing Apparatus.

Light for single sector. *Fixed Condensing Light for a Single Sector*, 1850.—The holophote *pLp* (fig. 46) throws its whole light on straight condensing prisms *c*, each of which distributes the rays over the required sector.

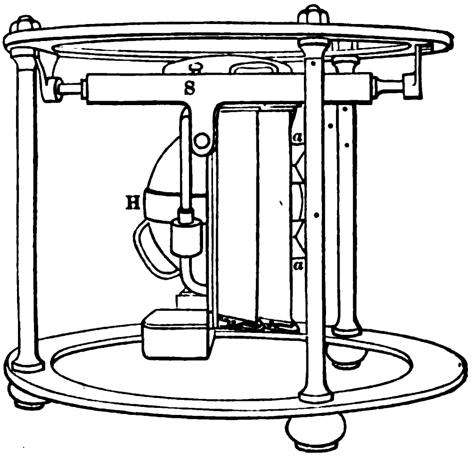

FIG. 47.—Side Elevation.

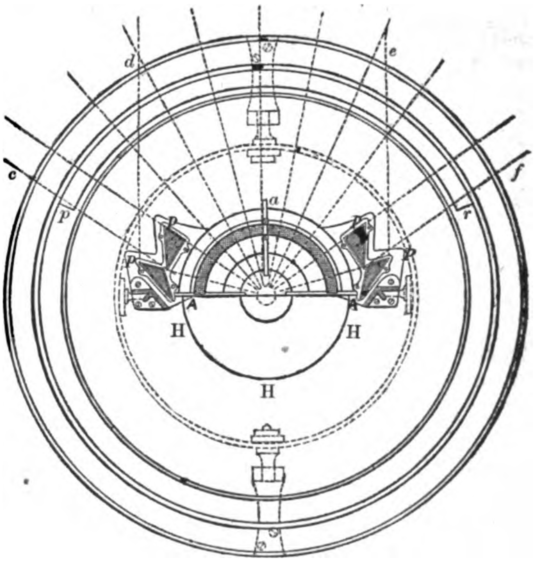

FIG. 48.—Horizontal Section.

Steamers side lights. *Condensing Apparatus for Steamers' Side Lights.*—By means of this application of the condensing principle (figs. 47 and 48) all the light can be distributed with strict equality over 112° 30′, which is the arc prescribed for steamers by the Board of Trade. Several of the Transatlantic and other steamers have adopted this kind of apparatus, which is hung on gimbals and placed in iron towers, having an entry from below the deck, which can be made use of in bad weather.

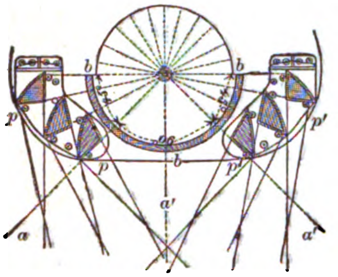

FIG. 49.—Horizontal Section.

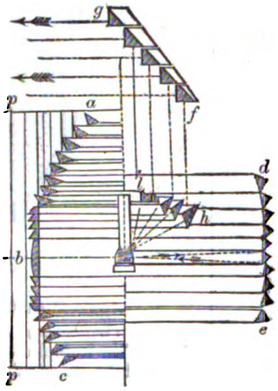

FIG. 50.—Vertical Elevation.

Condensing quadrant.

Condensing Quadrant.—The fixed apparatus *bbb*, with spherical mirror behind, throws its rays directly through the angle of 90° *afa′*, while the supplementary rays falling on the straight condensing prisms *p*, *p*, *p′*, *p′* (fig. 49) are sent out parallel to the corresponding rays in the unobstructed central quadrant of the main apparatus. The whole light will therefore be condensed equally over 90°.

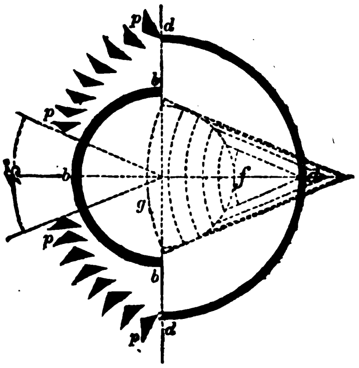

FIG. 51.—Horizontal Section.

Condensing octant.

Condensing Octant.—The central fixed apparatus *bb* (figs. 50, 51) with spherical mirror *dd* throws its rays directly over the angle of 45° *pgp*, while the supplemental rays fall upon the straight condensing prisms *p*, each of which spreads the incident rays parallel to the corresponding rays in the central angle *pgp*. In this way the whole of the front hemisphere of rays is parallelized in the vertical plane and spread equally over the 45° in azimuth. The hemisphere of back rays is condensed into the same arc seawards by the dioptric spherical mirror, which returns the rays incident upon it through the flame, where, mingling with the front rays, they are finally distributed over the arc of 45°. The light passing above the spherical mirror is parallelized by a half holophote *ih* (fig. 50), and sent vertically upwards, when, falling on the expanding prisms *gfe*, it also is finally spread over the required arc. Thus the whole light is condensed and distributed with strict equality over the 45° by means of six different optical agents. Two apparatus of this kind form the leading lights to the River Tay.

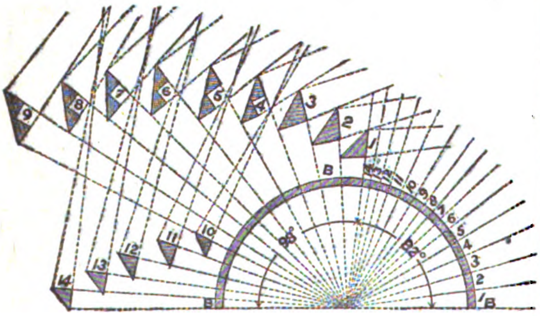

FIG. 52.—Horizontal Section.

Condensing twin prism.

Condensing Twin Prism Light.—Fig. 52 shows part of the Lamlash light in the Firth of Clyde. Its action will be easily understood by the numbers shown on the diagram.

Lights for sectors of unequal range.

Fixed Condensing Lights for more than one Sector of Unequal Range.—Fig. 53 is a chart of the Sound of Glenelg, in which the Isle Oronsay light has to be seen generally at a distance of 3 or 4 miles across the sound, but in the direction AB down the sound an angle of 10° has to be seen about 15 miles, and another up the sound between C and D an angle of 10° has to be seen about 7 miles. Fig. 54 shows in plan the apparatus, which was for certain local reasons not constructed according to the formula, but 193° of the spare light which would otherwise have fallen upon the land were allocated down Sleat Sound and 139° down the Sound of Glenelg. That for Sleat Sound was given directly by the main apparatus through the arc δ, and that to Glenelg through the arc β, but these arcs were respectively strengthened by portions of the holophotes B and C, the light from which was condensed respectively over the arc δ by each of the straight prisms *a*, and over the arc β by each of the prisms *b*. The condensed light at Isle Oronsay, which is of the fourth order, appears to be equal to that of a first order, so that with a lamp consuming annually only 170 gallons of oil a light is obtained in the only direction in which great power is required equal in effect to a lamp consuming 800 gallons per annum.

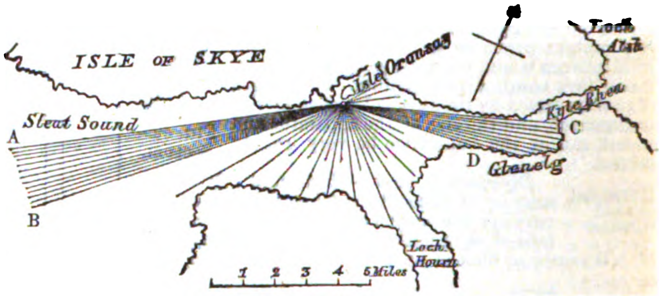

Fig. 53.

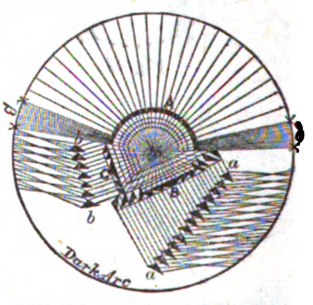

FIG. 54.—Horizontal Section.

Fixed Condensing Lights of Unequal Range which constantly Illuminate the whole Horizon.—For this purpose the condensing spherical mirror or spherical mirror of unequal area will be found applicable.

Revolving or Intermittent Lights for Condensing the Rays into one Sector.—The holophote in fig. 55 throws its rays on straight condensing prisms P, each of which spreads the light over the prescribed sectors, while masks M turning horizontally on pivots cut off the light either slowly or suddenly so as to produce a revolving or an intermittent light, both of which condense all the rays uniformly over the one sector.

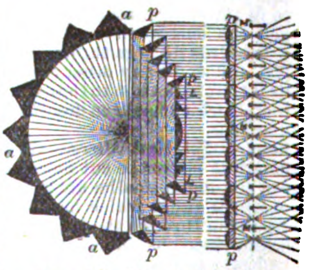

FIG. 55.—Vertical Section.

lication of Condensing Principle to Revolving Lights of Un- qual Range, which do not Illuminate the whole Horizon.

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Repeating Light.—Plane mirrors M (fig. 56) revolve on an endless chain placed outside of the apparatus and alter the direction of the es after they pass into the dark arc on the landward

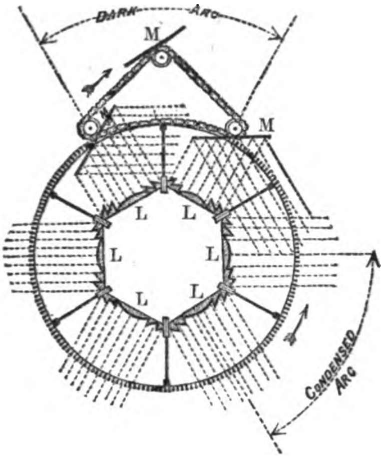

Fig. 56.—Horizontal Section.

so as to cause the lenses L, L to repeat their flashes the seaward arc which requires strengthening. The ensing spherical mirror and mirror of unequal areas

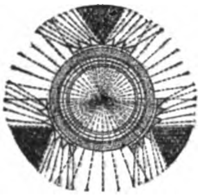

Fig. 57.—Horizontal Section.

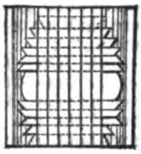

Fig. 58.—Elevation.

also be found applicable in cases where the flashes do equire to sweep over the whole horizon.

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Condensing Revolving Lights which Periodically Illuminate the whole Horizon, but which Vary the Strength of the Flashes in Passing over Certain s.—The spherical mirror of unequal areas and the

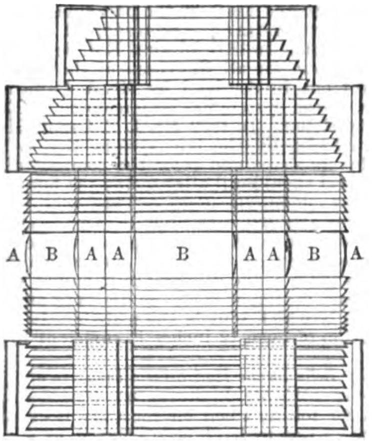


Fig. 59.

ensing mirror are equally well suited for those that ve.

mit- ights.

Condensing Intermittent Lights.—Figs. 57 and 58 show straight refracting or reflecting prisms, which revolve and intercept as they pass round in of the rays from a central fixed light apparatus so produce perfect darkness over the sectors which they nd at the time, while they spread the rays which they intercept uniformly over and thus strengthen the intermediate sectors which are illuminated directly by the central apparatus. The peculiar property of this arrangement is that the power is increased in proportion to the duration of the intervening periods of darkness. Thus, neglecting the loss by absorption, etc., the power is doubled when the periods of light and darkness are equal, trebled when the dark periods are twice as long as the light, and so on in proportion, while in every case the rays are spread uniformly over each illuminated sector.

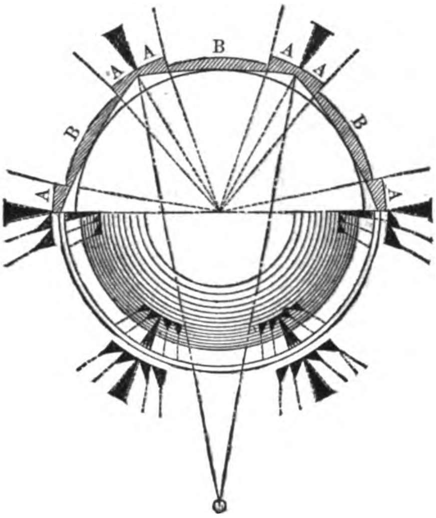


Fig. 60.

Intermittent light with differential refractor.

Intermittent Condensing Light with Differential Refractor.—Figs. 59 and 60 show the new apparatus of Mull of Galloway in which ABA is the differential refractor, by the compound horizontal and vertical action of which single agent the whole condensing intermittent effect is produced, so that condensing prisms are done away with opposite the central, which is the most important, part of the apparatus. The centre of the inner curve of the refractor is at O in fig. 60. Though there is no relative motion in this apparatus, every part of which revolves together, the parts may be arranged so that the condensers only move. This apparatus was constructed in the most satisfactory manner by Messrs. Barbier & Fenestre, Paris.

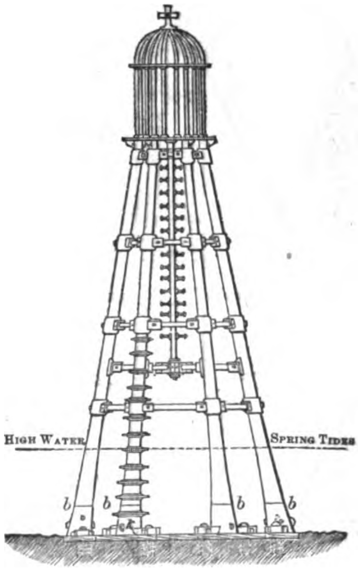


Fig. 61.

Change of fixed to intermittent apparatus.

Alteration of Fixed to Intermittent Apparatus.—Any existing fixed light can at once be made intermittent so as to show either equal or unequal periods by simply causing condensing prisms to circulate round it, while the power will be increased in proportion to the ratio of the duration of light to dark periods.

Beacons and Buoys.

Beacons. Beacons in exposed situations are constructed sometimes of stone, and cement-concrete or cement-rubble, but generally of cast-iron columns let into heavy base plates which are fixed to the rock by strong lewis bats. The small class iron beacons are generally of malleable iron and the larger of cast-iron, but steel or bronze might with advantage be used in very exposed places. Fig. 61 shows a first order cast-iron beacon as used in Scotland.

Apparent light. *T. Stevenson's Apparent Light.*—This kind of light is specially useful at places where there is a sunk rock with little sea-room round it, and at the pierheads of harbors which must be closely hugged by vessels seeking entrance. It consists of certain forms of optical apparatus for reflecting and redistributing at a beacon placed on a submerged rock parallel rays which proceed from a lamp and apparatus placed on the land. An optical deception is thus produced, as the sailor naturally supposes that there is a lamp burning on the beacon itself. The first light of this kind, which has been in use since 1851, was placed in a beacon on a sunk reef in Stornoway Bay, and is shown pictorially in fig. 62. This light is 530 feet distance from the lighthouse where the lamp is placed. Others have since been established at Grangemouth, which is 535 feet from the light, and at lesser distances at the harbors of Ayr and Arbroath, at Odessa in the Black Sea, and at Gat Combe Head, Queensland.

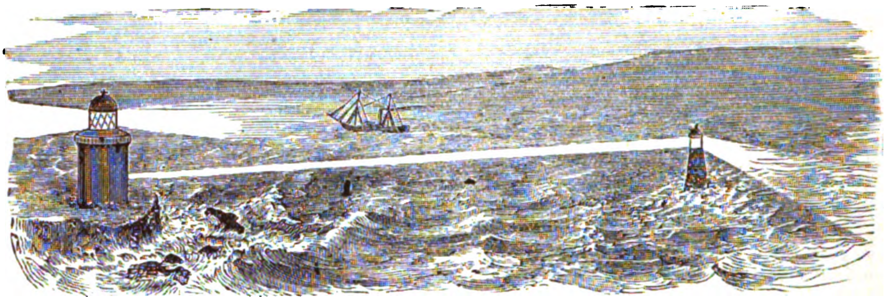


Fig. 62.

Beacon lights. *Beacon Lights.*—Lamps without glass chimneys, as used in the early experiments with paraffin, and as used with gas in Pintsch's buoy, having iron tubes placed at certain distances above the flame, and supplied with very large cisterns of crystal oil, have been kept continuously burning in Scotland for about a month without trimming. These lamps are for rocks at sea which can only be reached when the weather is moderate.

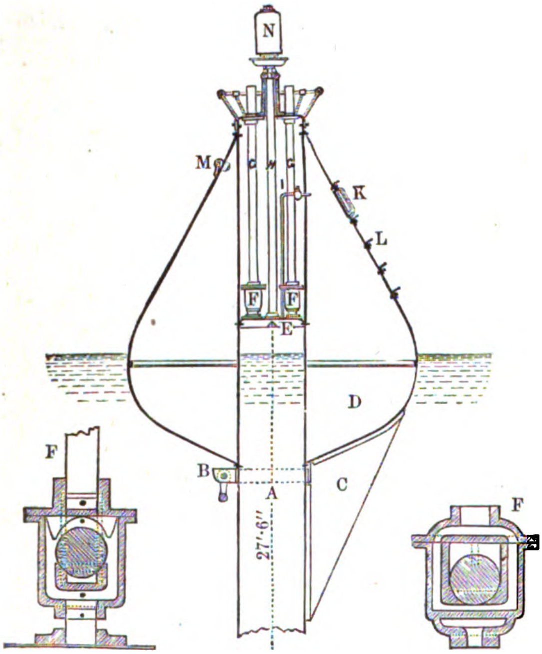


Fig. 63.—Courtney's Automatic Buoy. A, cylinder, 27 ft. 6 in. long; B, mooring shackle; C, rudder; D, buoy; E, diaphragm; F, ball valves; G, air inlet tubes; H, air (compressed) outlet tube to whistle; I, compressed air inlet to buoy; K, manhole; L, steps; N, whistle.

Illumination of Beacons by Gas to Produce a Fixed Light.—A light near Port-Glasgow has been illuminated by gas since 1861. The tower is about 300 feet from the shore, and the supply and pressure of gas are regulated by self-acting arrangements on the shore.

Pintsch's buoy. *Pintsch's Gas Illuminated Buoy for Producing a Fixed Light.*—These buoys are gas and water tight, and are charged to a pressure of ten atmospheres. The buoy is filled with gas sufficient to burn night and day for three or four months; the burning pressure is kept constant by Pintsch's regulator. These buoys promise to be of great service, and have now been in use for more than a year at several places both in England and Scotland.

Automatic Meter for Producing Intermittent Lights by the Flow of the Gas.—In order to distinguish one buoy or beacon from another, Mr. T. Stevenson has proposed to make the flow of the gas itself produce automatic intermittent action without using clockwork. The full flame continues to burn until the action of the meter reduces the supply, but leaves a small jet still burning in the sockets of the burner till the full flame is again produced. This meter has been tried successfully on shore for twenty-eight hours consecutively.

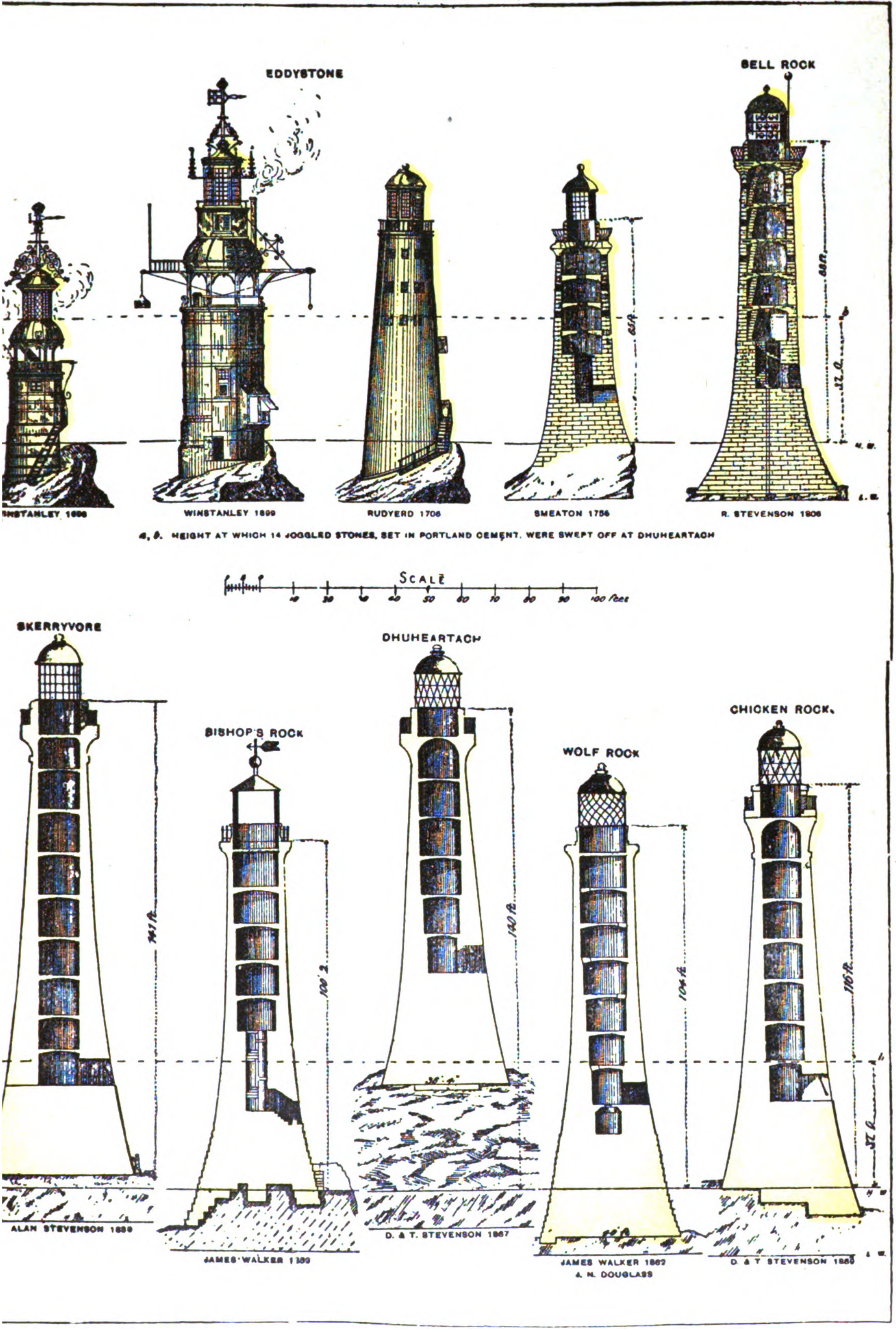
Uniform system of beacons. *Uniform System of Beacons and Buoys.*—The first proposal for dealing systematically with the colors of beacons and buoys was in 1828, when Mr. R. Stevenson proposed for the navigation of the river Forth that red buoys should be taken on the starboard and black on the port side in going up the river. This system has since been adopted generally in the United Kingdom. In 1857 Admiral E. J. Bedford suggested a uniform system for all the coasts of the country, which was carried out in Scotland by Mr. A. Cunningham. A different uniform system has been adopted in England by the Trinity House. In 1859 Mr. J. F. Campbell suggested what is undoubtedly the best system, that a buoy shall indicate by its shape and color the compass direction in which a vessel should sail after seeing the buoy.

Automatic buoy. *Courtenay's Automatic Buoy.*—This useful form of buoy (fig. 63) first used in America, has a cylindric tube A projecting below the level of the water, on the upper part of which cylinder there is a whistle N and also two inlet valves F, F, so that the rising and falling of the buoy draws in and expels the air alternately which sounds the whistle. It is said that an undulation of even 12 inches is sufficient to sound the whistle.

Tolling of bells by tide. *Tolling of Bells by the Hydrostatic Pressure of the Tide.*—In 1810 Mr. R. Stevenson designed apparatus for tolling a bell on the Carr Rock beacon, which was to have been effected by a float when ascending with the flowing tide, when descending with the fall of the ebb tide and by means of a peculiar arrangement of weights for keeping the bell in action during the time of slack water.

Illuminants.

Illuminants. Oils. After Argand's ordinary single-wick oil burner, Fresnel, still adhering to Argand's principle of the double air current, introduced two, three, and four concentric wick burners,


EDDYSTONE
BELL ROCK
NSTANLEY 1696
WINSTANLEY 1699
RUDYERD 1706
SMEATON 1756
R. STEVENSON 1806
65 ft
88 ft
32 ft
H. W.
L. W.
a, b. HEIGHT AT WHICH 14 JOGGLED STONES, SET IN PORTLAND CEMENT, WERE SWEPT OFF AT DHUHEARTACH
SCALE
10 20 30 40 50 60 70 80 90 100 Feet
SKERRYVORE
BISHOP'S ROCK
DHUHEARTACH
WOLF ROCK
CHICKEN ROCK.
141 ft
100' 2
110 ft
104 ft
116 ft
37 ft
a
b
H. W.
L. W.
ALAN STEVENSON 1838
JAMES WALKER 1858
D. & T. STEVENSON 1867
JAMES WALKER 1862
J. N. DOUGLASS
D. & T STEVENSON 1869

lan Stevenson th five, and Mr. Douglass the six wick r. These burners are suitable for the consumption of il and vegetable oils, which were in use in the vari-ighthouse services of the world till within the last ears. These oils are, however, superseded by hydro-ns, which at one half the cost give an increased ious intensity for an equal consumption, but they re a larger supply of air for their combustion, and quently an improved form of burner. M. Maris in

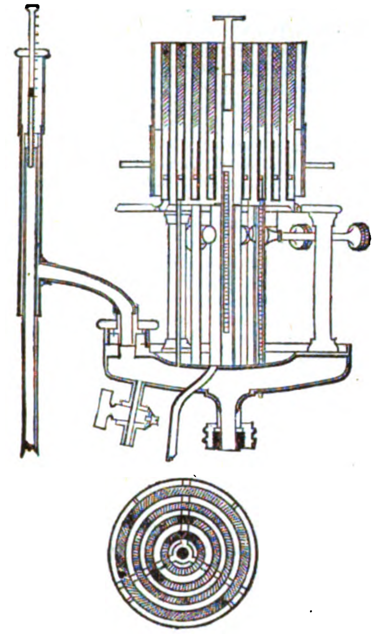


Fig. 64.

levised a single-wick burner for this purpose which ;ood results, but many and all attempts to construct iple-wick mineral oil burner failed till 1868, when n Doty's form was devised. By a happy choice of tions in the various parts of his burner (fig. 64), and addition of an exterior cylinder surrounding the wick, and a central disk, both placed in such a man-to throw a current of air into the flame at the right Captain Doty succeeded in producing single and le-wick hydrocarbon burners, which carry a flame of luminous intensity and regularity. The following ;ives the details of these burners, and also the candle and consumption, as determined by Dr. Stevenson am:—

r	Mean Diameter of Outer Wick in Inches.	Height of inteuse part of Flame, excluding Tails, in Inches.	Candle Power in Sperm Candles, each consuming 120 grs. Sperm per Hour.	Value of Light from Consumption of 1 Gallon in lb. Sperm.	Consumption per Hour in Gallons.
	·82	1	23·65	27·89	·0148
	1·75	1¼	80·13	27·04	·0508
	2·5	1¾	200·75	27·2	·1262
	3·2	2	287·62	27·3	·1801

J. N. Douglass has also introduced a mineral oil , which, however, Doty claims as similar in princi-nis. By igniting only half the number of wicks (the n a six-wick, for instance) the power of the burner diminished by one half. This is Mr. Douglass's lamp le and double power for use in clear and foggy wea-espectively.

mineral oil employed most extensively in lighthouse ation is Scotch paraffin. The specific gravity, which t of the relative richness of the oil, should be from 82 at 60° Fahr., and the flashing point or tempera-which it begins to evolve inflammable vapor should lower than 125° nor higher than 135° Fahr. The of Northern Lighthouses was the first lighthouse ity in Britain that adopted paraffin and Doty burn-d by doing so an annual saving of between £4500 000 in the maintenance of the lights on the Scotch ras effected.

Single-wick burners are supplied with oil from the cistern by the capillary action of the wick alone. But in the case of multiple-wick burners other methods must be employed to secure a sufficient supply. If the cistern be placed above the level of the top of the burner, the flow of the oil to the wick cases is effected by the direct action of gravity, regulated by a contrivance which maintains a constant head. If, however, the cistern be placed below this level, either a *mechanical* lamp is employed, in which the oil is forced into the burner by pumps worked by clockwork, or a *moderator* lamp, in which this is effected by the pressure exerted by a weighted piston descending in a cylinder forming the cistern.

Coal-gas.

Coal-Gas.—Coal-gas was first used as a lighthouse illuminant at Salvore, near Trieste, in 1817. For many years it has been used in the harbor lights of Great Britain when in the neighborhood of gas-works. Mr. J. R. Wigham has designed a compound or crocus burner consisting of a group of twenty-eight vertical tubes, each carrying an ordinary double fish-tail burner, and the ignited gases issuing from all these jets unite into one large flame. Additional groups of twenty jets each can readily be arranged around the first, which forms a central nucleus, and in this way, depending on the state of the atmosphere, the power of the burner can be made at will 28, 48, 68, 88, or 108 jets. Fig. 65 shows the arrangement for 28 jets, and fig. 66 one for 108 jets. In his triform or quadriform systems Mr. Wigham places two, three, or four of the burners already described vertically one above the other (fig. 67), with lenses opposite to each. The following table gives the candle powers, etc., of Mr. Wigham's burners.

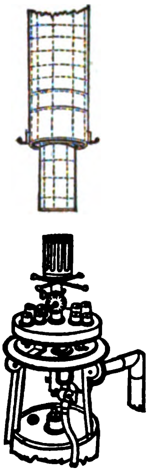


Fig. 65.

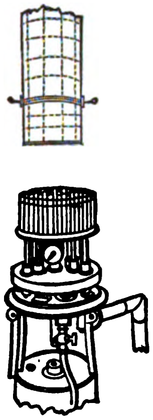


Fig. 66.

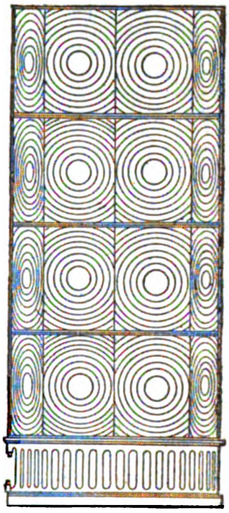


Fig. 67.

Number of Jets.	Consumption of Cannel Gas per Hour.	Candle Power in Sperm Candles, consuming 120 grs. per Hour.
28	51·4	429·6
48	93·2	832·0
68	146·3	1250·18
88	244·0	2408·0
108	308·0	2923·0

The diameter of the 108-jet burner is 12 inches.

Electric light.

Faraday and Holmes's Magneto-Electric Light.—In 1853 Professor Holmes made the first magneto-electric machine for lighthouses, which was tried by the Trinity House in 1857, and the electric light was first shown to the mariner in 1858. The Trinity House subsequently introduced it at Dungeness in 1862 and at Souter Point in 1871. The optical apparatus for these lights was designed by Mr. J. T. Chance. In 1869 Holmes constructed for the Trinity House a dynamo-electric machine (in which no permanent magnet is used), giving a light of about 2800 candles. The magneto-electric light of Holmes as exhibited from a third order dioptric apparatus at the South Foreland light has been estimated at 152,000 candles, or twenty times that of the old first order dioptric fixed white light. The following table shows the results which have been obtained by Dr. Tyndall and Mr. Douglass by the magneto-electric and dynamo-electric machines, tried at the South Foreland, 1876–77:—

Name of Machines.	Cost.	HP. absorbed.	Revolutions per Minute.	Light produced per HP. in Standard Candles.		Order of Merit.
	£			Max.	Mean.	
Holmes's Magneto-Electric...	550	3·2	400	476	476	6
Alliance do.	494	3·6	400	543	543	5
Gramme Dynamo-Electric (No. 1)..	320	5·3	420	1,257	738	4
Do. do. (No. 2)..	320	5·74	420	1,257	758	4
Siemens's do. (large)..	265	9·3	480	1,512	911	3
Do. do. (small, No. 58)	160	3·5	850	1,582	954	2
Do. do. (small, No. 68)	100	3·3	850	2,080	1,254	1
Two Holmes's Magneto-Electric..........	1,100	6·5	400	432	432	...
Two Gramme Dynamo........	640	10·5	420	1,085	654	...
Two Siemens's do (small, Nos. 58 and 68)...........	200	6·6	850	2,141	1,291	...

It must be kept in view that in the electric as well as in every other light the following requirements must be fulfilled:—(1) It shall be constantly in sight during those periods of time at which it is advertised to the mariner as being visible; (2) it shall be seen as far as possible in a thick and hazy atmosphere; (3) it shall constantly maintain the distinctive character of the station where it is employed so as not to be mistaken for another light; and (4), when revolving, its flashes shall remain long enough in view to let the sailor take the compass bearing of the light. The electric light practically fulfils all these conditions, and, when we consider its transcendent intensity, and the smallness of the luminous radiant which enables the engineer to adapt it to any required conditions far more strictly than oil light, we may certainly conclude that the electric is the best though the most costly of all illuminants.

The only question which has not yet been decided is whether an electric light of equal initial power will penetrate a hazy atmosphere as far as an oil light. Experiments made at Edinburgh in 1866 seemed to show that the highly distinctive flash of the electric light when acted on by optical apparatus is perhaps not so much due to a greater amount of light as to the more complete parallelism of the rays arising from the smallness of the radiant. The apparatus of a small size which was first used both in England and France necessarily produced a wasteful vertical divergence, and has therefore been now justly discarded.

Allard's Statistics of Lighthouse Apparatus.

Allard's statistics.

The following useful formulæ are taken from M. Allard's very valuable *Mémoire sur l'Intensité et la Portée des Phares*, Paris, 1876.

Consumption of Oil in Relation to Diameter of Burner.—If c denote the consumption of mineral oil in grammes per hour, d the diameter of the burner in centimetres, then

$$c = 4·9d^{2·22}.$$

Luminous Intensities.—A Carcel burner consuming 40 grammes of colza oil per hour being taken as unity, if I denote the intensity for mineral oil in a burner of diameter d in centimetres, then

$$I = 0·22d^{2·1}.$$

Luminous Intensities of Apparatus.—Loss due to Reflection, Absorption, and Framing of Apparatus.—The loss due to surface reflection on entering and leaving the glass may be valued at ·050, ·052, ·058, ·075, ·120, ·230, for angles of incidence respectively of 0°, 15°, 30°, 45°, 60°, 75°. In totally reflecting prisms the luminous ray suffers three deviations instead of two, therefore the above values should be multiplied by $\frac{3}{2}$.[1]

The loss by absorption in the glass, although properly given by an exponential formula, may, with sufficient accuracy, be taken as ·03 per centimetre of glass traversed.

The loss due to the horizontal joints of the lenses, and to the intervals between the reflecting rings, varies from ·02 to ·03, or from ·01 to ·04, in passing from the first to the fifth order.

Coefficients.—These are the ratios in which the intensity of the lamp is increased by the apparatus. Where m is the coefficient, f the focal distance, d the diameter, and h the height of flame in a fixed light apparatus, they can, if expressed in centimetres, be calculated from the formula—

$$m = \frac{3}{2}\left(\frac{f}{\sqrt{d}}\right)^{1·15}, \text{ or } m = 2·12\left(\frac{f}{h}\right)^{1·15}.$$

Annular Lens.—The intensity of an annular lens is obtained by multiplying that of the corresponding fixed light by $\frac{1}{4}\,\frac{\phi}{\alpha}$ where ϕ is the angle subtended by the annular lens, and α the horizontal semi-divergence. The intensity of light from an ordinary fixed light apparatus is increased 38 per cent. by the use of the dioptric spherical mirror.

Distinctions of Lights.

Distinctions of lights.

The most important characteristic distinctions of lights are the following:—(1) The *fixed light*. Two of these are sometimes shown at different heights from the same tower. (2) The *revolving light*, which at equal and comparatively long periods comes slowly and gradually into full power, and then as gradually disappears. (3) The *flashing light*, which at short periods (such as a few seconds) comes very quickly, though gradually, into full power, and as quickly and gradually fades away, was first introduced by the late Mr. Robert Stevenson in 1825. (4) The *colored light*, which is obtained by using colored media, and was first employed by Mills of Bridlington. (5) The *intermittent light*, introduced by the late Mr. R. Stevenson in 1830, which bursts instantaneously into full power, and after remaining as a fixed light for a certain length of time is as suddenly eclipsed and succeeded by a dark period. When the periods are very short, the intermittent is now called an occulting light. (6) The *intermittent light of unequal periods*, first proposed by Mr. R. L. Stevenson in 1871, showing from the same apparatus different durations of the dark periods with equal periods of light, such as fixed for 2″ eclipsed 5″, fixed 2″ eclipsed for 2″, and then, as at first, fixed for 2″. (7) *Group flashing light*. This distinction consists in giving a series of groups of two or more flashes separated by short eclipses, the groups being separated from one another by a larger eclipse. Mr. Wigham of Dublin first proposed this distinction, and applied it to a dioptric revolving apparatus illuminated by gas, the effect being produced by raising and lowering the gas as Mr. Wilson of Troon had done in 1827. Dr. Hopkinson produced the same effect optically and for any illuminant by altering the arrangement of the ordinary revolving apparatus. (8) *Fixed lights illuminating the whole horizon, but showing revolving or intermittent characteristics over small arcs.* These can be produced by masks arranged like venetian house blinds placed opposite the arc where the characteristic is to be different from the main light. This arrangement and No. 9 were lately proposed by Mr. T. Stevenson. (9) *Intermittent flashing light.* This is produced by condensing prisms revolving round a fixed light apparatus. The flashing light continues giving its rapidly recurring flashes for a certain period, which is succeeded by a dark period. The light which is not required during the dark periods is condensed by the prisms so as to strengthen the light periods.

Uniform System of Characteristics.—Various modes of distinguishing lights have been at different times proposed, such as Babbage's, which represented the stations by numbers, and Sir W. Thomson's by the Morse alphabet, or dots and dashes; but the following results seem to show that the present system is satisfactory, while it is free from many objections to which the other modes are liable. The Board of Trade records of shipwrecks show that during the space of twenty years (1857 to 1876) 2716 vessels were wrecked by stranding on the coasts and islands of Scotland and the Isle of Man, and that of all these there were only twenty-six, and the great majority of them were small vessels, in which it was even *alleged* that the cause was a failure in identifying the distinctive characteristic of some one of the Northern lighthouses, and in one-third of these cases the sailors were foreigners, and made such glaring mistakes as taking a fixed for a revolving light. It is surely more probable that in many of these cases they did not confound the characteristics at all, but really did not know what they were. But, waiving all these considerations, there were after all only about 1 per cent. of all the wrecks which were *alleged* to have been caused by mistaking one light for another.

Power of Colored Lights.—Experiments, and particularly those of M. Reynaud, have shown that red of the same initial power as white penetrates a fog to a greater distance than the white, owing to the red rays not being so much dispersed by refraction. Experiments made at Edinburgh in 1868 show that a light should, before passing through red glass, have four and a half times the initial power of a white light. The same results have since been obtained by M. Allard of Paris.

An objection to all colored lights is the fact that some persons are unable to detect any difference between certain colors. According to the experiments of Professor Holmgren on from sixty to seventy thousand persons in Europe and America, about 4·2 per cent. are congenitally color-blind, and the commonest form of this defect is inability to distinguish between red and green, which are the only tints employed for lighthouse distinctions. This objection, however, must gradually lose its weight, as the Board of Trade has now adapted the "colors test" as part of their examinations for certificates in navigation.

Distribution of Lights on a Coast.—Mr. Alan Stevenson

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[1] This result as to total reflection is not in accordance with the experiments of Professor Potter, which, however, were made with a very finely polished prism made for optical purposes.

Distribution of lights.

gives the following as a few of the chief considerations which should guide us in the selection of sites and characteristic appearance of the lighthouses to be placed on a line of coast.

"1. The most prominent points of a line of coast, or those first made on *over-sea* voyages, should be first lighted; and the most powerful lights should be adapted to them, so that they may be discovered by the mariner as long as possible before his reaching land.

"2. So far as is consistent with a due attention to distinction, revolving lights of some description, which are necessarily more powerful than fixed lights, should be employed at the outposts on a line of coast.

"3. Lights of precisely identical character and appearance should not, if possible, occur within a less distance than 100 miles of each other on the same line of coast which is made by over-sea vessels.

"4. In all cases the distinction of color should never be adopted except from absolute necessity.

"5. Fixed lights and others of less power may be more readily adopted in narrow seas, because the *range* of the lights in such situations is generally less than that of open sea-lights.

"6. In narrow seas also the distance between lights of the same appearance may often be safely reduced within much lower limits than is desirable for the greater sea-lights. Thus there are many instances in which the distance separating lights of the same character need not exceed 50 miles; and peculiar cases occur in which even a much less separation between similar lights may be sufficient.

"7. Lights intended to guard vessels from reefs, shoals, or other dangers should, in every case where it is practicable, be placed *seaward* of the danger itself, as it is desirable that seamen be enabled to *make* the lights with confidence.

"8. Views of economy in the first cost of a lighthouse should never be permitted to interfere with placing it in the best possible position; and, when funds are deficient, it will generally be found that the wise course is to delay the work until a sum shall have been obtained sufficient for the erection of the lighthouse on the best site.

"9. The elevation of the lantern above the sea should not, if possible, for sea-lights, exceed 200 feet; and about 150 feet is sufficient, under almost any circumstances, to give the range which is required. Lights placed on high headlands are subject to be frequently wrapped in fog, and are often thereby rendered useless, at times when lights on a lower level might be perfectly efficient. But this rule must not, and indeed cannot, be strictly followed, especially on the British coast, where there are so many projecting cliffs, which, while they subject the lights placed on them to occasional obscuration by fog, would also entirely and permanently hide from view lights placed on the lower land adjoining them.

"10. The best position for a sea-light ought rarely to be neglected for the sake of the more immediate benefit of some neighboring port, however important or influential; and the interests of navigation, as well as the true welfare of the port itself, will generally be much better served by placing the sea-light *where it ought to be*, and adding, on a smaller scale, such subsidiary lights as the channel leading to the entrance of the port may require.

"11. It may be held as a general maxim that the fewer lights that can be employed in the illumination of a coast the better, not only on the score of economy, but also of real efficiency. Every light needlessly erected may, in certain circumstances, become a source of confusion to the mariner; and in the event of another light being required in the neighborhood, it becomes a *deduction* from the means of distinguishing it from the lights which existed previous to its establishment.

"12. Distinctions of lights, founded upon the minute estimation of intervals of time between flashes, and especially on the measurement of the duration of light and dark periods, are less satisfactory to the great majority of coasting seamen, and are more liable to derangement by atmospheric changes, than those distinctions which are founded on what may more properly be called the *characteristic appearance* of the lights, in which the times for the recurrence of certain appearances differ so widely from each other as not to require for their detection any very minute observation in a stormy night. Thus, for example, flashing lights of five seconds' interval, and revolving lights of half a minute, one minute, and two minutes, are much more characteristic than those which are distinguished from each other by intervals varying according to a slower series of 5″, 10″, 20″, 40″, etc.

"13. Harbor and local lights, which have a circumscribed range, should generally be fixed instead of revolving; and may often, for the same reason, be safely distinguished by colored media. In many cases also, where they are to serve as guides into a narrow channel, the leading lights which are used should, at the same time, be so arranged as to serve for a distinction from any neighboring lights."

Distances at which objects are visible.

Table of Distances at which Objects can be seen at Sea, according to their respective elevations, and the elevation of the eye of the observer.

Heights in Feet.	Distances in Geographical or Nautical Miles.	Heights in Feet.	Distances in Geographical or Nautical Miles.	Heights in Feet.	Distances in Geographical or Nautical Miles.
5	2·565	70	9·598	250	18·14
10	3·628	75	9·935	300	19·87
15	4·443	80	10·26	350	21·46
20	5·130	85	10·57	400	22·9
25	5·736	90	10·88	450	24·33
30	6·283	95	11·18	500	25·65
35	6·787	100	11·47	550	26·90
40	7·255	110	12·03	600	28·10
45	7·696	120	12·56	650	29·25
50	8·112	130	13·08	700	30·28
55	8·509	140	13·57	800	32·45
60	8·886	150	14·22	900	34·64
65	9·249	200	16·22	1000	36·28

Example.—A tower 200 feet high will be visible 20·66 nautical miles to an observer whose eye is elevated 15 feet above the water; thus, from the table:—

15 feet elevation,	distance	visible	4·44	nautical miles.
200 "	"	"	16·22	" "
			20·66	

Floating Lights.

Floating lights.

Prior to 1807 the only kind of floating light was a ship with small lanterns suspended from the yard-arms or frames. The late Mr. Robert Stevenson introduced in that year a lantern which surrounded the mast of the vessel, and was capable of being lowered down to the deck to be trimmed. By his plan a lantern of much greater size could be used, and with this increase of size a larger and more perfect apparatus could be employed which admitted of gearing for working a revolving light, as adopted by the Trinity House. In fig. 68, *a a* is the mast, *b* tackle hook, *c*, *c* brass flanges for fixing parts of lantern together, *e* and *g* weather guards, *h* plate glass front of lantern, *i* shutter by which lamps are trimmed, *k* lamps, *l* silver reflector. Revolving catoptric apparatus was applied to floating lights in England, and M.

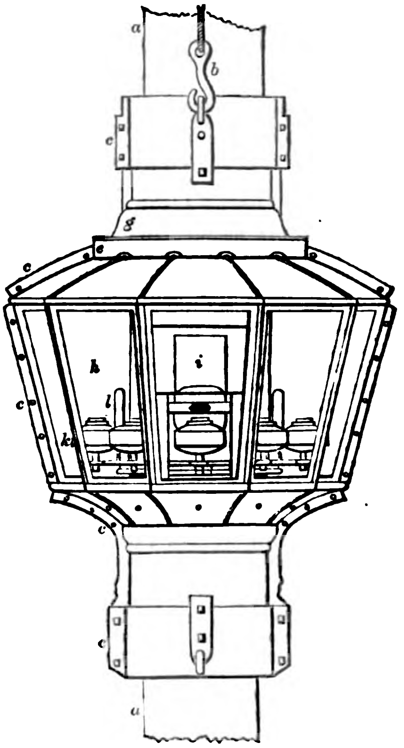

Fig. 68.

Letourneau, in 1851, proposed to employ a number of sets of dioptric apparatus in one lantern; figs. 69 and 70 show elevation and plan of one of the Hooghly floating lights on the dioptric principle, designed for the Indian Government by Messrs. Stevenson. It will be observed that not fewer than four of the separate lights are always in view from every part of the compass at once. The "Seven Stones" lightship, which has all the recently Trinity House improvements, is moored off the Lands End in 42 fathoms. Her moorings consist of a 40 cwt. mushroom anchor, and 315 fathoms of 1½ inch studded chain cable. The vessel is timber-built, copper-fastened throughout, sheathed with Muntz metal. Her length is 103 feet between perpendiculars; extreme breadth, 21 feet 3 inches; depth of hold from the strake next the timbers to the upper side of the upper deck beams, 10 feet 3 inches. In the event of the vessel breaking adrift, she is provided with sails, the mizzen being frequently used for steadying the vessel at her moorings. The cost of the vessel, fully equipped for sea, with illuminating and fog signal apparatus complete, was about £9500.

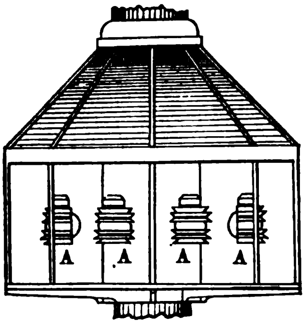

FIG. 69.—Dioptric Floating Light. Elevation.

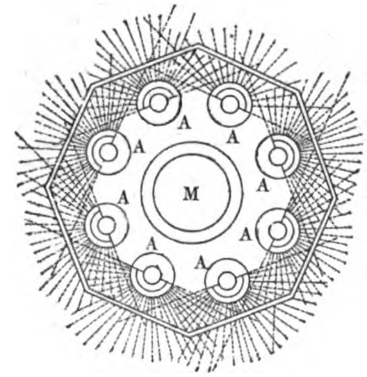

FIG. 70.—Dioptric Floating Light. Horizontal Section.

Lanterns. *Lanterns* are generally constructed of diagonally framed astragals (fig. 71) to avoid the obscuration of light in any one azimuth as would be the case with dioptric fixed light apparatus were vertical astragals used. The astragals are made of gun-metal, having a tensile strain of 33,000 ℔ to the square inch; the dome is made of copper plates riveted together; and the glass is the best plate ¼ inch thick. *Storm panes* are kept at hand which can be applied in a few minutes in the event of a pane being broken, which sometimes occurs from large birds driving against the lantern and by stones thrown up from the face of cliffs by sea and wind during storms. Mr. Douglass's cylindric or helical lanterns (fig. 72) have steel astragals, and the panes, which are also cylindrical, are ¼ inch thick.

Lightning conductors. *Lightning Conductors.*—Each lighthouse tower is furnished with a copper lightning conductor consisting of a ¾ inch copper rod or wire rope. These conductors terminate about 18 inches above the top of dome of lantern in a forked shape with two platinum points; the lower end bifurcated and furnished with large copper earth-plates is sunk into moist earth or into the sea. The conductor is put into metallic connection with all large masses of metal outside or inside the lightroom. See LIGHTNING CONDUCTORS.

Machinery. *Machinery.*—Revolving lights are propelled by clock-work machinery actuated by a falling weight. The machines are provided with a maintaining power which keeps the apparatus moving while the machine is being wound up, and a bell is attached which rings to warn the keepers when the machine requires winding up. A clock face is also attached which keeps time with the lightroom clock when the apparatus is revolving at the proper speed.

Masking screens. *Masking Screens.*—For the purpose of *cutting off* sharply the light proceeding from any fixed light apparatus, the late Mr. J. M. Balfour devised what he called radial masking screens. These screens, which are in use at several lighthouses where the fairway for ships is narrow, consist of a series of thin plates placed with their edges towards the apparatus, and with such a distance between them, and of such a length as will secure that only rays having the desired divergence can pass through between them.

With revolving lights it is not possible to effect a "cut off" as in the case of fixed lights, on any particular bearing; for the direction of the axis of the luminous beam projected by the lens or reflector is being continually changed in the horizontal plane by the revolution of the frame on which it is fixed. Mr. Stevenson's mode of overcoming this difficulty is by fixing a light metallic screen or colored glass shade outside of the revolving apparatus and on the safety side of the danger arc. These screens are fitted with rollers for running on a slightly inclined plane or circular path. Small projecting rods or snugs fixed to the sides of each lens are, in revolving, brought against the edge of the screen, and gradually press the screen before it up the inclined plane. By the time the lens reaches the edge of the danger arc the screen has been pushed to the top of the inclined plane, and the full beam of light, coming from the now entirely uncovered lens, points in the required line of cut off, which is the border of the danger arc. But whenever the further revolution of the apparatus causes the snugs to pass clear of the edges of the screen so as to free it from their pressure it immediately runs back again to its original position in front of the lens, so as to prevent any of the light being now sent seawards. By this continued reciprocative movement of the screen, as lens after lens comes round, the same effect will be successively produced and the light will always be cut off on the lines of obscuration, so that the flashes can never be seen within the danger arc.

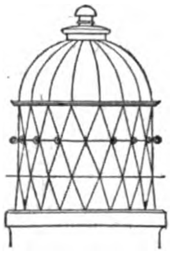

FIG. 71.—Diagonal Lantern.

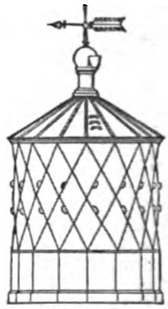

FIG. 72.—Helical Lantern.

Mathematical formulæ. *Mathematical investigations and formulæ* for constructing the optical instruments for lighthouses will be found in the books undernoted by Alan Stevenson, Swan, Chance, Nehls, Reynaud, Allard, etc., to which the reader is referred.

Literature. *Literature.*—Smeaton, *Narrative of the Eddystone Lighthouse*, London, 1793; Stevenson, *Account of the Bell-Rock Lighthouse*, Edinburgh, 1824; Fresnel, *Mémoire sur un nouveau système d'éclairage des phares*, Paris, 1822; Brewster, *Treatise on Burning Instruments*, 1812; *Fanale di Salvore, nell' Istria, Illuminato a Gas*, Vienna, 1821; *Account of a New System of Illumination for Lighthouses*, 1827; Alan Stevenson, *Account of Skerryvore Lighthouse, with Notes on Lighthouse Illumination*, 1847; Stevenson, *Treatise on the History, Construction, and Illumination of Lighthouses*, London, 1850; *Report of the Lighthouse Board of America*, Washington, 1852; J. T. Chance, "On Optical Apparatus used in Lighthouses," in *Proc. Inst. C. E.*, vol. xxvi.; "Dioptric Apparatus in Lighthouses for the Electric Light," *Proc. Inst. C. E.*, vol. lii.; Douglass, "The Wolf-Rock Lighthouse," *Proc. Inst. C. E.*, vol. xxx.; "Electric Light applied to Lighthouse Illumination," *Proc. Inst. C. E.*, vol. xlvii.; Thos. Stevenson, *Lighthouse Illumination*, 2d ed., Edinburgh, 1871 (German translation with appendix, *Ueber die Berechnung von Leuchthurmhohen und Leuchtthurm-apparatus*, by Chr. Nehls, Hanover, 1878); L. Reynaud, *Mémoire sur l'éclairage et le balisage des côtes de France*, Paris, 1864; Thos. Stevenson, *Lighthouse Construction and Illumination*, London, 1881; W. Swan, "New Forms of Lighthouse Apparatus," *Trans. Roy. Scot. Soc. of Arts*, vol. viii.; M. E. Allard, *Mémoire sur l'intensité et la portée des phares*, Paris, 1876; Id., *Mémoire sur les phares électriques*, Paris, 1881; *Proc. Inst. C. E., passim.* (T. ST.)

HTING, Electric. Artificial light is generally ed by raising some body to a high temperature. temperature of a solid body be greater than that ounding bodies it parts with some of its energy form of radiation. Whilst the temperature is radiations are not of a kind to which the eye is e ; they are exclusively radiations less refrangible greater wave-length than red light, and may be infra-red. As the temperature is increased the d radiations increase, but presently there are radiations which the eye perceives as red light. temperature is further increased, the red light es, and yellow, green, and blue rays are success- hrown off. On pushing the temperature to a gher point, radiations of a wave-length shorter an violet light are produced, to which the eye sitive, but which act strongly on certain chemical ces; these may be called ultra-violet rays. It seen that a very hot body in general throws out f various wave-length, our eyes, it so happens, only sensitive to certain of these, viz., those not ng and not very short, and that the hotter the he more of every kind of radiation will it throw it the proportion of short waves to long waves es vastly greater as the temperature is increased. roblem of the artificial production of light with ny of energy is the same as that of raising some o such a temperature that it shall give as large a tion as possible of those rays which the eye hap- be capable of feeling. For practical purposes mperature is the highest temperature we can e. As an illustration of the luminous effect of gh temperature produced by converting other of energy into heat within a small space, consider llowing statements. 120 cubic feet of 15 candle ll, if burned in ordinary gas burners, give a light standard candles for one hour. The heat pro- by the combustion is equivalent to about 60 mil- ot-pounds. If this gas be burned in a gas-engine, 8 million foot-pounds of useful work will be done e the engine, or four horse-power for one hour. s sufficient to drive an "A" Gramme machine e hour; the energy of the current will be about 000 foot-pounds per hour, about half of which, y 3,200,000 foot-pounds, is converted into radiant y in the electric arc, but this electric arc will radi- light of 2000 candles when viewed horizontally, wo or three times as much when viewed from be- Hence 3 million foot-pounds changed to heat in lectric arc may be said roughly to affect our eyes mes as much as 60 million foot-pounds changed at in an ordinary gas burner.[1] Owing to the high rature at which it remains solid, and to its great ive power, the radiant body used for artificial illu- tion is nearly always some form of carbon.

e consideration of electric lighting naturally divides wo parts—the production of suitable electric cur- and the conversion of the energy of such currents adiations. Although electric lights were first pro- l from currents generated by batteries, they have attained commercial importance by the use of ines for converting mechanical energy into electric nt.

namo-Electric Machines.—In the widest sense a mo-electric machine may be defined as an apparatus onverting mechanical energy into the energy of rostatic charge, or mechanical power into its equiv- electric current through a conductor. Under this ition would be included the electrophorus and all onal machines; but the term is used in a more re- ted sense for those machines which produce electric ents by the motion of conductors in a magnetic , or by the motion of a magnetic field in the neigh- ood of a conductor. The general laws of electro- netic induction need not be set forth here; as they ully explained in the article Electricity, they will be assumed in all that follows. Since, if the current in a closed circuit be in one direction when the number of lines of force is increasing, it will be in the opposite direction when they are diminishing, it is clear that the current in each part of the circuit which passes through the magnetic field must be alternate in direction. Hence also the current in the wire outside the machine must also be alternate, unless something of the nature of a commutator be employed to reverse the connections of the internal wires, in which the current is induced, and the external circuit. We have then broadly two classes of dynamo-electric machines:—the simplest, the alternate current machine,[2] where no commutator is used; and the continuous current, in which a commutator is used to change the connections to the external circuit just at the moment when the direction of the current would change.

The mathematical theory of alternate current machines is comparatively simple.[3] Let τ be the period of the machine, that is, the time taken to move the armature from one position to the next exactly similar position, *e.g.*, in a Siemens alternate current machine of sixteen magnets on each side, one-eighth of the time of revolution; let γ be the coefficient of self-induction of the whole circuit, and R the resistance of the whole circuit; and let t denote the time at any instant counting from any epoch as initial, and I the magnetic induction at time t multiplied by the number of convolutions. The electromotive force in the circuit at time t will be

$$\frac{dI}{dt};$$

and the equation of the current will be

$$\gamma\frac{dx}{dt}+Rx=\frac{dI}{dt},$$

where x is the current. Now I may be expressed in the form

$$\Sigma_1^\infty A_s \sin 2\pi s\frac{t-t_s}{T},$$

where A_s and t_s are constants for the machine with given excitation of the fixed magnets. Hence

$$\gamma\frac{dx}{dt}+Rx=\Sigma_1^\infty\frac{2\pi s}{T}A_s\cos 2\pi s\frac{t-t_s}{\tau},$$

$$c=C\varepsilon^{-\frac{R}{\gamma}t}+\Sigma_1^\infty\frac{2\pi s}{\tau}A_s\frac{\cos 2\pi s\frac{t-t_s-\tau_s}{\tau}}{\sqrt{\left(\frac{2\pi s\gamma}{\tau}\right)^2+R^2}},$$

where

$$\tan\frac{2\pi s\tau_s}{T}=\frac{2\pi s\gamma}{RT}.$$

The term $C\varepsilon^{-\frac{R}{\gamma}t}$ is unimportant except just after closing the circuit. In the Siemens machine M. Joubert states that the only important term is that of longest period. Hence, properly choosing the epoch, we write

$$x=\frac{2\pi A}{T}\frac{\cos 2\pi\frac{t-\tau}{T}}{\sqrt{\left(\frac{2\pi\gamma}{T}\right)^2+R^2}},$$

where

$$\tan\frac{2\pi\tau}{T}=\frac{2\pi\gamma}{RT}.$$

Hence we see the current is diminished either by increasing γ or increasing R, also that the moment of reversal of current is not coincident with that of no electromotive

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roc. Inst. C. E., lii. 69; *Report from the Select Committee on ric Lighting*, 1879.

[2] For descriptions of various alternate current machines, consult the following authorities:—Alliance: H. Fontaine, *Éclairage à l'Électricité*, Paris, 1879, p. 114; Dr. H. Schellen, *Die magnet- und dynamo-electrischen Maschinen*, Cologne, 1879, p. 35. De Meritens: *Engineering*, xxviii. 372, xxxii. 356, 380, 392; *Tel. Jour.*, vi. 393; Shoolbred, *Electric Lighting*, London, 1879, p. 14; *Electrician*, ii. 27. Gramme: *Engineering*, xviii. 413, xxvi. 63, xxix. 134, xxxii. 615; *Tel. Jour.*, viii. 26, ix. 206; *Electrician*, iv. 176; Shoolbred, 25, Fontaine, 161; Schellen, 176; *Report from the Select Committee on Electric Lighting*, 231. Holmes: Fontaine, 119; Schellen, 85. Holmes-Alliance: Shoolbred, 13. Lachaussée: *Engineering*, xxxii. 465; *Tel. Jour.* ix. 381. Lontin: *Engineering*, xxv. 48, xxviii. 174; Shoolbred, 22; Fontaine, 171; *Report from the Select Committee on Electric Lighting*, 229; Schellen, 167. Rapieff: *Tel. Jour.*, viii. 150. Siemens: *Tel. Jour.*, vii. 284; Schellen, 315.

[3] *Journal de Physique*, x. 141; Joubert, "Théorie des machines à courants alternatifs," in *Phil. Mag.*, x. 298, 384.

force, but occurs after that time by an amount depending on the relative magnitudes of γ and R. This explains in a general way what is known as the lead of the brushes in a continuous current machine. If we wished to apply a commutator to the Siemens alternate current machine for the purpose of producing an external current constant in direction, the change effected by the commutator should occur at an epoch after that of greatest electromotive force, an epoch which, with varying external resistance or varying speed, will depend on the resistance and speed.

The power of the current is Rx^2, and the energy in any considerable time, Θ, is

$$\Theta R\frac{2\pi^2A^2}{T^2}\frac{1}{\left(\frac{2\pi\gamma}{T}\right)^2+R^2},$$

which shows that most power will be required to drive the machine when

$$R=\frac{2\pi\gamma}{T}.$$

In what precedes it has been assumed that the copper wires are the only conducting bodies moving in the magnetic field. In most cases the moving wire coils of these machines have iron cores, the iron being in some cases solid, in others more or less divided. It is found that if such machines are run on open circuit the iron becomes hot, very much hotter than when the circuit of the copper wire is closed; in some cases the phenomenon is so marked that the machine actually takes more to drive it when the circuit is quite open than when the machine is short-circuited. The explanation is that on open circuit currents are induced in the iron cores, but that when the copper coils are closed the current in the latter by its induction diminishes the current in the iron. The effect of currents in the iron cores is not alone to waste energy and heat the machine; the current produced is also actually less for a given intensity of field and speed of revolution. The cure of the evil is to subdivide the moving iron as much as possible in directions perpendicular to those in which the current tends to circulate.

Continuous or Direct Current Machines.—It has been shown that to produce a continuous current a commutator is needed. If there is but a single wire in the armature, or if there are more than one, but all are under maximum electromotive force at the same time, the current outside the machine, though always in the same direction, will be far from uniform. This irregularity may be reduced to any extent by multiplying the wires of the armature, giving each its own connection to the outer circuit, and so placing them that the electromotive force attains a maximum successively in the several circuits. A practically uniform electric current was first commercially produced with the ring armature of Pacinotti as perfected by Gramme. Suppose a straight bar electromagnet surrounded by a coil of copper wire from end to end. Let the electromagnet be bent with the copper wire upon it until its ends meet and it forms an annulus or anchor ring. Let the two ends of the copper wire be connected, so that the iron core is surrounded by an endless copper wire, and you have the Pacinotti or Gramme ring. This ring rotates about its axis of figure between two diametrically opposed magnetic poles of opposite name. The ring may at any instant be supposed divided in halves by a diameter perpendicular to the diameter joining the centre of the poles. Equal and opposite electromotive forces act on the copper wire of the two halves, giving two opposite electric poles half way between the magnetic poles. If electric connections could be maintained with these two points as the ring revolves, a continuous current would be drawn off. In practice this is only approximated to. The copper wire is divided into a series of equal sections, and at the point of junction of each section with its neighbor a connection is made with a plate of a commutator, having as many divisions as there are divisions of the copper coil. Collecting brushes bear upon the commutator plates, which are connected to the coil nearest to the point of maximum potential. Owing to the self-induction and mutual induction of the several coils of the armature, this point is displaced in the direction of rotation when a current is being drawn off, to an extent greater as the current is greater in relation to the strength of the magnetic field. The magnetic field in the Gramme and other continuous dynamo-electric machines may be produced in several ways.[1] Permanent magnets of steel may be used, as in the smaller machines now made, and in all the earlier machines; these are frequently called magneto-machines.[2] Electromagnets, excited by a current from a smaller dynamo-electric machine, were introduced by Wilde; these may be described shortly as dynamos with separate exciters. The plan of using the whole current from the armature of the machine itself for exciting the magnets was proposed almost simultaneously by Siemens, Wheatstone, and S. A. Varley.[3] For some purposes it is advantageous to divide the current from the armature, sending the greater part through the external circuit, and a smaller portion through the electromagnet, which is then of very much higher resistance, as the electromagnet is a shunt to the external circuit. Machines so arranged are sometimes called shunt dynamos.[4] The last two arrangements depend on residual magnetism to initiate the current, and below a certain speed of rotation give no practically useful electromotive force.

In discussing the comparative efficiency of dynamo-machines there are two points to be examined—(1) how much of the power applied is converted into energy of current in the whole circuit, whether external or in the wires of the armature or of the electromagnets, and (2) how much of the power is available outside of the machine. The practical sources of loss are friction of bearings, and of the brushes on the commutator, electric currents induced in the iron of the machine, production of heat in the copper wire of the armature due to its resistance, and production of heat in the wire of the electromagnet due to its resistance. There is also a certain loss in sparks upon the commutator. The currents in the iron are reduced by dividing the iron by insulating surfaces perpendicular to the electromotive force tending to produce such currents. The loss by resistance of wire in armature and magnets greatly depends on the dimensions of the machine. For imagine two exactly similar dynamo-electric machines, the one being n times the dimensions of the other, we have the following relations between them, assuming the same magnetic field per square centimetre, and the same speed of rotation.

The electric resistances of the several parts are as $1 : n$;
The electromotive force of the armature as n^2;
Current round magnets required to produce the field as n.

Thus the work wasted in heating the wire of the electromagnets varies as the linear dimensions of the machine. The current which the armature can carry with safety to the insulation will increase more rapidly than the linear dimensions of the machines, but less rapidly than the square of the linear dimensions. If the current vary as the linear dimensions n, the whole electric work done by the machine will vary as its weight n^3, and the work wasted in the coils both of the electromagnets and of the armature will only vary as n,—showing a great theoretic advantage in favor of the larger machines.

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[1] See for descriptions of various continuous current machines:—BALL: *Engineer*, lii. 807; *Tel. Jour.*, ix. 415; *Electrician*, vii. 896 *Engineering*, xxxiii. 52. BRUSH: *Engineering*, xxxi. 56, 85, 123; *Engineer*, xlv. 447, li. 15; *Tel. Jour.*, vii. 21; *Electrician*, iii. 87; Shoolbred, 21; Fontaine, 181. BÜRGIN: *Engineering*, xxxii. 205: *Electrician*, vii. 229. CANCE: *Tel. Jour.*, viii. 846. DE MERITENS: *Engineering*, xxxii. 856, 380, 892. EDISON: *Engineering*, xxxii. 409, 418, xxxiii. 226, 252, 805, 407; *Tel. Jour.*, x. 440; *Engineer*, lii. 325, liii. 42; *Electrician*, viii. 28, 202. FEIN: *Electrician*, vii. 117; *Engineering*, xxxiii. 115. FITZGERALD: *Engineer*, l. 284; *Electrician*, v. 224. GRAMME: *Engineering*, xxviii. 64, xxxiii. 58; *Engineer*, xlv. 447; *Tel. Jour.*, vi. 491; *Electrician*, i. 15; Shoolbred, 18; Fontaine, 151; *Report from the Select Committee on Electric Lighting*, 226; Schellen, 113. GÜLCHER: *Engineer*, lii. 843; *Electrician*, vii. 873. HEINRICH: *Engineering*, xxxii. 120; *Tel. Jour.*, xviii. 859. HENLEY: *Tel. Jour.*, ix. 288. JÜRGENSEN: *Engineering*, xxxiii. 130; *Engineer*, lii. 237; *Electrician*, vii. 831. LADD: Fontaine, 124. LONTIN: Fontaine, 169. MAXIM: *Engineering*, xxxi. 618; *Electrician*, viii. 228; *Tel. Jour.*, viii. 413. PACINOTTI: *Engineering*, xxxii. 501; *Engineer*, lii. 293; *Tel. Jour.*, vii. 217, ix. 478; Schellen, 79; *Nuovo Cimento*, xix. (1864); *Journal de Physique*, x. 461. SCHUCKERT: Schellen, 139; *Engineering*, xxxiii. 244; *Tel. Jour.*, vii. 119. SIEMENS: *Engineering*, xxviii. 101; *Electrician*, ii. 89, vii. 58; Shoolbred, 17; Fontaine, 178; Schellen, 42, 144. WALLACE-FARMER: *Engineer*, xlv. 447; Shoolbred, 20; *Report from the Select Committee on Electric Lighting*, 246. WESTON: *Engineering*, xxxii. 42; *Electrician*, i. 267; viii. 230. WILDE: Shoolbred, 19; Fontaine, 121; Schellen, 49.

[2] Mascart, *Journal de Physique*, vi., vii.

[3] See for experiments on machines so arranged:—AUERBACH and MEYER: Wiedemann's *Annalen*, November, 1879. CROMPTON: *Engineering*, xxxii. 205. HOPKINSON: *Proc. Inst. Mech. E.*, 1879, 238, 1880, 266; *Engineering*, xxvii. 408, xxix. 424; *Engineer*, xlvii. 849; *Tel. Jour.*, vii. 167, 185, viii. 167; *Electrician*, ii. 279, iv. 295. SCHWENDLER: *Tel. Jour.*, vii. 47, 82, 395; *Electrician*, ii. 107, 117.

[4] For experiments on "shunt dynamos" see Siemens, *Trans. Roy. Soc.*, 1880.

Electric Lamps. Incandescent Lamp.[1]—The simplest way of obtaining light from an electric current is by passing it through a considerable resistance in such small compass that the conductor becomes intensely hot. It is of course necessary that the conductor shall be able to endure a very high temperature without injury. Iridium and platinum-iridium wire have been employed, but are too expensive for commercial use. Hitherto the only available substance is carbon, in the form of a thread or filament. This carbon must be protected from the air by enclosing it in a glass globe from which every trace of air has been removed. An electric current passing through a carbon filament obeys Ohm's law, as through a metallic wire. But in metals the resistance increases as the temperature rises, in carbon it diminishes.[2] The filament or thread of carbon being enclosed in a vacuous space, the energy of current converted into heat in the filament only leaves it in the shape of radiations. To light economically, it is necessary to heat the filament to such a temperature that the greatest possible proportion of these radiations shall belong to that part of the spectrum to which the eye is sensitive, *i. e.*, to the highest temperature the filament will stand. The fundamental problem of incandescent electric lighting is to produce a carbon thread the substance of which shall permanently stand the highest possible temperature, to make good electrical connection between the ends of the filament and the conducting wires, and above all to secure that the thread shall be uniform throughout its length, for the current which can be safely used is limited by the weakest point of the filament. Several inventors have recently succeeded in meeting these conditions, but their relative merit and priority cannot be discussed here.[3]

Semi-incandescent Lamp.—The lamps of Werdermann, Reynier, and Joel are intermediate between arc lamps and incandescent lamps, and present the distinctive advantages of neither.[4]

Arc Lights.—Sir Humphry Davy discovered that if two pieces of carbon were placed in contact with each other, and the current from a battery of a sufficient number of elements were passed from one piece to the other, the current did not cease when the carbons were slightly parted, but that the current passed across the intervening space, causing an intensely high temperature and consequently brilliant light. The pieces of carbon gradually burned away, the positive carbon being consumed more rapidly than the negative. When an electric current passes through a conducting solid body maintained at a constant temperature, the difference of potential on the two sides of the body has a constant ratio to the current passing through; this constant ratio is known as the electric resistance of the body at its then temperature. No such constant ratio exists in the case of the electric arc. If you increase the current passing between two carbons at a small distance apart, you do not materially change the difference of potential at the two ends of the electric arc. It is, therefore, not strictly appropriate to speak of the resistance of the electric arc; the appropriate constant, or approximate constant, for an electric arc is the difference of potential between the two sides of the arc.[5] However near the carbons approach without touching, this does not fall below a certain minimum value, and as the carbons are separated its value increases. In ordinary practice with continuous currents the potential of the electric arc may be taken as ranging from 35 to 45 volts. If the current in amperes be multiplied by the difference of potential in volts, and the product be divided by 746, we have the power used in the arc itself in horse-power, that is, the power effectively used in lighting. The mechanism of an electric lamp has two functions to perform, it has first to bring the carbons into contact and then part them, or simply part them if they are initially in contact when the light is started, or when it is accidentally extinguished (this is called striking the arc); it has also to bring the carbons together as they are consumed. The former function is always accomplished by an electromagnet or solenoid. In the electric candles, *e. g.*, those of Jablochkoff, Rapieff, Wilde, or Siemens, the carbons are approximately parallel, and they burn down as does a candle,—the arc being forced to the ends of the carbons by the repulsion of the current in the carbons on the electric arc.[6] In the ordinary arc lamps the carbons have their axes in the same line, and their approach or recession must be controlled by the current passing through, by the difference of potential, or by both combined. When the same current passes through a succession of lamps in series, it is clear that the regulation cannot be by the current alone, as this is the same for all the lamps, and might be maintained constant by the adjustment of any one only of the lamps. When lamps are burned in series, it is essential that the difference of potential shall be an element in the control. This is done by using an electromagnet bound by fine wire so as to have a resistance of some hundreds of ohms, and connecting it to the two sides of the arc. In the Siemens differential lamp, and in some others, a potential or shunt coil and a current coil oppose each other; as the arc lengthens the current becomes less, and the potential greater, each acting to cause the carbons to approach. It will be seen that the possible combinations of mechanisms and electromagnets for adjusting an electric arc are endless; and so also are tho patents for such combinations.[7]

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[1] See for descriptions of various incandescent lamps:—BROUGHAM and ANDRE: *Engineer*, xlix. 190; *Electrician*, iv. 218. EDISON: *Engineering*, xxxiii. 305, 407; *Tel. Jour.*, viii. 28, x. 440; *Electrician*, vii. 862. FOX (ST. G. LANE): *Engineer*, li. 197; *Tel. Jour.*, ix. 97; *Electrician*, viii. 5. JABLOCHKOFF: *Engineering*, xxxii. 391. KONN: *Electrician*, vii. 361; Fontaine, 292. MAXIM: *Engineering*, xxxi. 618. NAPOLI: *Electrician*, vi. 138. SAWYER-MANN: *Engineer*, xlvii. 5; *Tel. Jour.*, vii. 7; *Electrician*, ii. 100. STARR: *Electrician*, vii. 361. SWAN: *Tel. Jour.*, viii. 378; *Electrician*, vii. 218, 377.

[2] Thomson, *Tel. Jour.*, ix. 378.

[3] The application of incandescent lighting on a large scale has been thoroughly worked out in all its details by Edison. For a description of the whole system see *Engineering*, xxxiii. 226, 250, 305, 407.

[4] See for description of various semi-incandescent lamps:—JOEL: *Tel. Jour.*, viii. 364; *Electrician*. vi. 298. REYNIER: *Electrician*, ii. 88; *Tel. Jour.*, vii. 335; Fontaine, 297; Shoolbred, 38. WERDERMANN: *Engineer*, xlvi. 312; Fontaine, 301; Shoolbred, 39.

[5] Edlund, *Pogg. Annal.*, 1867, 1868.

[6] See for descriptions of various electric candles:—DE MERITENS: Shoolbred, 43. GATEHOUSE: *Tel. Jour.*, viii. 352. HEINRICH: *Engineer*, xlviii. 413. HICKLEY: *Tel. Jour.*, vii. 229. JABLOCHKOFF: *Engineering*, xxxii. 251, 300, 326; *Tel. Jour.*, vii. 10; Shoolbred, 41; Fontaine, 76; *Report from the Select Committee on Electric Lighting*, 233; Schellen, 243. JAMIN: *Tel. Jour.*, viii. 224; *Electrician*, v. 68; Fontaine, 81. RAPIEFF: *Tel. Jour.*, vii. 43; Shoolbred, 44. WILDE: *Tel. Jour.*, vii. 46; Shoolbred, 44; *Engineering*, xlvii. 385.

[7] See for descriptions of various arc lamps:—BROCKIE: *Engineering*, xxxi. 93; *Engineer*, xlix. 268; *Tel. Jour.*, viii. 114; *Electrician*, iv. 282. BRUSH: *Engineering*, xxxi. 55, 85, 123; *Engineer*, li. 15; *Tel. Jour.*, vii. 21; *Electrician*, iii. 87; Fontaine, 45. CANCE: *Engineering*, xxxiii. 80. CROMPTON: *Engineering*, xxxii. 205; *Engineer*, xlix. 323; *Tel. Jour.*, viii. 131; *Electrician*, iv. 278, vii. 229. DE MERSANNE: *Engineering*, xxxii. 647, 650; Shoolbred, 34. FONTAINE: Fontaine, 70. FOUCAULT and DUBOSCQ: Fontaine, 48; Schellen, 211. GAIFFE: Fontaine, 36. GORDON: *Tel. Jour.*, viii. 397. GRAMME: *Tel. Jour.*, ix. 250; *Engineering*, xxxiii., 172. GÜLCHER: *Engineer*, lii. 343; *Tel. Jour.*, ix. 464; *Electrician*, vii. 373. HEDGE: *Engineering*, xxxiii. 393; *Electrician*, iv. 40, vii. 404; *Tel. Jour.*, ix. 418. HEINRICH: *Engineering*, xxxii. 154; *Tel. Jour.*, vii. 301, ix. 73; *Electrician*, iii. 201. HICKLEY: *Tel. Jour.*, vii. 371. JASPAR: *Engineering*, xxxii. 645; Fontaine, 40. KRUPP: *Engineer*, xlvii. 167; *Tel. Jour.*, vii. 198; *Electrician*, ii. 255. LACASSAGNE and THIERS: Fontaine, 28. LONTIN: Shoolbred, 33; Fontaine, 59. MACKENZIE: *Engineering*, xxxi. 38. MAXIM: *Tel. Jour.*, viii. 417, ix. 144; Fontaine, 69. MOLERA and CEBRIAN: *Tel. Jour.*, vii. 232. ORME: *Tel. Jour.*, vii. 184. PILSEN: *Engineering*, xxxi. 514, xxxiii. 152; *Tel. Jour.*, viii. 419. RAPIEFF: *Engineering*, xxvii. 55; *Tel. Jour.*, vii. 60; Fontaine, 22; Shoolbred, 34; *Report from the Select Committee on Electric Lighting*, 239. SCRIBNER: *Tel. Jour.*, viii. 379. SERRIN: Shoolbred, 31; Fontaine, 53; Schellen, 218. SIEMENS: *Engineering*, xxxi. 276; *Tel. Jour.*, vii. 318, 412, viii. 93; *Electrician*, ii. 52; Schellen, 227; Fontaine, 63; Shoolbred, 38. SOLEIL: *Engineering*, xxxii. 453. STEWART: *Tel. Jour.*, viii. 80, 115. THOM

When an alternate current is used for an electric arc, the phenomena are much more complicated, owing to the difference of potential being a discontinuous function of the time. The difference of potential will be (say) 40 volts in one direction for a certain fraction less than half of the periodic time of the current; the current then entirely ceases, generally for a finite time, and is then reversed with a sudden reversal of difference of potential.[1] The work done in the arc is measured by the time integral of the product of difference of potential and current passing. A knowledge of neither the mean strength of the current, nor of the difference of potential, nor of both, gives the means of ascertaining the work done in an arc with alternate current. The only satisfactory electrical method is the quadrant electrometer suitably connected, and this is open to the objection that a considerable resistance must be introduced into the circuit.

Electric Light Measurements.—Under this head we content ourselves with a warning. A bare statement that an electric arc light is of so many candle power really conveys no accurate information at all. The light from an electric arc differs greatly in color from that of a candle;[2] a given arc light may have three thousand times as much red of a certain wave-length as a standard candle has of the same wave-length, but ten thousand times as much green light. Any one will admit that green light is not measurable in terms of red light; a mixture of red and green is not measurable in terms of another mixture in which the proportions of the colors are wholly different. Again, the intensity of the light obtained from an arc light depends greatly on the direction in which it is viewed.[3] Neither of these considerations applies in the same degree to incandescent lamps. (J. HO.)

LIGHTNING. See METEOROLOGY and THUNDERSTORMS.

LIGHTNING CONDUCTOR, or LIGHTNING ROD (*Paratonnerre, Blitz-ableiter*), is the name usually given to apparatus designed to protect buildings or ships from the destructive effects of lightning. The title, alike in English, French, and German, is misleading; for, when properly constructed, lightning rods serve rather to prevent the occurrence than to ward off the effects of a flash of lightning. Damping the enemy's powder would be a most efficient precaution against cannon-shot, but it would be very inappropriately termed fortification. When a conductor charged with electricity is brought near to another conductor connected with the earth, it induces on it a charge of the opposite kind of electricity. The result is an attractive force which tends to bring the conductors nearer to one another, and to augment the electric density on their opposed surfaces. When the density is sufficiently great, there is rupture of the dielectric (air) between the conductors, and the disruptive discharge takes place as an electric spark. If one of the conductors have projecting points or angles, the electric density is usually much greater at such places than over the rest of the surface. But, though the density is great at such places, the charge on them is usually small, and the discharge takes place in an almost continuous manner by a brush or glow. When, for instance, a large conductor, connected with an electric machine, is giving a rapid succession of bright sparks to a ball connected with the ground, the sparks cease as soon as a pointed wire, connected with the ground, is held in the vicinity of the conductor. No discharge is heard, but in the dark a faint glow is seen at the end of the wire, which continues as long as the machine is turned. Remove the wire and the sparks instantly recommence. This glow is known to sailors as St. Elmo's (San Telmo's) fire, in old days Castor and Pollux (Plin., *H. N.*, ii. 37). Suppose now one of the conductors to be a thundercloud, the other the surface of the earth, the discharge will usually take place between the places of greatest surface density; and it will in general be the more gradual as these are more pointed, and of less capacity. Hence Franklin's idea of furnishing buildings or other prominent objects with a projecting metal spike well connected with the ground, for the purpose of preventing a lightning discharge by substituting for it what is practically a continuous electric current.

To effect this object thoroughly, only three things are necessary:—(1) the points should so project from the building or ship to be protected as to prevent any great development of electric density elsewhere than on themselves; (2) they should be effectually connected with the earth; (3) the connecting rod ought to be so good a conductor as not to be injured even by a powerful electric discharge.

The first of these conditions is realized by making the rod branch out to all the salient portions of the building or ship, and furnishing it with points projecting beyond each of them. No general rule can be laid down as to the extent of the region protected by a single point, though it may usually be assumed with safety that the region extends throughout a vertical cone whose vertex is at the point, and whose semivertical angle is about 45°. This is probably not true if the point be very high,—on the top of a tall chimney or tower, for instance. Objects not far from the base of such a protected tower, and within the cone just described, have occasionally been damaged by lightning.

The second condition is easily fulfilled in towns by connecting the lower end of the rod with the iron gas and water-mains, which form an excellent "earth," as it is technically called. Water-pipes, being usually jointed with metallic-lead-washers, are preferable to gas-pipes, which are usually put together with white lead. This condition is also easy to secure in ships and in lighthouses, where large metal plates (in the case of a ship, the copper sheathing is precisely what is required) can easily be permanently immersed in sea-water. In country houses it is usually more difficult to obtain a proper earth. Plates and tubes of metal, of large surface, buried in ground which is permanently damp, form usually the best arrangement. A well makes a good earth; a carefully constructed water tank (of stone or cement) is not an earth at all.

The third condition, so far as experience can guide us, seems to be effectually realized by making the conductor *throughout* of iron rod of an inch in diameter, or of copper rod not less in diameter than ⅜ths of an inch. Such rods of equal length have nearly the same conducting power, and therefore would have equal amounts of heat developed in them by a given discharge. But if such a discharge took place, the copper would be heated much more than the iron, in consequence of its smaller mass per foot (the specific heat being approximately the same in the two materials). Hence iron is, in this respect, preferable to copper, if the conducting powers of the rods are equal. Another advantage possessed by the iron rod is that it is much less likely to be wilfully damaged or stolen. Against this may be set the objections that it is easily injured by rust, and is not nearly so flexible as the equivalent copper rod. Conductors are now usually made of wire-rope, so that the question of flexibility is no longer of serious importance; but when iron is used it should always be protected by zinc, *i. e.*, be what is absurdly called "galvanized." Many fantastic forms of lightning rods were devised in consequence of the old erroneous notion that their efficiency depended on their surface and not on their cross section. In reality all conductors of equal length, and of the same material, are equally efficient if their cross sections be equal.[4]

SON and HOUSTON: *Engineer*, xlvi. 295; *Electrician*, i. 282: Fontaine, 67. TCHIKOLEFF: *Electrician*, v. 80. WALLACE-FARMER: *Engineer*, xlvi. 295; Shoolbred, 86; Fontaine, 83; *Report from the Select Committee on Electric Lighting*, 246. WESTON: *Engineering*, xxxii. 42; *Electrician*, viii. 246.

[1] Joubert, *Journal de Physique*, ix. 297.

[2] Abney, *Proc. Roy. Soc.*, 1878.

[3] Allard, *Mémoire sur les phares électriques*, p. 13, Paris, 1881; *Proc. Inst. C. E.*, lvii. 130; Shoolbred, 59.

[4] Some curious modifications of this statement are introduced when we deal with magnetizable metals, but they are unimportant in practice.

Thus, instead of stating the diameter of a rod, we may speak of its weight per foot, and say that a copper conductor should weigh at least about half a pound, and an iron one at least two pounds and a half per foot,—provided the materials be of good conducting quality.

The points need not be very sharp, but they ought to be protected by a coating of platinum or other non-oxidizable metal. And they should be in a group of two or three at the end of each branch of the rod, lest one of them should be fused and impaired in efficiency by an accumulation of electricity so rapid as to make the silent continuous discharge impossible. Joints should be avoided as far as possible; where they are unavoidable they should be made not by screws or brazing, but by means of a large mass of solder completely enveloping the ends to be connected.

Another point to be carefully attended to is that all large metallic bodies, such as lead or zinc roofing, metal tanks, etc., should be in good conducting connection with the rod, so as to prevent discharges of electricity inside the ship or building. In many buildings we see the lightning rods attached by means of glass or porcelain insulators, such as are employed for telegraph wires. This is a perfectly needless, expensive, and possibly dangerous practice.

The literature of this subject is very extensive, as may be seen from Ronalds's *Catalogue of Works on Electricity*. The reader may also consult Anderson on *Lightning Conductors* (1880), and the *Report of the Lightning-Rod Conference* (1882). In the latter work will be found abstracts of many valuable papers, especially the reports on lightning-rods made to the French Academy by some of its most distinguished members, including Coulomb, Laplace, Poisson, Gay-Lussac, Fresnel, Pouillet, Cagniard de la Tour, Regnault, etc. There will also be found hints about some of the most ludicrous devices employed by men ignorant of the laws of electrical phenomena. One of the most singular of these was the so-called "Repeller." A lightning-rod, in all respects sufficient, was wont to be capped by a piece of glass like a thick soda-water bottle, inverted upon its point. The effect of this could only have been to prevent the possibility of the silent discharge, to produce which is the proper function of the rod, and to make probable a lightning flash, just as if the rod had been terminated by a ball instead of a point. One of these dangerous monuments of ignorance was removed from a British lighthouse within the last ten years. In an Irish lighthouse, which was recently examined after suffering serious damage, it was found that the lower end of the lightning-rod was jumped into the solid rock—a truly original form of "earth"!

In 1876 Clerk Maxwell suggested to the British Association the idea (based on Faraday's experiments) of protecting a building from the effects of lightning by surrounding it with a sort of cage of rods or stout wire. Here an "earth" would not be absolutely required. The present writer had some months previously suggested the same idea in a Report to the Board of Northern Lights. It is possible, though not certain, that this form of defence might be useful against globe-lightning, which undoubtedly occurs, and against which ordinary lightning-rods would probably be of little use.

These brief remarks contain all that is yet known to be necessary to the complete solution of an important practical problem about which many treatises have been written.

(P. G. T.)

LIGNITE. See COAL.

LIGNUM VITÆ. See GUAIACUM.

LIGUORI, LIGUORIANISM. The name Liguorianism has been popularly given in the present century to a particular school of moral and devotional theology in the Roman Catholic Church by the controversial opponents of that school, whether themselves Roman Catholics or not. It is derived from the name of one of its principal and most influential exponents, Alfonso Maria de' Liguori, a theologian, saint, and doctor of the Roman Church. In strictness, the term is not accurate, for Liguori was in no sense the founder of the school, nor did he innovate upon, develop, or exaggerate its principles and maxims. He was simply a fair representative of the national type of piety of Italian devotees in his day; and, as a casuist, he was a diligent compiler, whose avowed design was to take a middle course between the two principal varieties of teaching in moral theology current in his own time, avoiding their extremes of severity or laxity. His own words, in the preface to his *Homo Apostolicus*, a work intended for the guidance of priests in hearing confession, explain clearly the intention of his bulkier treatise, the *Theologia Moralis*. He says:—"When compiling that work, I spent the labor of fifteen years in perusing and weighing the teachings of very many writers whom I examined, some of whom I found more lenient than is just; . . . while I found others who, strongly disliking such indulgence, fell into the other extreme of excessive rigor. And this was my principal task, to select from such a mass of opinions those decisions which, on the one hand, should uphold the obedience due to the precepts of God and of the church, and on the other should not add burdens which God has not imposed, by binding every one to that perfection which, through human weakness, is morally impossible to the general body of believers." A brief glance at the names of those casuists whom he cites most frequently, as Covarruvias, Soto, Lessius, Vasquez, Bonacina, the doctors of Salamanca, Sanchez, Diana, etc., shows them to belong mainly to the hundred years between 1580 and 1680, and therefore to the period of Jesuit predominance in moral theology, and of the prevalence of those maxims which Pascal lashed in the *Provinciales*, many of which were soon after condemned by Pope Innocent XI. in 1679. But, as Liguori embodies also in his materials the casuistical authors of the succeeding century, who were taught some caution by those mishaps of their predecessors, his works represent the final stage of casuistry in what is accounted a purified and moderate form, and have a yet greater importance, in that they have been accorded an official approval and authorization from the highest authorities of the Roman Catholic Church, such as those of no previous casuist of the post-Reformation era can allege. They are fully sanctioned, encouraged, and recommended for general use amongst the Roman Catholic clergy, and in fact only just fall short of being actually enjoined. Consequently they themselves, and the works based on them by Scavini and Gaume, as also the kindred manual of Gury, are all but universally found in use, and it is thus easy to learn from them what is now the accredited moral theology prevalent throughout the Latin obedience. So much being premised, we may now turn to the life of Liguori himself, and thence to the analysis of the system which he expounds.

Alfonso Maria de' Liguori, son of Giuseppe de' Liguori, a Neapolitan noble, and of Anna Cavalieri de Brindes, his wife, was born at Marianella, near Naples, on September 27, 1696. He was educated chiefly at home, though he attended an Oratorian school at Naples for a time; and, as his father desired that he should rise to office in the magistracy, he was especially directed to the study of jurisprudence, both civil and canonical. He took the degree of doctor in this faculty in January, 1713, being then little more than sixteen years old. He was called to the bar in due course, and obtained considerable practice, while his biographers dwell much on the high moral tone of the rules he laid down for his guidance in the conduct of professional business. The loss of an important suit in which he was engaged as counsel for a Neapolitan noble against the grand-duke of Tuscany, and in which he had entirely mistaken the force of a leading document, so mortified him that, acting on a temper already disposed towards the monastic life, it induced his withdrawal from the legal profession, which he never resumed after this defeat. He soon adopted the ecclesiastical dress as a candidate for orders, which he received in December, 1724, when he entered as a novice into the Congregation of Missions, being ordained priest in December, 1726.

He soon became popular as a preacher and as a confessor, obtaining much influence in Naples and its vicinity. In 1732 he founded the "Congregation of the Most Holy Redeemer," usually known as Redemptorists, or, as they are often named, Liguorians, whose special object is the religious instruction of the rural poor and other uneducated classes, establishing the first house of the society, in the face of much opposition, at the little town of Scala, about 8 miles from Salerno. The headquarters were transferred somewhat later to Ciorani, and in 1743 to Nocera dei Pagani, which is still the chief house. The confirmation of the rule and institute was obtained from Benedict XIV. in February, 1749, and in the following year Liguori, who had previously made some minor literary ventures, published one of his most famous and popular books, *Le Glorie di Maria*, a book intended to promote the cultus of the Blessed Virgin; and in 1753 he issued his yet more celebrated *Moral Theology*, dedicating it to Pope Benedict XIV., expressly as a "via media" treatise. An Italian version of this book, somewhat abridged, recast, and adapted for the use of the clergy, was his next task; and, on this shorter treatise becoming popular, and a demand for it arising outside of Italy, he translated it into Latin, and issued it in 1755 as the *Homo apostolicus*.

In 1762, being then sixty-six years of age, he accepted the bishopric of Sant' Agata dei Goti, a small town in the province of Benevento, at the express desire of the pope (though he had several years before refused the archbishopric of Palermo, offered him by the king of Naples), and by a very unusual concession was permitted to retain his superiorship of the Redemptorists, governing them by means of a vicar-general. He worked diligently in this sphere of labor for thirteen years, busying himself with practical reforms of various kinds in his diocese, notably in trying to raise the standard of clerical life and work, while not intermitting either his literary pursuits or his efforts to promote the growth of his Redemptorist institute. In 1775, being then seventy-nine years of age, he obtained permission from Pius VI. to resign his bishopric, on the plea of enfeebled health, and retired to the Redemptorist house at Nocera dei Pagani, where he died August 1, 1787, aged nearly ninety-one. He was decreed the rank of "Venerable" very speedily, being so named by Pius VI. in 1796, was beatified by Pius VII. in 1816, canonized by Gregory XVI. in 1839, and finally declared a "Doctor of the Church" by Pius IX., March 11, 1871. He is one of the most copious of the later Roman theologians, and his productiveness extended over a period of thirty years, from the issue of his *Visits to the Blessed Sacrament* in 1747 till the appearance of no fewer than eleven treatises in 1777; but his only writings necessary to be added here to those already named are his treatises *De Usu Moderato Opinionis Probabilis*, 1754, recast and reissued in 1756; *Praxis Confessarii*, 1756; six apologies in defence of his views on probabilism and of his *Moral Theology*, in the same year, followed by three more in 1768; *Verità della Fide*, against Helvetius and the deists, 1767; *Storia delle Eresie*, directed chiefly against the Jansenists and Molinists, 1772: *Dissertazioni teologiche morale*, 1772; and *Vindiciæ pro suprema Pontificia potestate, adversus Justinum Febronium*, in the same year.

He was a man of naturally amiable and gentle disposition, ascetic and self-denying in his personal habits, indefatigably diligent in many forms of activity, and of more than respectable abilities, though with the emotional side of his character in greater relief than its intellectual side. He was learned, as learning was understood amongst the Italian clergy of the 18th century, though altogether lacking in critical faculty, whence he is quite untrustworthy as a controversalist, not only as habitually quoting spurious or interpolated authorities, but by adding matter of his own to amplify genuine quotations which fall short of proving his case. In estimating the nature of his moral teaching, not only have these personal characteristics to be steadily kept in mind, but also the fact that his life exactly synchronizes with that epoch of European history which was the seed-time of the Revolution, and when, owing to reaction from the fervid theological controversies of the 16th and 17th centuries, a general languor, coldness, and indifference towards religious questions reigned in all parts of Western Christendom. It was Liguori's firm belief that only the most lenient and gentle treatment could win back the alienated laity; and consequently, though he professed to steer a middle course between errors of laxity and severity in moral teaching, and fully believed himself to have done so, yet in fact such a treatment was impossible to one who viewed the question as he did. For, while he regarded errors on the side of laxity as pardonable mistakes committed through excess of zeal in winning over penitents, contrariwise he looked on the stricter method of the rigorists, who upheld a loftier morality, as not merely inexpedient, but as positively and intentionally evil, as designed to make religion odious by making it impossible, and so to prepare the way for the triumph of unbelief. He identified all teaching of the sort with Jansenism, and Jansenism, from its resistance to various pontifical decrees, seemed to him all but equivalent to atheism.

Hence the opinions of rigorist theologians find almost no place in his writings, save for the purpose of censure, since he did not regard them as authorities to be relied on; and accordingly the line he draws is not, what he probably thought it, an intermediate one between rigorism and laxity, but between a greater and a lesser degree of laxity, depending on the working of the principle known as "Probabilism." The meaning of this principle (due to the scholastic form of the Aristotelian dialectic, and thus visible in germ as early as St. Thomas Aquinas, though not taking final shape till the writings of Medina, Valencia, Vasquez, and others, mainly, but not exclusively, Jesuits, at the close of the 16th century) is simply this:—when a doubt arises as to the binding force of some divine or human precept in any given case, it is permissible to abandon the opinion in favor of obedience to the law—technically known as the "safe" (*tuta*) opinion—for that which favors noncompliance, provided this laxer opinion be "probable." And by "probable" is meant any judgment or opinion based on some reasonable grounds, though with some doubt that the opposite view is perhaps the true one (Gury, *Theol. Mor.*, vol. i. n. 51). It may be probable in two chief ways,—intrinsically, because of reasons drawn from the nature of the thing itself, or extrinsically, because supported by one or more theologians of repute; and its degree of probability may vary according to a variety of conditions. Casuists are divided into six classes according to their mode of regarding probability:—(1) Rigorists, who lay down that the safer way, that of obedience to the law, is always to be followed; (2) Mitigated Rigorists, or "Tutiorists," who, holding that the law is always the safer and better way, yet allow that an opinion of the highest intrinsic probability in favor of liberty may sometimes be followed; (3) Probabiliorists, who hold that the law is always to be obeyed unless an opinion clearly very probable (*probabilior*) is opposed to it; (4) Equiprobabilists, who teach that in a balance of opinions the less safe opinion may be lawfully followed, provided it be as probable, or nearly as probable, as its opposite; (5) Moderate Probabilists, according to whom it is lawful to follow the less safe and somewhat less probable opinion, provided it have some degree of real probability, even if the opposite opinion be clearly more probable; (6) Laxists, who hold that even slightly probable opinions may be followed; but, as they were condemned by Innocent XI., they no longer exist as an avowed school, but are still latent under classes 4 and 5.

On further examination, it appears that the right of judging of the *intrinsic* probability of an opinion is restricted to persons of considerable learning, and specially versed in moral theology, since they alone can know that there is not any certain argument in opposition. All other inquirers must fall back on *extrinsic* probability, that is, on what may be called "counsel's opin-

And, in forming a judgment on this basis,
owing rules are laid down by F. Gury:—a mod-
educated person may accept as probable any
which he finds asserted by distinguished theo-
of the present day, and may follow even a single
of repute, though teaching contrary to the com-
eceived view, provided he brings forward some
gument, and can urge reasonable pleas against
solutions; while an ignorant man may take the
any person whom he thinks trustworthy, able,
ned, that a particular opinion is probable (*Theol.*
ol. i. n. 54). Some classes of things are, how-
cluded by Roman casuists from the operation
principle; as, for example, all questions relating
ers of faith, in which the very highest degree
ability is not sufficient to excuse from following
opinion, which is that of the Roman Church.
s own position is that of an equiprobabilist, and
fore, as a rule, leans to the laxer side.

e proceeding to illustrate the exact nature of
hing by extracts from his works, it is desirable
tain what degree of authority attaches to those
n virtue of the position now accorded to him.
irst place, one of the earliest steps in the pro-
anonization is a strict review of every writing
ndidate proposed, whether published or unpub-
Every single proposition therein must be sepa-
onsidered, and be judged on its own merits,
taking the author's probable intention into ac-
nd if even one passage be found which fails to
is test, as containing any moral or theological
e process is stopped at once, unless proof be
that the author had in his lifetime formally
y retracted the erroneous opinion. But a de-
the Congregation of Rites, confirmed by Pius
1803, declared that in none of the writings of
de' Liguori was anything found meriting cen-
l the testimony of Artico, bishop of Asti, and
relate of the papal household, is that the ex-
n had been unusually severe, that Liguori's
f morality had been discussed more than twenty
d that the approval of the congregation was
unanimous. Next, in the year 1831, Cardinal
habot, archbishop of Besançon, submitted a
the cardinal grand penitentiary, desiring to
hereas the teaching of Liguori's *Moral The-*
s resisted by some persons in his diocese, as too
gerous to salvation, and contrary to the moral
ther a professor of theology might safely fol-
teach the opinions in that work, and further,
a confessor should be molested for following
inions in the confessional, solely on the ground
y had been pronounced free from censure by
tolic see, and without having examined them
lently himself. To the former of these ques-
affirmative reply was given, to the latter a
one. Thirdly, in the bull of canonization is-
Gregory XVI. in 1839, the entire absence of
Liguori's writings is once more asserted.

, no more is implied than the entire orthodoxy
al soundness of Liguori's writings, vouched for
dinary Roman Catholic by the fact of his canon-
And, though the liberty is thereby taken away
ly censuring any proposition in the writings of a
doctrinally or morally untenable, yet there is no
bligation to follow all things contained therein.
lawful to challenge the opinions of a saint, if
e modestly and with the production of strong
(Bened. XIV., *De Canoniz.*, ii. 32, 12); but
rty is very seriously abridged if the saint be
Doctor of the Church." For the meaning of
is that the person who bears it is one who has
ely transmitted the teaching of the church to
ut has taught the church itself (Bened. XIV.,
oniz., iv. ii. xi. 11), and whose doctrine has
ntly been generally followed and authorized by
ch. The number of these doctors of the church
mall; and, in the special case of Liguori, he is
not only the latest so named, but the only post-mediæval casuist who has yet been canonized. Accordingly, it is not merely permissible, as heretofore, to follow his teaching, but it is now clothed with so high a degree of authority that it becomes matter of grave doubt whether even such a modified expression of dissent from his teaching as occurs in the *Apologia* of Cardinal Newman in 1864 be now feasible without risk of censure. For the letters apostolic of Pius IX. declare that the works of Liguori may be used publicly in the same manner as the writings of other doctors of the church, such as Augustine, Gregory the Great, and Thomas Aquinas; with, however, this notable difference that, whereas the teaching of those earlier doctors is necessarily qualified and conditioned by the subsequent development of theology, and by the successive glosses which they have received, on the other hand, Liguori's recent date makes him the sole authoritative interpreter of all moral theologians earlier than himself, while no writer has yet appeared to modify authoritatively, much less to supersede, his own moral teaching.

It may seem, at first sight, that a great advantage is gained by having thus a standard text-book on morals, even if some exceptions may be taken to its rulings in certain cases, because it may be expected to check serious divergency of opinion, and to put, indirectly at least, a high ethical ideal before the body of religious teachers. This, however, can be the case only when such a text-book expressly repudiates the principle of probabilism, and so comes to be ranked amongst rigorist works. For once probabilism is conceded as part of the system, as is the case with Liguori, then every opinion not officially condemned by authority, which is set down in the text-book itself, and is fortified with the names of any casuists of repute, becomes thereby probable and sanctioned, even though it be not the one professed by Liguori himself. Thus it may freely be followed by any priest in the confessional; and, what is yet more startling, it is the common and preferable doctrine that a penitent in confession can require absolution to be given him as a right, if he claim to have followed a probable opinion as to the act involved, even though not only the opposite opinion may be the more probable in the confessor's judgment, but that of the penitent seem absolutely false, and the confessor is therefore bound *sub gravi* to absolve in such a case (Lig., *Theol. Mor.*, vi. 605); nor is it necessary that the opinion which the penitent advances should really convince or satisfy his own conscience. It is enough that it stands in the books, and is citable. Accordingly, the only practical effect of such a text-book as Liguori's is to undermine all rigorist propositions, and to make tenable every lax proposition, except the very few which have been specifically condemned.

As regards Liguori himself, his usual method is to begin with taking very high ground, and to state in unexceptionable terms the moral obligation of the precept with which he is concerned, but then to evacuate it of all real force by exceptions and qualifications. That such was felt to be the case, even in the relaxed society of his own day, appears from the frequency with which, even before his death, his moral teaching was impugned in Italy and France as of dangerous consequences, and from the number of apologies he was obliged to put forward in its defence.

He lays down broad general propositions, such, for example, as that all voluntary departure from the divine rule, whether of human and natural law or of revealed law, is sin (*Theol. Mor.*, ii. 1, 1); that nearly all sins against the decalogue are mortal sins (*Ibid.*, ii. 52, 2); that all sins, whether mortal or venial, deserve punishment (*Ibid.*, ii. 51, 1, 2); and, specifically, that all lying and falsehood is a breach of one precept of the decalogue (*Ibid.*, vi. 1, *proœm.*), and all theft and dishonesty a breach of another (*Ibid.*, iv. 518); but the favorable impression which such unimpeachable rulings produce is not maintained on further inquiry.

In the first place, he lays down that, to make any act sinful, three conditions must be fulfilled:—(1) it must be done with consent of the will; (2) it must be free, that is, it must be in the power of the will to do it or leave it undone; (3) there must be intellectual consciousness (*advertentia*) of its evil nature. These look specious enough, and against the first no objection can be raised. But Liguori then alleges that violent gusts of passion or desire, which disturb the reason, and take away liberty of action, sometimes excuse from sin (*Ibid.*, ii. 1, 2). He is not speaking of actual insanity, which is not under consideration; and he adds that evil acts done by a drunken person are either not sinful at all, or are at most venial sins (*Ibid.*, ii. 1, 4), because the effect cannot be more sinful than the cause. And as to the degree of advertence necessary as a condition of sin, he first mentions the stricter view, that actual and immediate attention to the nature of the act is not required, but that a virtual knowledge of its character suffices, by which a man might reasonably be expected to recognize it, since otherwise all evil-doers who are blinded by their passions, or by a long course of malpractices, may go on taking no notice, and continue to commit sins with moral impunity. He then states the laxer and commoner view, that some direct advertence of the sinful nature of the act is necessary to constitute sin in doing it, and proceeds to reconcile these two opinions by ruling that voluntary ignorance, whether due to conscious neglect, to deliberate following of passion, to a course of evil habit, or to omission of the degree of consideration which the act demands, does not excuse from sin; but that all other forms of it do acquit the offender. The obscurity inseparable from some of these qualifications complicates a sufficiently simple matter, and in any case the doubter is at liberty to fall back on the laxer opinion. But there is one exception;—unbelievers and heretics cannot plead ignorance as their excuse. All their errors, of whatever kind, are imputed to them as sin (*Ibid.*, ii. 1, 4). A further difficulty is created by the distinction made between mortal and venial sins, and by the inferences drawn from this distinction. "A mortal sin is that which, by reason of its gravity, dissolves grace and friendship with God, and merits eternal punishment. It is called mortal, because it takes away the principle of spiritual life, that is, habitual grace, and brings death on the soul. A venial sin is that which, by reason of its slightness, does not take away grace and friendship, though it abates the warmth of charity, and deserves temporal punishment. It is called venial because, without damage to the principle of spiritual life, that is, grace, it brings on the soul an easily curable weakness, and easily obtains pardon" (*Ibid.*, ii. 51). This seems at first merely a recognition of the broad practical distinction between serious and trifling offences acknowledged by every sound ethical thinker and by every civilized penal code. But its consequences go much further, for in the Roman system of casuistry the aim is as a rule to attenuate mortal sins into venial ones; while these latter are regarded as of such little moment as scarcely to deserve the very name of sin. This appears from the fact that, whereas the canon (xxi.) *Omnis utriusque sexus fidelis* of the council of Lateran (1215), which first made private confession compulsory, enjoins the confession of all one's sins at least yearly, on the other hand, the council of Trent (Sess. xiv. c. 5) lays down that only mortal sins need be so disclosed, while venial sins, though they may be named in confession, according to the practice of devout persons, can be passed over in silence without any fault. And Liguori gives his own sanction to the proposition that a Christian does not sin gravely who proposes to commit *every one* of the venial sins (*Theol. Mor.*, v. 1, 12). Such being the light estimate of these sins, it might be fairly supposed that great care would be taken to mark them off so clearly from mortal sins that even the least instructed conscience could not confuse them with each other. But every sin which, considered in itself, is mortal, becomes venial if any one of these three conditions be absent:—full advertence and deliberation; entire consent; for the most part, gravity of the subject matter. Insufficient deliberation may be known in three ways:—imperfect consciousness of the sinfulness of the act, as if one were half asleep; subsequent regret, and a conviction that you would not have done the act had you fully apprehended it; such disturbance, through passion, alarm, or distraction, as to confuse the sense of what you were doing. Imperfect consent is established by the presence of a doubt in any one's mind whether he did really consent; by the habitual disposition being that of regarding mortal sin as a worse evil than death; by consciousness of having proceeded very timidly and hesitatingly in the action; by being half asleep, so as to be only doubtfully conscious, and being of opinion that the act would not have been done in case of full possession of the senses. And gravity of the subject matter is to be decided, not merely on the merits of the thing in itself, but in its relation to the end proposed by the agent. If it make but little for this end, it is trifling; if much, then it becomes serious (*Theol. Mor.*, ii. 54, 55, 56).

It is obvious that each of these subdivided qualifications admits of indefinite hair-splitting, and so that the security apparently provided by the general distinction between mortal and venial sins is elusive. It is true that there are also causes which will raise a venial sin to the rank of mortal; but the ascending process is more uncertain and difficult than the descending one. A venial sin, committed deliberately as a stepping-stone to a mortal sin, is to be judged in respect of this its object, and so becomes mortal. A venial sin, so passionately clung to as to make its votary ready to commit a mortal sin rather than forego its indulgence, also becomes mortal. But in neither of these cases is it necessary to confess the venial sin, only the mortal sin to which it has led up. The third mode of a venial sin becoming mortal is when it is committed with the formal and express purpose of disobedience to a superior, or to a precept, just because it is a precept. And in this case alone, because of the supreme place given to obedience in the Roman system, wherein it is not only the first and highest of virtues, but practically almost the only one insisted on for all, there is no manner of withdrawal from the category of mortal sins (*Theol. Mor.*, ii. 59, 60, 61).

So far, only the general principles on which Liguori's system is based have been explained. It next remains to exhibit their practical application, both as regards his own statements and also as regards those opinions of other casuists which, though not accepting them for himself, he yet embodies without censure in his work, thereby giving them the character and sanction of probability. It will simplify the inquiry to limit it mainly, though not exclusively, to the teaching on falsehood and theft.

Both of these are declared by Liguori to be sins of grave character, and in regard to the former he cites, amongst other authoritative condemnations, these words of Pope Innocent III.: "Not even to defend our life is it lawful to speak falsely." He adds that persons who are being lawfully questioned by such as have a right to interrogate, as judges in court, or a priest in the confessional, are bound to disclose truly all that they know of the matter inquired into. Those who are questioned by such as have no right to interrogate them, or are questioned irregularly by lawful authority, are not bound to communicate their knowledge, and may set aside and avoid such questioning by any lawful means,—such means however, not including falsehood, nor answers made with mental reservation, making the words actually spoken false, this latter mode of evasion having been formally condemned by Innocent XI. in 1679, though it was permitted by the casuists of the immediately preceding period. This is all tenable enough, but its apparent force is easily reduced by a little ingenuity.

In the first place, he distinguishes amphibology or equivocation from mental reservation, and names three varieties of equivocation: (1) that of a word having two quite different senses, as *volo* in Latin means to "wish" and to "fly,"—to which may be added the frequent English ambiguity of two distinct words having the same sound, as *air* and *heir*; (2) a sentence having two main meanings, as "This book is Peter's," which may signify his ownership or his authorship; (3) that of words having two senses, one more common than the other, or one literal and the other metaphorical. The example he gives of this last form is the phrase "I say No," uttered by a person who wishes to conceal something as to which he is questioned. The words seem to his hearer to denote express denial of the fact; the meaning in which he uses them is merely "I utter the word 'No,'" this sentence being complete in itself. "It is certain," adds Liguori, "and the common opinion of all, that it is lawful for a just cause to use equivocation in the manners described, and to confirm it with an oath. . . . And the reason is because we do not then deceive our neighbor, but for a just cause permit him to deceive himself; and besides, we are not bound, if there be a just cause, to speak so that others may understand. And any honest object for retaining any good things that are useful to our body or spirit may be a just cause" (*Theol. Mor.*, iv. 151).

But suppose that it is impossible to allege a just cause, is it then mortal sin to swear with such equivocation? Some of the stricter casuists say so, but Liguori sides with the laxists, and declares it merely venial, except in a court of law or in formal contracts,—alleging that, save in these two cases, any reasonable cause, such as desire to be quit of troublesome and irregular questioning, is sufficient to mitigate the sin. He adds, however, two cautions—that a more serious cause is required to justify equivocation with an oath than without one, and that, in proportion as the equivocal words employed give greater occasion for mistake, a graver cause is required for their proper use, a qualification instantly modified by the next clause, which lays down that, when words which are in themselves equivocal, having two equally valid meanings, are used, then they give little or no cause for error, and may be used on the very lightest grounds.

Next, as to mental reservation, or "restriction," which is the technical name, this was expressly condemned in three propositions by Innocent XI., forbidding it in all cases. According to the analogy of all prohibitory laws, this general prohibition of the genus should include prohibition of all the species also. But the casuists, unable to oppose direct resistance to the papal decree, have turned its flank by inventing a new distinction which was unknown in 1679. They have now divided mental restriction into two main heads, the first of which, absolute or "pure" mental restriction (by which is meant such reservation as cannot possibly be observed by the hearers, or conjectured from the attendant circumstances), is always illicit, whether with or without an oath. But "non-pure" mental restriction (that is, such as may conceivably be observed and inferred from attending circumstances, such as an inaudible whisper, or a qualifying gesture) does not, they allege, fall under the ban of Innocent XI., and is always lawful for a just cause. "The reason of this opinion is that, if it were not permissible to use non-pure mental restriction, there would be no lawful means of concealing a secret, which one could not disclose without loss or inconvenience, which would be as hurtful as lying to human intercourse. And therefore the condemnation passed by the pope on mental restriction is rightly to be understood of a restriction taken absolutely and strictly, for that alone can be called true mental restriction which takes place in the mind alone, and so remains hidden, and can in no wise be recognized from external circumstances" (*Theol. Mor.*, iv. 152). And the following illustrations are supplied. (1) A confessor may affirm with an oath that he is ignorant of a crime which he has heard in confession, secretly meaning thereby that he is ignorant of it as a mere man, though not as a minister of religion. (2) An accused or a witness, if *irregularly* questioned by the judge in court, may swear that he knows nothing of a crime which he does in fact know of, understanding thereby that he does not know it so as to be legally bound to answer or depose concerning it. This alarming proposition is apparently corrected by the warning that, when the interrogation of the judge is in due form, then the person questioned is bound to obedience, and barred from all equivocation. But this safeguard is at once fatally weakened by the further provisions that, if the act be not a crime in the witness's opinion, he need not disclose it, and that if the crime be altogether hidden (*i. e.*, where only the criminal himself and the witness know the facts), the witness is not merely permitted, but is actually bound, to say that the accused did not commit it. And the accused is equally free to do so, unless there be already "half-full" proof against him, because, in the absence of such a degree of presumption, the judge has no legitimate right to question him as to his guilt. Those who have deceived the court by such sworn equivocation are, Liguori rules, entitled to absolution without the declaration of the truth being imposed as a condition.[1] (3) A needy man, who has made away, for his maintenance, with property due to his creditors, may affirm to the judge that he has nothing. (4) A witness asked by the judge whether he has had any conversation with the accused may deny it, meaning that he has not talked with him so as to co-operate in the crime. (5) An adulteress, questioned by her husband as to her guilt, may deny it in any of these four ways: (*a*) that she has not broken the marriage-tie, because it is not voided by adultery; (*b*) if she have gone to confession, she may say that she is innocent of the crime because it has been remitted in confession; (*c*) that she has not committed adultery, using the word in its frequent Biblical sense of "idolatry;" (*d*) that she has not committed it so as to be bound to tell him of it (*Theol. Mor.*, iv. 153–162).

Promises are no safer than assertions under this code. As usual with Liguori, a broad statement of their binding character is prefixed to the qualifications which leave nothing but the outer shell remaining. For we are told (*a*) that "the whole obligation is commonly understood as depending on the intentions of the promisers, and not binding unless that be confirmed with an oath or a formal document, in the absence of which it may be considered a mistake or a jest;" and (*b*) that "it is certain that every promise, even an accepted one, does not bind, if after the date of the promise it becomes impossible, or very hurtful, or unlawful, or useless, and generally speaking, when there has been a serious change of circumstances, which, if foreseen, would have prevented the promise; such a promise is always presumed to have been made under some such tacit condition" (*Theol. Mor.*, iv. 720).

Theft is treated in a very similar fashion. A broad general rule is laid down as to its sinfulness, and this is at once traversed by the following doctrine: "It is certain that a man who is in extreme necessity may purloin other people's goods, enough to relieve himself of such necessity. So the doctors in common say, agreeing with St. Thomas." Extreme necessity is defined as meaning risk of loss of life, or of some limb or other important bodily member, peril of perpetual captivity, or of any serious disease or discredit. And Liguori, contradicting the stricter casuists, includes under the same heading the case of a man of rank ashamed to work or to beg, who may then lawfully steal to maintain himself. Then the case is put whether a poor man in extreme need is free to steal before asking. One rigorist lays down that it is a mortal sin to do so, because no man can be held to be in extreme necessity who can get what he wants by asking. But the laxer casuists rule that, though he is bound to ask first, he sins only venially by omitting to do so; and Liguori solves the difficulty by saying that the robber sins mortally if what he takes is not absolutely necessary to relieve his want, but that if he does so need it that the owner, if aware of the fact, would be bound by the laws of charity to give it him, then he does not sin even venially by stealing it, because he has in that case an absolute right to take it (*Theol. Mor.*, iv. 520).

Some of these rulings are contrived so as to evade the condemnation passed by Innocent XI. on the proposition that "it is allowable to steal, not only in extreme necessity, but also in grave necessity." But a more direct conflict with the papal ruling appears in respect of another censured proposition, that "men and women servants may secretly pilfer from their employers to compensate themselves for their work, which they account as of more value than the wages they receive." This is explicit enough, but it is at once set aside by the casuists, who allege that the rule holds good only in the case of a servant who has of his free will contracted to accept a low salary, as he thereby bars himself from compensation; but if he has made the bargain under any sort of constraint, as, for instance, being in great poverty, and thus glad to take any situation, he is at liberty to steal to the amount of what he considers his just additional wages. Some casuists do, indeed, question the servant's right to be judge and assessor in his own cause, but the point is ruled practically in his favor (*Theol. Mor.*, iv. 522, 523, 524). Again, servants may purloin such eatables and drinkables as are not locked up, provided they do so for their own consumption, and not to sell out of doors, and so long as each such theft is singly trifling (*Ibid.*, iv. 54). Even when restitution is enjoined, there is a notable provision in favor of the thief. If he is uncertain who it is he has robbed, he is to make restitution in one or other of certain ways, one of which is that if he be poor he may apply the proceeds of the theft to himself or to his family (*Prax. Confess.*, ii. 44).

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[1] Akin to this teaching is the maxim laid down in another place, that it is lawful to procure the giving of perjured evidence, "if you have a great interest in employing perjury to expose the fraud of another person in order to obtain your own rights" (*Theol. Mor.*, iii. 3, 77), with which may be coupled the permission for suitors to offer and for judges to take bribes for expediting causes, so long as the bribing is not expressly for delivering false judgment (*Ibid.*, v. 196, 212)

In addition to these glosses on the decalogue, there is one element of doubtfulness introduced into nearly all questions of theft, which is, as to the "gravity of matter," constituting the offence mortal or venial according to the degree of this factor, and a comparison of the various places where Liguori employs the term "gravitas materiæ" shows that in all cases where numerical expression can apply he means *quantity*. Accordingly, he, in common with many other casuists, constructs a sliding tariff of guilt, depending, as a rule, on the amount stolen (*Theol. Mor.*, iv. 526–528).

A few brief citations from other decisions will show that the same principles applied to questions of lying and theft extend to the remaining forms of sin. (1) A man of high position may lawfully kill any one who attempts to slap his face, if there be no other way of warding off the insult (*Theol. Mor.*, iv. 38). (2) He who kills A, meaning to kill B, is not bound to make compensation, because the homicide is casual and inadvertent as regards A; and similarly if a man burns down the house of his friend, meaning to burn that of an enemy (*Ibid.*, iv. 628, 629). (3) Though we are bound to love our enemies, we are not bound to salute them, to speak to them, to visit them if sick, to comfort them in any trouble, to receive them into our house, or to hold any kind of familiar intercourse with them (*Ibid.*, v. 3, 28). (4) A servant may help his master, by lifting him on his shoulders, or by providing him with a ladder, to enter a house, even forcibly, for immoral purposes; for the act is innocent and colorless in itself, nay, even an act of charity or good-will, and the servant is not responsible for the subsequent conduct of his employer (*Ibid.*, iii. 3, 66).

For all practical purposes, the probabilism which is at the base of all this casuistical method, and which is simply the substitution of an external authority for the dictates of conscience, is now in absolute possession throughout the Latin obedience, having finally conquered the resistance it has encountered at intervals since its first formulation as a working theory. Although it owes its chief development to the Jesuits, yet some of its ablest opponents were members of that company, such as Comitolus, Rebellus, Gisbert, and even two of the generals, Mutio Vitelleschi and Tirso Gonzales; while the Sorbonne and the Dominicans were also engaged in frequent controversy against its upholders, and in censuring the teaching of several of Liguori's favorite authorities, such as Lessius, Escobar, Tamburini, Bauny, Viva, Busembaum, and Diana.

Authorities.—Glattini, *Vita di Liguori*, Roma, 1815; *Life of St. Alphonso Maria de Liguori*, edited by F. W. Faber, 4 vols., London, 1848–49; *Theologia Moralis S. Alphonsi de Ligorio*, 10 vols., Mechlin, 1845; *Homo Apostolicus*, 3 vols., Mechlin, 1849; Scavini, *Theologia Moralis Universa*, 4 vols., Paris, 1855; Gury, *Compendium Theologiæ Moralis*, 8 vols., Parma, 1852, and *Casus Conscientiæ*, 2 vols., Lyons, 1864; *The Provincial Letters of Pascal*, edited by John de Soyres, Cambridge, 1880; Article "Probabilisme," in Richard and Giraud, *Bibliothèque Sacrée*, vol. xix., 29 vols., Paris, 1822–27; Besombes, *Moralis Christiana*, 2 vols., Toulouse, 1745 (the best of the anti-probabilist treatises); Meyrick, *Moral and Devotional Theology of the Church of Rome, according to the teaching of S. Alfonso de Liguori*, London, 1857; *Charge of Archdeacon Sinclair*, in 1867. (R. F. L.)

LIGURIA, in ancient geography, was the name given to a portion of the north-west of Italy, including the districts, on both sides of the Maritime Alps and the Apennines, which border on the Tyrrhenian Sea from the frontiers of Gaul to those of Etruria. Along the sea-coast it extended from the river Varus or Var, which separated it from Gaul, to the Macra (Magra), which formed its limit on the side of Etruria, thus comprising the whole district between the mountains and the sea, now known as the Riviera of Genoa. But besides this it comprehended a broad tract to the north of the same range, formed by the underfalls of the Apennines and the hilly tract adjoining them, extending to the plains of the Padus or Po,—that river itself constituting its northern limits under the Roman administration. But at an earlier period the term had a much wider signification,—all the tribes on the south slopes of the Alps, in the north-west of Italy, being apparently of Ligurian origin. This we are expressly told by ancient authors in the case of the Taurini, who dwelt around Turin, and of the Lævi and Libici, who extended from thence to the Ticinus; and there can be little doubt that it was true also of the Salassi, who occupied the modern Val d'Aosta. But to the west of the Maritime Alps also the Ligurians were undoubtedly widely spread in ancient times, and occupied a considerable extent of what was afterwards included in Gaul. Thus the Salyes, who held all the southern part of Provence from the Var to the Rhone, are distinctly termed a Ligurian tribe, as well as the minor tribes of the Oxybii and Deciates, near Frejus and Nice. All the early Greek writers speak of the important colony of Massilia as founded in Liguria.

Of the origin or affinities of the Ligurians (or Ligyans, as they are termed by Greek writers) we know absolutely nothing. All ancient writers concur in representing them as a distinct people from the Gauls on the one hand, and from the Iberians on the other; and the attempts of some modern writers to assign them to a Celtic stock rest upon no adequate foundation. In the absence of all remains of their language, all such speculations must be matters of mere conjecture. They appear in the historical period as a rough and hardy race of mountaineers, cultivating a rugged territory with much industry, and opposing a stubborn resistance to the efforts of the Romans to reduce them to subjection. They first came in contact with the Roman arms in 235 B. C., but it was not till after the Second Punic War—in which the Ligurians had openly espoused the cause of Hannibal—that a serious struggle began, which, commencing in 200 B. C., was continued with little intermission for more than eighty years. While the Roman generals in the East were overthrowing, with comparative ease, the powerful monarchies of Macedonia and Syria, one of the consuls was generally engaged in inglorious hostilities with the hardy mountaineers of the Ligurian Apennines. Even after these were reduced to subjection, the tribes which held the still more rugged fastnesses of the Maritime Alps long maintained their independence, and it was not till the reign of Augustus that they were finally subdued. The construction by that monarch of a Roman highway along the coast, which followed almost exactly the same line as the modern road of the Corniche, marked the period of their complete subjection.

The physical geography of Liguria has been already described in the article on ITALY. All the rivers which take their rise on the northern slope of the mountains ultimately discharge their waters into the Po; of these by much the most considerable is the Tanaro, which receives the tributary streams of the Stura and the Bormida, while to the east of it flow the Scrivia and the Trebia, celebrated by the victory of Hannibal over the Romans. This last stream, according to the division of Augustus, formed the boundary between Liguria and Gaul south of the Po. The streams which flow from the Apennines southward to the sea are for the most part inconsiderable, and mere mountain torrents. But the Magra, which forms the limits of the province on the east, is an important stream, and brings with it the waters of its tributary, the Boactes or Vara. On the west also the Var is a river of considerable magnitude, which forms a natural boundary on this side between Liguria and Gaul, as it long constituted their political limit. The Rutuba or Roya, a little farther east, is also a considerable river, descending through a deep mountain valley from the Col di Tenda.

The principal Ligurian tribes were (1) the Apuani, inhabiting the valley of the Magra, including the district known in modern times as the Lunigiana; (2) the Friniates, on the northern slope of the Apennines towards Modena; (3) the Briniates, in the valley of the Vara; (4) the Genuates, around Genoa; (5) the Veturii, immediately west of the preceding; (6) the Ingauni, whose capital was Albium Ingaunum, still called Albenga; (7) the Intemelii, whose chief city still retains the name of Vintimiglia; and (8) the Vediantii, extending thence to the Var. North of the Apennines the most important tribes were the Vagienni, who held the whole mountain tract from the Monte Viso and the sources of the Po to the Tanaro; and the Statielli, east of them, whose chief town was Aquæ Statiellæ or Acqui.

The chief city on the Ligurian sea-coast was, in ancient as in modern times, that of Genoa, which combined an excellent natural port with a central position, and easy communications with the interior. West of it, along the coast, were Vada Sabbata (Vado, near Savona), Albium Ingaunum (Albenga) Albium Intemelium (Vintimiglia), the Portus Herculis Monoeci (Monaco), and Nicæa (Nice), which was founded by a colony from Massilia. In its immediate vicinity was the Roman town of Cemenelium (Cimiez). On the northern slope of the Apennines were several considerable towns, almost all of them of Roman origin. The chief of these were Augusta Vagiennorum (Bene), Alba Pompeia, Asta, Aquæ Statiellæ, Dertona (Tortona), and Iria (Voghera), but none of them attained to anything like the same prosperity and importance as the great cities of Cisalpine Gaul. The towns on the eastern Riviera, between Genoa and the Gulf of Spezia, were inconsiderable places; and even on the shores of that gulf, forming the magnificent port called the Portus Lunæ, there was never any town of importance, Luna itself being some distance inland, and within the confines of Etruria. (E. H. B.)

LILAC, *Syringa vulgaris*, L., belongs to the olive family, *Oleaceæ*. The common lilac is said to have come from Persia in the 16th century, but according to Heuffel it is indigenous in Hungary, the borders of Moldavia, etc. (De Candolle, *Prod.*, viii. p. 282). Two kinds of *Syringa*, viz., *alba* and *cærulea*, are figured and described in Gerard's *Herball* (1597), which he calls the white and the blue pipe privets. The former is the common privet, *Ligustrum vulgare*, L., which, and the ash tree, *Fraxinus excelsior*, L., are the only members of the family native in Great Britain. The latter is the lilac, as both figure and description agree accurately with it. It was carried by the European colonists to North-East America, and is still grown in gardens of the Northern and Middle States. There are several varieties of lilac, *e. g.*, "Dr. Lindley," which bears large clusters of reddish lilac flowers, *alba*, *violacea*, *rubra*, *insignis*, and *rosea grandiflora*. *S. dubia*, Pers., or *chinensis*, Willd., the Siberian lilac, is a closely allied species, if it be really distinct. The variety *Rothomogensis*, Mirb., or *Lilas Varin* of the French, probably belongs to this species. Of other species, there is *S. Josikæa*, Jack., from Transylvania, with scentless bluish-purple flowers, *S. Emodi*, Wall., a native of the mountains of India, and *S. persica*, L., the Persian lilac, rarely exceeding 4 or 5 feet, the flowers of which vary from rosy carmine to white.

LILBURNE, JOHN (1618–1657), an English sectary and prolific pamphleteer, was the younger son of a gentleman of good family in the county of Durham, and was born in 1618. At the age of twelve he was apprenticed to a clothier in London, but he appears to have paid only slight attention to business, and to have early addicted himself to the "contention, novelties, opposition of government, and violent and bitter expressions" for which he afterwards became so conspicuous as to provoke the saying of Marten that, "if the world was emptied of all but John Lilburn, Lilburn would quarrel with John, and John with Lilburn." He appears at one time to have been law-clerk to Prynne. In February, 1638, for the part he had taken in importing and circulating the *Merry Litany* and other publications of Bastwick and Prynne, offensive to the bishops, he was sentenced to be publicly whipped from the Fleet prison to Palace Yard, Westminster, there to stand for two hours in the pillory, and afterwards to be kept in jail until a fine of £500 had been paid. Though gagged at the pillory, and confined in prison, he was not the man to give up his opinions or forego the pleasure of expressing them, and in the following year he did not improve his prospects of a speedy release by the kind of literary activity to which he devoted his enforced leisure.[1] In point of fact he did not regain his liberty until November 7, 1640, when one of the earliest recorded speeches of Oliver Cromwell was made in support of his petition to the House of Commons. In 1641 he received an indemnity of £3000. He now entered the army, and in 1642 was taken prisoner at Brentford and tried for his life; sentence would no doubt have been executed had not the parliament by threatening reprisals forced his exchange. He soon rose to the rank of lieutenant-colonel, but in April, 1645, having become dissatisfied with the general conduct of affairs, and especially with the predominance of Presbyterianism, he resigned his commission, presenting at the same time to the Commons a petition for considerable arrears of pay. His violent language in Westminster Hall about the speaker and other public men led in the following July to his arrest and committal to Newgate, whence he was discharged, however, without trial, by order of the House, in October. In January, 1647, he was again committed to the Tower for accusations which he had brought against Cromwell, but was again set at liberty in time to become a disappointed spectator of the failure of the levelling or ultra-democratic party in the army at the Ware rendezvous in the following December. The scene produced a deep impression on his mind, and in February, 1649, he along with other petitioners presented to the House of Commons a paper entitled *The Serious Apprehensions of a part of the People on behalf of the Commonwealth*, which he followed up with a pamphlet, *England's New Chains Discovered* (March 1, 1649), criticising Ireton, and another exposing the conduct of Cromwell, Ireton, and other leaders of the army since June, 1647 (*The Hunting of the Foxes from Newmarket and Triploe Heath to Whitehall by Five Small Beagles*, the "beagles" being Lilburne, Overton, Walwyn, Prince, and another). Finally, the *Second Part of England's New Chains Discovered*, a violent outburst against "the dominion of a council of state, and a constitution of a new and unexperienced nature," became the subject of discussion in the House, and led anew to the imprisonment of its author in the Tower on April 11. His trial in the following October, on a charge of seditious and scandalous practices against the state, resulted in his unanimous acquittal, followed by his release in November. In January, 1652, for printing and publishing a petition against Sir Arthur Hasilrig and the Haberdasher's Hall for what he conceived to have been an injury done to his uncle George Lilburne in 1649, he was sentenced to pay fines amounting to £7000, and moreover to be banished the Commonwealth, with prohibition of return under the pain of death. In June, 1653, he nevertheless came back from the Low Countries, where he had busied himself during the interval in pamphleteering and such other agitation as was possible, and was immediately arrested; the trial, which was protracted from July 13 to August 20, indeed issued in his acquittal, to the great joy of London, but it was nevertheless thought proper to keep him in captivity for "the peace of the nation." He was detained successively in the Tower, in a castle at Jersey, and in Dover Castle. At Dover he came under Quaker influence, and signified his readiness at last to be done with "carnal sword fightings and fleshly bustlings and contests;" and in 1656, on giving security for his good behavior, he was set free. He now settled at Eltham in Kent, frequently preaching at Quaker meetings in the place and neighborhood during the brief remainder of his troubled life. He died on August 29, 1657.

See Masson, *Life of Milton*, who refers (iv. 120) also to Walker (*History of Independency*, ii. 247), Godwin (*Commonwealth*, iii. 163–177), and Bisset (*Omitted Chapters of the*

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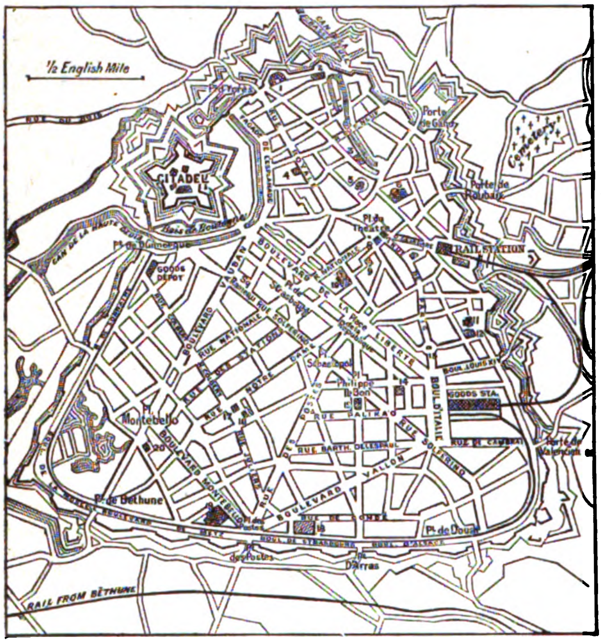
[1] *Come out of Her, My People: or an Answer to the Questions of a Gentlewoman, a professor in the Anti-Christian Church of England, about Hearing the Public Ministers; where it is largely discussed, and proved to be unlawful. Also a Just Apology for the way of Total Separation, commonly but falsely called "Brownism;" that it is the truth of God though lightly esteemed in the eyes of the world. With a challenge to dispute them publicly before King and Council, to prove whatsoever I have said at the pillory against them: viz., that the calling of them is* jure Diaboli, *even from the Devil himself. By me John Lilburne, close prisoner in the Fleet for the cause of Christ. Printed in the year of hope of England's Purgation and the Prelates' Dissolution, 1639.*

History of England, 191–251), and adds, "Mr. Bisset relates Lilburne's trial (in 1649) at length, with copious extracts, and makes John more of a hero than Godwin does, though Godwin is not unfavorable. On the whole, I like him myself, and am glad that he is in the history of England, but think he was an ass."

LILLE, capital of the department of Nord, France, and the ancient capital of Flanders, is situated about 155 miles by rail north of Paris, and at an elevation of 75 feet, in a low plain on the Deule, which flows to the Scheldt by the Lys. It is the chief fortress of the north of France, and headquarters of the first army corps, and is defended by a rampart and by a pentagonal citadel situated to the west of the town beside the Deule. The water of the river fills the moat, and the environs of the citadel can be laid under water. Prior to 1858 the town occupied an elliptical area of about 2500 yards by 1300, with the church of Notre Dame de la Treille in the centre, but the ramparts on the south side have since been demolished and the ditches filled up, their place being now occupied by the great Boulevard de la Liberté, which extends in a straight line from the goods station of the railway to the citadel. The new enceinte is much more extensive, and encloses the old communes of Esquermes, Wazemmes, and Moulins-Lille, the area of the town being thus more than doubled; in the new quarters fine boulevards and handsome squares, such as that De la République, have been laid out in pleasant contrast with the sombre and dirty aspect of the old town. The district of St. André to the north, the only elegant part of the old town, is the residence of the Lille aristocracy.



Plan of Lille.

1. Barracks of St. André.
2. Cattle Market and Slaughter House.
3. Palais de Justice.
4. Bank of France.
5. Notre Dame de la Treille.
6. Lycée and Museum.
7. Grand Theatre.
8. Exchange.
9. Hôtel de Ville.
10. Military Hospital.
11. Ch. of St. Sauveur.
12. St. Sauveur Hospital.
13. Paris Gate.
14. Industrial Institute.
15. Ch. of St. Michel.
16. Ch. of St. Peter and St. Paul.
17. Nouvelle Aventure Market.
18. Arsenal.
19. St. Eugénie Hospital.
20. Ch. of St. Martin.

At the demolition of the old fortifications, the Paris gate, a triumphal arch erected in 1682 in honor of Louis XIV., after the conquest of Flanders, was preserved, as also the Ghent and Roubaix gates, which date from the time of the Spanish domination, and are built in the Renaissance style, with bricks of different colors. The present rampart is pierced by eleven gates, besides a special gate for the railway, and two water gates for the canal of the Deule. The goods station has also its special outlet, and a line from it, after making the round of the new quarters, passes within the enceinte to the quays of the river. Crossing the bridges which span the different arms of the Deule, we reach the citadel, the glacis of which, planted with trees, forms a public walk. Within the citadel are extensive barracks and a considerable arsenal. The church of Notre Dame de la Treille, in the style of the 13th century, which has been in process of building since 1855, occupies the site of the old Château du Buc, the original nucleus of the city. The town-house, on the site of the old palace of the duke of Burgundy, Philip the Good, was built in 1846. The exchange, which dates from the period of the Spanish domination, is in an original style. It is surmounted by a graceful campanile, and contains a statue of Napoleon I., made from cannon taken at Austerlitz. In the middle of the great square stands a column, erected in 1848, commemorating the defence of the town in 1792. There are several large hospitals, faculties of medicine and of science, a Catholic institute, comprising the five faculties of theology, letters, law, science, and medicine, an academy of music affiliated to the Conservatoire at Paris, several learned societies, and a large number of various kinds of schools. The picture gallery, with upwards of eight hundred works, is one of the richest in the provinces, and the Wicar museum contains a unique collection of original designs of the great Italian masters. Lille possesses also an ethnographical museum (Musée Moillet), as well as museums of archæology, numismatics, the industrial arts, and natural history. The communal library is also worthy of mention; it includes numerous MSS., and particularly a valuable *Evangeliarium* of the 12th or 13th century. On the front of the building where the departmental archives are kept are to be seen medallions of all the sovereigns who have successively possessed Lille from Baldwin of the Iron Arm to Louis XIV. Lille, which is pre-eminently a manufacturing and commercial town, enjoys exceptional advantages as regards means of transit. The lower Deule is canalized to its junction with the Lys, and there is continuous water communication with the Scheldt in Belgium, and with Paris by way of Douai and St. Quentin. The town is at the same time an important railway junction, and is also provided with tramways.

The principal industry is flax-spinning, in which thirty-five mills, with 190,000 spindles, give employment to 14,000 persons (of whom 9000 are females), the annual turnover being £1,800,000. Forty thread mills employ 2000 persons, and produce thread to the annual value of £240,000. Fifteen factories, with 1000 operatives, produce woollen goods worth from £120,000 to £160,000 per annum; 5000 persons are engaged in cotton-spinning (115,000 spindles), to the amount of £800,000. There are besides eighty factories in which damasks, tickings, and the usual staples of the linen trade are manufactured; quilts and packsheets occupy from 6000 to 7000 persons, and 4000 are employed in producing the fabric out of which the smock frocks of the peasantry are made. Connected with these industries are dye-works, bleach-fields, and establishments for the production of engines, looms, and combing and carding machines; and there are also chemical works, sugar-works, breweries, and oil-works.[1] The state manufacture of tobacco in Lille gives employment to 1200 persons. The total population of Lille in 1876 was 162,775.

Lille is said to date its origin from the time of Count Baldwin IV., who in 1030 surrounded with walls a little town which had risen around the castle of Buc. At the end of the 12th century Lille, which had developed rapidly, obtained communal privileges. Destroyed by Philip Augustus in 1212, it was rebuilt by Johanna of Constantinople, but besieged and retaken by Philip the Fair in 1297. After having taken part with the Flemings against the king of France, it was ceded to the latter in 1312. In 1369 Charles V. gave it to Louis de Male, who transmitted his rights to his daughter Margaret, wife of Philip the Bold, duke of Burgundy. Under the Burgundian rule Lille enjoyed great prosperity; its merchants were at the head of the London Hansa. Philip the Good made it his residence, and within its walls held the first chapters of the order of the Golden Fleece. With the rest of Flanders it passed from the dukes of Burgundy to Austria, and then to Spain. After the death of Philip IV. of Spain, Louis XIV. reclaimed the territory, and besieged Lille in 1667. He forced it to capitulate, but preserved all its laws, customs, privileges, freedoms, and liberties. In 1708, after an heroic resistance, it surrendered to Prince Eugene and the duke of Marlborough. The treaty of Utrecht restored it to France. In 1792 the Austrians bombarded it for nine days and nights without intermission, but had ultimately to raise the siege. (G. ME.)

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[1] The old commune of Moulins, now annexed to the town, derived its name from the windmills in which the oil was pressed.

LILLEBONNE, capital of a canton in the department of Seine-Inférieure, France, 131 miles west-north-west by rail from Paris, and 20 miles due east from Havre, is a pretty little town, picturesquely built at the foot of wooded hills, in the valley of the Bolbec, which falls into the Seine 3 miles lower, at Port Jérôme. The principal industries are cotton-spinning and the manufacture of calico. The population in 1876 was 5400.

Lillebonne was the capital of the Caletes, or inhabitants of the Pays de Caux, in the time of Cæsar, by whom it was destroyed. It was afterwards rebuilt by Augustus, who called it Juliobona after his daughter; and before it was again ruined by the barbarian invasions it had become a very important centre, whence Roman roads branched out in all directions. Some forty years ago the remains of ancient baths and of a theatre capable of containing 3000 persons were brought to light. Statues, tombstones, all sorts of articles in iron, bronze, ivory, marble, stone, glass, etc., have been found in the course of excavation, and deposited, for the most part, in the museum at Rouen. The most beautiful object yet discovered is a large mosaic found in 1870 (some 28 feet by 21). In the Middle Ages the fortifications of the town were constructed out of the materials supplied by the theatre. William of Normandy built at Lillebonne a castle whence he dates several charters. It is now a ruin within a charming park. The 13th century donjon, with walls over 12 feet in thickness, is in admirable preservation. The church of Notre Dame, of the 16th century, had a fine porch, formerly adorned with rich sculptures, which have mostly disappeared. The graceful tower is about 180 feet high.

LILLY, William (1602-1681), an astrologer somewhat famous in his day, was born in 1602, at Diseworth in Leicestershire, his family having been settled as yeomen in the place for "many ages." He received a tolerably good classical education at the school of Ashby-de-la-Zouche, but he naively tells us what may perhaps have some significance in reference to his after career, that his master "never taught logic." In his eighteenth year, in consequence of his father having fallen into great poverty, he went to London, and was employed in a sort of menial situation in attendance on an old citizen and his wife, with whom he so managed to ingratiate himself that his master, at his death in 1627, left him an annuity of £20; and, Lilly having soon afterwards married the widow, she, dying in 1633, left him property to the value of about £1000. Having now a good deal of leisure on his hands, he began to dabble in astrology, reading all the books on the subject he could fall in with, and occasionally trying his hand at unravelling mysteries by means of his art. The years 1642 and 1643 were devoted to a careful revision of all his previous reading, and in particular having lighted on Valentine Naibod's *Commentary on Alchabitius*, he "seriously studied him and found him to be the profoundest author he ever met with." Him he "traversed over day and night," and so "advanced his judgment and knowledge" to the utmost height he ever arrived at. He characterizes him as "a most rational author and the sharpest expositor of Ptolemy that hath yet appeared." About the same time he tells us that he "did carefully take notice of every grand action betwixt king and parliament, and did first then incline to believe that as all sublunary affairs depend on superior causes, so there was a possibility of discovering them by the configurations of the superior bodies." And, having thereupon "made some essays," he "found encouragement to proceed further, and ultimately framed to himself that method which he ever afterwards followed." He then began to issue his prophetical almanacs and other works, and it is a curious illustration of the state of intelligence even among educated people at the time that trash of this kind really seems to have met with serious attention from some of the most prominent members of the Long Parliament. If we may believe himself, Lilly lived on friendly and almost intimate terms with Bulstrode Whitlock, Lenthall the speaker, Sir Philip Stapleton, Elias Ashmole, and others. Even Selden seems to have given him some countenance, and probably the chief difference between him and the mass of the community at the time was that, while others believed in the general truth of astrology, he ventured to specify the future events to which its calculations pointed. Even from his own account of himself, however, it is evident that he did not trust implicitly to the indications given by the aspects of the heavens, but like more vulgar fortune-tellers kept his eyes and ears open for any information which might make his predictions safe. It appears that he had correspondents both at home and in foreign parts to keep him conversant with the probable current of affairs. He was evidently a proficient in all the unscrupulous cunning, adroitness, and plausibility which go to make up the successful quack and impostor, and not a few of his exploits indicate rather the quality of a clever police detective than of a profound astrologer. After the restoration he very quickly fell into disrepute. His sympathy with the parliament, which his predictions had generally shown, was not calculated to bring him into royal favor, and the frivolous and sceptical character of the age could scarcely be expected to fall in with transcendentalism either in the shape of sense or nonsense. He came under the lash of Butler, who, making allowance for some satiric exaggeration, has given in the character of Sidrophel a probably not very incorrect picture of the man; and, having by this time amassed a tolerable fortune, he bought a small estate at Hersham in Surrey, to which he retired, and where he diverted the exercise of his peculiar talents to the practice of medicine. He died in 1681, in the eightieth year of his age.

Lilly's life of himself, published after his death, is still worth looking into as a remarkable record of credulity and successful imposture. Superstition dies hard; and it is a curious evidence of the inveteracy of popular delusions that so lately as 1852 a prominent London publisher put forth a new edition of Lilly's *Introduction to Astrology*, "with numerous emendations adapted to the improved state of the science."

LILY, *Lilium*, the typical genus of *Liliaceæ*, embraces nearly fifty species, all confined to the northern hemisphere, about fifteen being natives of Japan and China, six of the mountains of India, eight of south Europe, five of the east and nine of the west coasts of North America. The earliest in cultivation were described in 1597 by Gerard (*Herball*, p. 146), who figures eight kinds of European (true) lilies, viz., *L. album* (*L. candidum*, L.), and a variety, *L. byzantinum*, two umbellate forms of the type *L. bulbiferum*, Park, named *L. aureum* and *L. cruentum latifolium*, and three with pendulous flowers, apparently forms of the martagon lily. Parkinson, in his *Paradisus* (1629), described five varieties of martagon, six of umbellate kinds—two white ones, and *L. pomponium*, *L. chalcedonicum*, *L. carniolicum*, and *L. pyrenaicum*—together with one American, *L. canadense*, which had been introduced in 1629. For the ancient and mediæval history of the lily, see M. de Cannart d'Hamale's *Monographie historique et littéraire des Lis* (Malines, 1870).

Since that period many new species have been added. The latest authorities for description and classification of the genus are J. G. Baker ("Revision of the Genera and Species of Tulipeæ," *Journ. of Linn. Soc.*, xiv. p. 211, 1874) and J. H. Elwes (*Monograph of the Genus* Lilium, 1877–78), who first tested all the species under cultivation, and has published every one beautifully figured by W. H. Fitch, and some hybrids. With respect to the production of these latter, the genus is remarkable for its power of resisting the influence of foreign pollen, for the seedlings of any species, when crossed, generally resemble that which bears them. For the hardier kinds in cultivation, reference may be had to Hemsley's *Handbook of Hardy Trees*, etc., p. 501. The structure of a lily is of simple type, consisting of two whorls, of three free parts each, six free stamens, and a consolidated pistil of three carpels, ripening into a three valved capsule containing many winged seeds. In form, the flower assumes three types:—trumpet-shaped, with a more or less elongated tube, *e. g.*, *L. longiflorum* and *L. candidum*; an open form with spreading perianth leaves, *e. g.*, *L. auratum*; or assuming a pendulous habit, with the lips strongly reflexed, *e. g.*, the martagon type. All have scaly bulbs, which in three west American species, as *L. Humboldti*, are remarkable for being somewhat intermediate between a bulb and a creeping rhizome. *L. bulbiferum* and its allies produce aerial reproductive bulbils in the axils of the leaves. The bulbs of several species are eaten, such as of *L. avenaceum* in Kamchatka, of *L. Martagon* by the Cossacks, and of *L. Tigrinum*, the "tiger lily," in China and Japan. Medicinal uses were ascribed to the species, but none appear to have any marked properties in this respect. See HORTICULTURE, vol. xii. p. 264.

The white lily, *L. candidum*, the λείριον of the Greeks, was one of the commonest garden flowers of antiquity, appearing in the poets from Homer downwards side by side with the rose and the violet. According to Hehn, roses and lilies entered Greece from the east by way of Phrygia, Thrace, and Macedonia (*Kulturpflanzen und Hausthiere*, 3d ed., p. 217). The word λείριον itself, from which *lilium* is derived by assimilation of consonants, appears to be Eranian (*Ibid.*, p. 527), and according to ancient etymologists (Lagarde, *Ges. Abh.*, p. 227) the town of Susa was connected with the Persian name of the lily *sûsan* (Gr. σοῦσον, Heb. *shôshan*). Mythologically the white lily, *Rosa Junonis*, was fabled to have sprung from the milk of Hera. As the plant of purity it was contrasted with the rose of Aphrodite. The word κρίνον, on the other hand, included red and purple lilies, Plin., *H. N.*, xxi. 5 (11, 12), the red lily being best known in Syria and Judæa (Phaselis). This perhaps is the "red lily of Constantinople" of Gerarde, *L. chalcedonicum*, L. The lily of the Old Testament (shôshan) may be conjectured to be a red lily from the simile in Cant. v. 13, unless the allusion is to the fragrance rather than the color of the lips, in which case the white lily must be thought of. The "lilies of the field," Matt. vi. 28, are κρίνα, and the comparison of their beauty with royal robes suggests their identification with the red Syrian lily of Pliny. Lilies, however, are not a conspicuous feature in the flora of Palestine, and the red anomone (*Anemone coronaria*), with which all the hill-sides of Galilee are dotted in the spring, is perhaps more likely to have suggested the figure. For the lily in the pharmacopœia of the ancients see Adams's *Paul. Ægineta*, iii. 196. It was used in unguents and against the bites of snakes, etc. In the Middle Ages the flower continued to be common, and was taken as the symbol of heavenly purity. The three golden lilies of France are said to have been originally three lance-heads.

LILYE, WILLIAM (*c.* 1466–1523), one of the introducers of a knowledge of the Greek language into England, was born at Odiham, in or about the year 1466. He entered the university of Oxford in 1484, became a demy of Magdalen in 1486, and after taking his first degree in arts went on a pilgrimage to Jerusalem. On his return he put in at Rhodes, which was still occupied by the Knights, under whose protection many Greeks had taken refuge after the taking of Constantinople by the Turks. Here he laid the foundation of a knowledge of the Greek language. We next hear of him in Italy, following the lectures of John Sulpitius and Pomponius Lætus at Rome. From this he passed on to Venice, from which place he writes to his friend and patron Thomas Starkey, that "he is assiduously attending the lectures of Egnatius in Latin, but that he finds no one in Venice who can assist him in the study of Greek. He reads, however, Greek by himself, and has read seven plays of Sophocles, five of Euripides, three of Aristophanes, besides extracts from Xenophon and Plutarch, by himself without a teacher." After his return he settled in London, as a private teacher of grammar, and is believed to have been the first who taught Greek in that city. In 1510 Colet, dean of St. Paul's, who was then founding the school which afterwards became famous, appointed Lilye the first highmaster. He held this office only twelve years, dying of the plague in February, 1523.

Lilye's name deserves commemoration, not only as one of the pioneers of Greek learning, but as one of the joint authors of a book, familiar to many generations of students, down to the present century, the old Eton Latin grammar. The *Brevissima Institutio*, a sketch by Colet, corrected by Erasmus, and worked upon by Lilye, contains two portions, the authorship of which is indisputably Lilye's. These are the lines on the genders of nouns, beginning "Propria quæ maribus," and those on the conjugation of verbs, beginning "As in præsenti." The "Carmen de moribus" bears Lilye's name in the early editions; but Hearne asserts that it was written by Leland, who was one of his scholars, and that Lilye only adopted it. Besides the *Brevissima Institutio*, Lilye wrote a variety of Latin pieces both in prose and verse. Some of the latter are printed along with the Latin verses of Sir Thomas More in *Progymnasmata Thomæ Mori et Gulielmi Lylii Sodalium*, Basle, 1518. Another volume of Latin verse directed against a rival schoolmaster and grammarian, Whittington, whose grammar that of Lilye superseded, is entitled *Antibossicon ad Gulielmum Hormannum*, 1521.

The only authority for the few facts which make up the above life of Lilye is a short sketch furnished by his son George to Paulus Jovius, who was collecting for his history the lives of the learned men of Great Britain. All the other names, such as Bale, Pits, Fuller, Wood, which figure in the dictionaries as authorities, are only transcripts of George Lilye. To these scanty memoranda the present article adds an extract from three letters of Lilye's preserved in the British Museum, Cotton. Nero. B. vi. fol. 157, now printed for the first time.

LIMA, capital of the republic of Peru, as also of the department and province of Lima, is situated on an extensive plain, 500 feet above the sea-level, and 7 miles east from its port Callao on the Pacific coast, in 12° 2′ 34″ S. lat., 77° 7′ 36″ W. long. The general configuration of the main portion of the city, previous to 1870 surrounded by walls, is that of an irregular triangle.

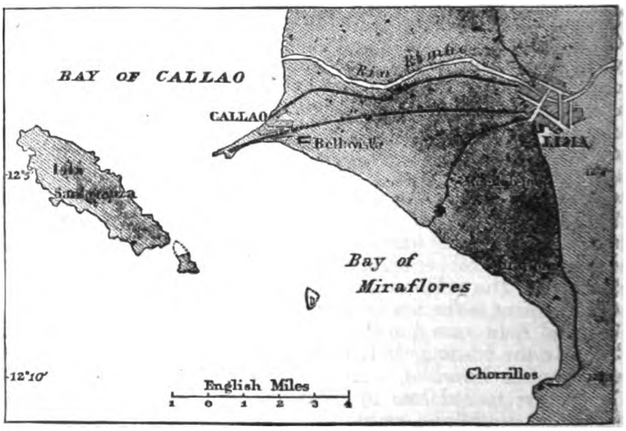


Fig. 1.—Neighborhood of Lima and Callao.

whose base rests on the river Rimac, which separates the city from its offshoot or suburb of San Lazaro. Sheltered on the north and east by the spurs of the Andes, the city is exposed to the winds prevailing from the south-east, as also to those from the south and west. Although the atmosphere is moist, and the transitions of the seasons are rapid, the climate is not unhealthy, the rainfall being slight, and the variations of temperature not excessive. The summer commences in December, and the winter in June, and the mean temperature for the year is about 73° Fahr. The city is divided into five quarters or parishes, and is well laid out with broad and regular thoroughfares, the streets intersecting one another at right angles. The houses are spacious, but generally of only two stories, and are approached by portals leading into an open court or yard. In the principal square, which covers an area of nine English acres in the centre of the city, stands a fine fountain of bronze. Here also are the cathedral, a stone structure with two lofty towers and a broad façade, the archiepiscopal palace, the Government house, and the Portal de los Escribanos, containing the municipal offices and archives. Besides the cathedral there are five chief parochial and sixty-two other churches and chapels, and numerous monasteries and convents. Of the churches, the largest is that of San Pedro (1598), which has seventeen altars; of the religious houses that of the Dominicans is the finest, and that of the Franciscans the most extensive. The university, built in 1576, is the oldest in America; it contains the hall and offices used by the chamber of deputies. Lima has more than seventy schools, a public library containing upwards of forty thousand volumes, and many charitable institutions, several of them connected with the religious orders. The principal place of amusement is the amphitheatre for bull-fights in the Plaza del Acho, accommodating nine thousand spectators. In the Plaza de la Exposicion is a marble statue of Columbus unveiling a figure of America. Of the many other monuments in Lima the most famous is the bronze equestrian statue of Simon Bolivar in the Plaza de la Independencia (or de Bolivar), 11 tons in weight, commemorating the battle of Ayacucho, which secured the independence of Peru. Among the public promenades are reckoned the cemetery outside the Maravillas gate, and the Paseo de la Alameda de los Descalzos, in the centre of which is a gorgeous garden. As the capital of Peru, Lima is one of the most important trading centres in South America. It has, however, but few home industries, its manufactured goods being chiefly imported from Europe *via* Callao, the medium of nearly all its foreign commerce. Several attempts have from time to time been made to establish factories, but the high price of labor has hitherto prevented any efforts on a large scale being permanently successful. There are, however, manufactories for tallow, soap, sperm candles, glue, gold lace, gilt leather, and silver filigree work, and the capital supplies the towns of the republic with coarse woollen fabrics. The market is attended daily by about a thousand dealers. Fish is supplied from Callao, and vegetables partly from gardens in the city and environs, and partly from the native villages. Since 1857 the water for drinking purposes has been obtained filtered from the Rimac, and supplied by pipes to the houses. The imports are various; the exports include guano, cinchona, Indian wool, raw cotton, hides, sugar, saltpetre, gold, silver, and other minerals. Under ordinary conditions the imports and exports together exceed £5,000,000 annually. There are railways from Lima leading to Callao, Chancay, Chorrillos, and Oroya; the construction of several other lines has been stopped by the war with Chili. In 1780 the population of Lima was 50,000; in 1860 it had reached 100,341, and in 1868 121,362, of whom 38,761 were foreigners. A recent estimate (1877) gives the number at about 200,000, but, considering the vicissitudes the city has since then endured, these figures must be considered at the present time (1882) as far too high. The Spanish natives have the reputation of being courteous, affable, and generous, but at the same time fond of pleasure, improvident, and superstitious. By confession they are mostly Roman Catholics.

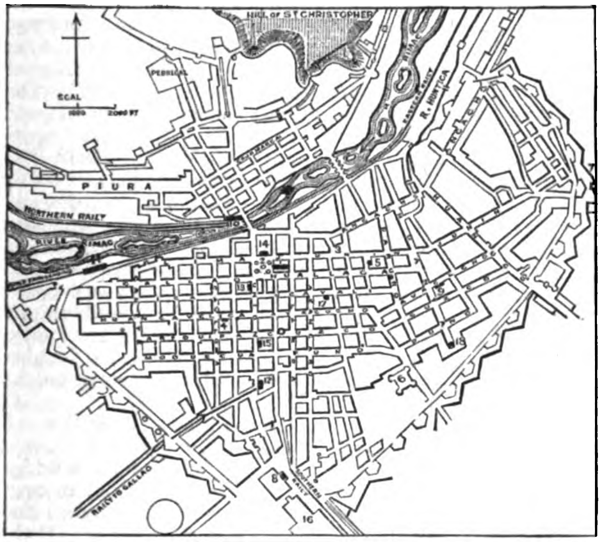


FIG. 2.—Plan of Lima.

1. Cathedral.
2. Plaza Mayor.
3. Plaza Bolivar.
4. Principal Theatre.
5. Infantry Barracks.
6. Artillery Barracks.
7. Cavalry Barracks.
8. Penitentiary.
9. Military Hospital.
10.
11. Railway Stats.
12.
13. Municipal Hall.
14. Gov'r's Palace.
15. Telegraph Office.
16. Museum, etc.
17. Library.
18. Botanic'l Garden.

Lima was founded 18th January, 1535, by Francisco Pizarro, who named it *Ciudad de los Reyes* in honor of the emperor Charles V. and Doña Juana his mother, or, according to some authors, from its site having been selected on the 6th January, the Feast of the Epiphany. The name afterwards gave place to that of *Lima*, a Spanish corruption of the Quichua word *Rimac*. In 1548 Lima received its first archbishop, and in 1582 the earliest provincial council for the state was held there. Remaining under Spanish rule during the 17th, 18th, and early part of the 19th centuries, the city continued to increase in prosperity, though often visited by terrible earthquakes, of which the most disastrous was that of the 28th October, 1746, when 5000 of the inhabitants perished and the port of Callao was destroyed (see CALLAO, vol. iv. p. 626). On the 12th July, 1821, after a siege of some months, Lima was entered by a Chilian force under General San Martin, who on the 28th was proclaimed protector of Peru as a free state, but its independence was not finally secured until after the victory of Ayacucho (9th December, 1824). In March, 1828, the city again suffered from an earthquake, and in 1854-55 the yellow fever carried off a great number of the inhabitants. On the 11th of August, 1857, Mr. Sullivan, British minister to Peru, was assassinated. In November, 1864, a congress of plenipotentiaries from Chili and other South American states was held here to concert measures of mutual defence. Of the various revolts which have during the last few years taken place at Lima may be mentioned that of November, 1865, when President Pezet was displaced for Canseco; the riots against religious toleration, 15th April, 1867; and the military insurrection, 22d July, 1872, when Gutierrez, minister of war, arbitrarily assumed power, had President Balta imprisoned and shot, but himself soon fell a victim to the popular fury; order being afterwards with difficulty restored by Vice-President Zavallos. In consequence of the ill-success of the war with Chili, Lima towards the close of 1879 was again in an unsettled condition; President Prado fled, and on the 22d December, after a sanguinary coup d'état, Pierola was proclaimed dictator. In April, 1880, Callao was blockaded by Chilian war ships, and Lima had to be placed in a state of defence. On the 20th of November the Chilian army effected a landing at Pisco, a fortified place about 100 miles south of Lima, and having afterwards advanced upon the capital, forcibly occupied it upon the 17th of January, 1881.

See Mariano F. Paz Soldan, *Diccionario geográfico estadistico del Perú*, Lima, 1877, pp. 518–27; Mateo Paz Soldan and M. F. Paz Soldan, *Geografía del Perú*, Paris, 1862, vol. i. pp. 290–820; M. A. Fuentes, *Lima, or Sketches of the Capital of Peru, Historical, Statistical, Administrative*, etc., London, 1866; C. R. Markham, *Cuzco . . . and Lima*, London, 1856. For further information as to the early history of Lima, see Lopez de Gómara, *Hist. gen. de las Ind.*; A. de Herrera, *Hist. gen. de las Ind. Occid.*; W. H. Prescott, *Hist. of the Conquest of Peru*; F. de Xeres, *Conquista del Perú*; A. de Zarate, *Hist. de la Conq. del Perú*; and J. de Ferreras, *Hist. d'Espagne* (French translation by Hermilly), Paris, 1751. (E. D. B.)

LIMA, capital of Allen county, Ohio, U. S., on the Ottawa river, and at the intersection of four railway lines, 130 miles north of Cincinnati. It is pleasantly situated in a fine farming country, and has two large railway repairs shops, extensive car-works, and other smaller manufactories. The population in 1850 was 757; in 1860, 1989; in 1870, 4464; and in 1880, 7567.

LIMBORCH, Philip van (1633–1712), a prominent Remonstrant theologian, was born June 19, 1633, at Amsterdam, where his father held a good position in the legal profession. He received his education at Utrecht, at Leyden, in his native city, and finally at Utrecht university, which he entered in 1652. In 1657 he became a Remonstrant pastor at Gouda, and in 1667 he was transferred to Amsterdam, where, in the following year, the office of professor of theology in the Remonstrant seminary was added to his pastoral charge. He died there on April 30, 1712.

His most important work, *Institutiones theologiæ christianæ, ad praxin pietatis et promotionem pacis christianæ unice directæ* (Amsterdam, 1686, 5th ed. 1735), remains unrivalled as a full and clear exposition of the system of Episcopius and Curcellæus. The fourth edition (1715) included a posthumous "Relatio historica de origine et progressu controversiarum in fœderato Belgio de prædestinatione." Limborch also wrote *De veritate religionis Christianæ amica collatio cum erudito Judæo*, Gouda, 1687; *Historia Inquisitionis* (1692), in four books prefixed to the "Liber Sententiarum Inquisitionis Tolosanæ" (1307–1323), and *Commentarius in Acta Apostolorum et in Epistolas ad Romanos et ad Hebræos*, Rotterdam, 1711. His editorial labors included the publication of various works of his predecessors, and of *Epistolæ ecclesiasticæ præstantium ac eruditorum virorum* (Amsterdam, 1684), chiefly by Arminius, Uytenbogardus, Vorstius, Vossius, Grotius, Episcopius (his grand-uncle), and Barlæus; they are of great value for the history of Arminianism. An English translation of the *Theologia*, "with improvements, from Wilkinson, Tillotson, Scott, and others," was published in the beginning of last century by W. Jones (*A Complete System or Body of Divinity, both Speculative and Practical, founded on Scripture and Reason*, London, 1702); and a translation of the *History of the Inquisition*, by S. Chandler, with "a large introduction concerning the rise and progress of persecution and the real and pretended causes of it" prefixed, appeared in 1731.

LIMBURG, or Limbourg, one of the nine provinces of Belgium, is bounded on the N. and E. by Holland, on the S. by the province of Liége, and on the W. by those of Brabant and Antwerp; the area is 932 square miles, with a population, in 1880, of 211,694. The surface is for the most part flat, but rising somewhat towards the south-east. Most of the province is included in the barren and marshy district of sandy heath known as *La Campine* (Flem., *Kempen*). The Meuse, with a tolerably fertile valley, is its chief river. The soil is metalliferous; the chief vegetable products are cereals, leguminous plants, flax, hemp, and beetroot; and stock-breeding is largely carried on. Industries are less developed in Limburg than in the rest of Belgium; but the distilleries of the province are very considerable and noted. Limburg is divided for administrative purposes into three arrondissements, of which the capitals are Hasselt (population 11,500), Tongres (7600), and Maeseyck (4400). The last-named is the birthplace of Hubert and John van Eyck, the Flemish painters. One of the most interesting towns of the province is St. Trond (*q. v.*), thought to be the ancient *Atuaticum Oppidum*, the oldest town in Belgium. Near Tongres is a mineral well, described by Pliny.

The territory of Limburg was that of the *Eburones*, whom the Romans exterminated, and was afterwards inhabited by the *Tungri* and *Taxandri*. It was one of the first conquests of the invading Franks, who established themselves and proclaimed their first kings there. In the Middle Ages it constituted the county of Looz, holding of the bishop of Liége; afterwards it became the duchy of Limburg, which was taken possession of in the 13th century by the duke of Brabant. From the 12th to the end of the 18th century the duchy included only a small portion of the present province; it extended eastward from the Meuse as far as to Aix-la-Chapelle, and southward to the Vesdre. In the 16th century Limburg remained in the possession of Spain, and it passed to Austria in 1713. After the treaty of Campo Formio (1797) it became a French department, Meuse-Inférieure, with Maestricht as capital. By the treaty of Vienna (1815) it formed one of the nineteen provinces of the kingdom of the Netherlands, and by that of London (1831) the eastern portion was ceded to Holland, becoming a Dutch province, the remainder constituting the present province of Belgium.

LIMBURG, or Limbourg, one of the eleven provinces of Holland, is bounded on the W. by Belgium (Limburg) and North Brabant, on the N. by North Brabant and Guelderland, on the E. by Rhenish Prussia, and on the S. by Belgium (Liége), and has an area of 851 square miles, with a population in 1876 of 235,135 (97 per cent. being Roman Catholics). The surface, which is flat, is partly covered with heaths and fens; of the latter the most considerable is the "peel" or marsh in the north, which extends into North Brabant. The province is traversed by the Maas, of which the chief affluents here are the Geule, the Geleen, and the Roer, all on the right; means of water communication are also supplied by the Zuid Willem's canal and its branches. The agricultural products are similar to those of Belgian Limburg; bée-keeping is also engaged in. Coal occurs within the province, and there is a mine at Kerkrade. The arrondissements are two in number,—Maestricht and Roermonde,—Maestricht being the capital. For the history of the province see the preceding article.

LIMBURG, a town in the circle of Unterlahn and district of Wiesbaden, Prussia, is situated 360 feet above the sea-level, on the Lahn, here crossed by a bridge dating from 1315, and on the Nassau Railway midway between Coblentz and Wetzlar. A local branch line connects it with Hadamar. It is the seat of a Catholic bishop, and has one evangelical and four Catholic churches. The only prominent architectural feature is the small seven-towered semi-Byzantine cathedral, picturesquely situated on a rocky site overhanging the river; it was founded by Conrad Kurzbold, count of Niederlahngau, in 905, and finally consecrated in 1235 (restored 1872–78). Limburg has a seminary for the education of priests, and a variety of schools; the industries, which are unimportant, include manufactures of cloth, tobacco, machinery, pottery, and leather. The population in 1875 was 5161.

Limburg, which was a flourishing town during the Middle Ages, passed in 1404 into the possession of the archbishops of Treves after the extinction of its own line of counts, and in 1803 fell to the duke of Nassau. It was the scene of a victory of the archduke Charles of Austria over the French under Jourdain on September 16, 1796. It possesses an interesting MS. fragment of its chronicles, the *Fasti Limpurgenses*. The original writer is supposed to have been the recorder Tillmann (ob. 1400), additions being made by subsequent copyists; the document, which has been more than once printed, is valuable especially for the ancient rhymes it embodies, and for its notices of old German poets.

LIMBUS. The *Limbus Infantum* or *Puerorum* in mediæval theology is the "margin" or "border" (limbus) of hell to which human beings dying without actual sin, but with their original sin unwashed away by baptism, were held to be consigned; the category included, not unbaptized infants merely, but also idiots, cretins, and the like. The word "limbus," in the theological application, occurs first in the *Summa* of Thomas Aquinas; for its extensive currency it is perhaps most indebted to the *Commedia* of Dante (*Inf.*, c. 4). The

as to the destiny of infants dying unbaptized
d itself to theologians at a comparatively early
and received very various answers. Generally
; it may be said that the Greek fathers inclined
erful and the Latin to a gloomy view. Thus
of Nazianzus (*Orat.* 40) says "that such chil-
die unbaptized without their own fault shall
e glorified nor punished by the righteous Judge,
g done no wickedness, though they die unbap-
d as rather suffering loss than being the authors
Similar opinions have been expressed by Greg-
yssa, Severus of Antioch, and others,—opin-
ch it is almost impossible to distinguish from
gian view that children dying unbaptized might
tted to eternal life, though not to the kingdom

In his recoil from Pelagian heresy, Augustine
pelled to sharpen the antithesis between the
the saved and that of the lost, and taught that
e only two alternatives,—to be with Christ or
devil, to be with Him or against Him. Fol-
p, as he thought, his master's teaching, Ful-
declared that it is to be believed as an indubi-
uth that, "not only men who have come to
of reason, but infants dying, whether in their
s womb or after birth, without baptism in the
the Father, Son, and Holy Ghost, are punished
erlasting punishment in eternal fire." Later
ans and schoolmen followed Augustine in reject-
notion of any final position intermediate between
and hell, but otherwise inclined with practical
ity to take the mildest possible view of the des-
the irresponsible and unbaptized. Thus the
tion of Innocent III. that "the punishment of
sin is deprivation of the vision of God" is prac-
homologated by Thomas, Scotus, and all the
reat theologians of the scholastic period, the only
ding exception being that of Gregory of Rimini,
this account was afterwards called "tortor in-
." The first authoritative declaration of the
hurch upon this subject was that made by the
council of Lyons (1274), and confirmed by the
of Florence (1439), with the concurrence of the
ntatives of the Greek Church, to the effect that
uls of those who die in mortal sin or in original
forthwith descend into hell, but to be punished
equal punishments." Perrone remarks (*Præl.*
pt. iii. chap. 6, art. 4) that the damnation of
and also the comparative lightness of the pun-
t involved in this are thus *de fide;* but nothing
mined as to the place which they occupy in hell,
hat constitutes the disparity of their punishment,
their condition after the day of judgment. In
ncil of Trent there was considerable difference
ion as to what was implied in deprivation of the
of God, and no definition was attempted, the
icans maintaining the severer view that the "lim-
antum" was a dark subterranean fireless cham-
hile the Franciscans placed it in a lightsome
above the earth. Some theologians continue
tain with Bellarmine that the infants "in limbo"
fected with some degree of sadness on account
elt privation; others, following Sfrondati, hold
ey enjoy every kind of natural felicity, as regards
ouls now, and as regards their bodies after the
ection, just as if Adam had not sinned. In the
nnation (1794) of the synod of Pistoia (1786),
enty-sixth article declares it to be false, rash, and
us to treat as Pelagian the doctrine that those
in original sin are not punished with fire, as if
neant that there is an intermediate place, free
fault and punishment, between the kingdom of
nd everlasting damnation.

Limbus Patrum, *Limbus Inferni*, or *Sinus*
æ is defined in Roman Catholic theology as the
in the underworld where the saints of the Old
ment were confined until liberated by Christ on his
ent into hell." Regarding the locality, and its
ntness or painfulness, nothing has been taught
as *de fide*, and opinions have been various. It is sometimes regarded as having been closed and empty since Christ's descent, but other authors do not think of it as separate in place from the *limbus infantum*. The whole idea, in the Latin Church, has been justly described as the mere caput mortuum of the old catholic doctrine of hades, which was gradually superseded in the West by that of purgatory.

LIME is the name of the strongly basic monoxide CaO of the metal calcium. This base is widely diffused throughout the three kingdoms of nature in the form of salts, of which the carbonate $CaCo_3$ and the hydrated sulphate $CaSO_4.2H_2O$ are by far the most abundant. Both are found in the mineral kingdom in a variety of forms. Of native carbonates of lime, *calc-spar* (Iceland spar), though comparatively rare, may be mentioned first as representing the purest native form of the compound. It generally presents itself in the form of well-developed transparent colorless rhombohedra, which possess to a remarkable degree the property of producing double refraction of light, whereupon is founded its application in the construction of certain optical instruments. Of the varieties of massive or crystalline carbonate of lime, those which, through the fineness of their grain and other qualities, lend themselves for the purposes of the sculptor go by the name of marble, while the remainder are embraced under the generic term of limestone. This name, however, is understood to exclude chalk, a soft, amorphous variety which according to Ehrenberg, consists mainly of *Foraminifera* shells. All limestones contain at least traces of magnesia. When this foreign base is present in considerable proportion the rock is termed "dolomite" (see MAGNESIUM). Among the native forms of (hydrated) sulphate of lime the mineral "selenite" (glacies Mariæ) corresponds to Iceland spar among the carbonates. It forms colorless transparent clino-rhombic prisms, generally united into "twins," and flattened down into plates readily cleavable along planes parallel to the surface. Hardness ranges from 1·5 to 2; the specific gravity is 2·3. Far more common than selenite are the massive varieties known as ALABASTER (see vol. i. p. 389) and ordinary GYPSUM (vol. xi. p. 313).

Both sulphate and carbonate of lime, apart from their occurrence as independent minerals, are almost universally diffused throughout the earth's crust, and in the waters of the ocean. Now the sulphate is appreciably soluble in even pure water, while the carbonate, though practically insoluble in pure, is quite decidedly soluble in carbonic acid water. As all atmospheric water must necessarily hold carbonic acid gas in absorption, most natural waters, and certainly all deep-well waters, are contaminated with more or less of bicarbonate or sulphate of lime, or with both. When such a water is being boiled, there is an escape of the free and the loosely combined carbonic acid, and the carbonate of lime comes down as a loose precipitate or as a "crust;" and, when the water is sufficiently concentrated by evaporation, the sulphate likewise is partly deposited. The decomposition of the "bicarbonate" in fact takes place, though slowly, even at ordinary temperatures, when the water in which it is held in solution is exposed to the atmosphere. It is in this manner that stalagmites and stalactites frequently seen within rock-caverns are produced, and there is no difficulty in accounting for the grotesque and fantastic forms which the latter often exhibit.

Quicklime.—The native carbonate always serves as the starting-point in the preparation of calcium compounds. From it the oxide CaO, known as quicklime or caustic lime, is produced industrially by heating limestone or marble in kilns, between layers of fuel, which in the United Kingdom is generally coal. The carbonic acid goes away with the gaseous products of combustion, and the oxide remains in unfused lumps of the form of the original stones. Lime, when pure, is an amorphous white solid, which is absolutely infusible and non-volatile; and on this account, when raised to high temperatures, it emits a brilliant white light ("lime-light"). The commercial article is generally gray or otherwise discolored by the presence of foreign metallic oxides.

The decomposition that goes on in a limekiln is not brought about by the effect of heat alone. Gay-Lussac found long ago that carbonate of lime, when heated to intense redness in a closely covered crucible, loses its carbonic acid only very slowly, while the acid goes off readily even at somewhat lower temperatures when a current of steam is passed over the heated limestone. This may be accounted for by assuming that the steam, in the first instance, produces hydrate—from the carbonate—of lime, which latter then at once breaks up into its two components. More probably, however, the steam acts only by producing a *quasi* vacuum, that is, by clearing out the carbonic acid which, if allowed to stagnate even at high temperatures, would react on the quicklime produced, thus preventing the decomposition of a portion of the carbonate.

Quicklime acts readily and energetically on water, with evolution of much heat (269 units per unit weight of lime, Berthelot) and formation of a bulky white powder of the hydrate $CaOH_2O$ or $Ca(OH)_2$. This powder readily mixes with water into a smooth paste, which may be diluted to a milky liquid—milk of lime. This, when filtered through paper, yields "lime-water," a strongly alkaline liquid containing about $\frac{1}{700}$th of its weight of lime (calculated as CaO). When boiled it deposits a part of its dissolved lime as such, and when exposed to ordinary air it quickly draws a skin of carbonate of lime. Hence its application as a reagent for carbonic acid, and the extensive use of milk of lime (whitewash) as a cheap white pigment in wall-painting. Lime-paste, as every one knows, is most extensively used as a mortar or cement for bricks and stones in building. For this purpose it is always mixed with a certain proportion of sand. This admixture in all probability was originally intended only to save lime and prevent shrinking. But it is now generally assumed to have a chemical function, causing the formation of a hard silicate of lime pervading and thus strengthening the mortar. Some chemists deny the practical importance though not the occurrence of this silication; what admits of no doubt is that the hardening of mortar involves the very gradual conversion of the original hydrate into carbonate of lime. Under the name of plaster, a fine smooth paste of lime and sand, with short hair to increase the tenacity of the mixture, is a most important material for coating the internal walls and roofs of ordinary buildings.

Hydraulic Cements.—Ordinary mortar, on account of the solubility of lime in water, is unfit for aquatic masonry; for this purpose hydraulic cements must be used. Of these there are a great variety, which, however, mostly agree in this that they consist of calcined mixtures of limestone and clay (preferably alkaliferous clay) and other silicates. By calcining such mixtures at temperatures short of that at which a glass would be produced, the lime becomes caustic, and part of the caustic lime, by uniting with the clay (and silicate generally), forms a silicate sufficiently basic to be disintegrable by acids and even by water. When such cement, as a powder, is mixed with water, the lime acts upon the silicate of alkali and the gelatinous silica-hydrate transitorily produced, and with the silica and alumina and oxide of iron unites into a hard, waterproof, very complex, silicate mixture.

H. Ste. Claire Deville having found that magnesia has hydraulic properties, hydraulic cements have been made by calcining dolomites of the proper composition so far as to decompose only the carbonate of magnesia (into MgO and CO_2). See CEMENT, vol. v. p. 285.

Lime, being the cheapest of powerful bases, is largely used in chemical manufacturing. It serves for the causticizing of soda, for the preparation of ammonia from ammonia salts, and for the manufacture of bleaching powder. It also enters into the composition of certain kinds of glass, and is used (as lime or as carbonate), in the making of soda ash.

Lime Salts.—These can in general be prepared by the saturation of the respective acids with lime hydrate. Thus the (pure) *carbonate* $CaCO_3$ may be prepared by passing carbonic acid into lime-water. But a more convenient method is to decompose a solution of pure chloride of calcium with excess of carbonate of ammonia, preferably at 70–80° C., when the carbonate assumes the form of a crystalline precipitate which settles readily and is easily washed with hot water. The *sulphate* (artificial gypsum) appears as a voluminous white precipitate, consisting of minute colorless needles, when sulphuric acid is added to a not too dilute solution of chloride of calcium or other lime salt. The precipitate $CaSO_4.2H_2O$ is appreciably soluble in water, 1000 parts of which at 0°, 35°, and 100° C. dissolve 2·05, 2·54, and a little over 2 parts respectively of gypsum. The hydrated sulphate at temperatures exceeding 110° C. loses its water. The anhydrous sulphate, if formed below about 200° C., readily recombines with water into compact gypsum (plaster of Paris). By exposure to high temperatures (500° C. and upwards) sulphate of lime loses its power of recombining with water; at very high temperatures it fuses. A naturally anhydrous sulphate of lime (anhydrite) occurs in association with rock salt, and otherwise, as a not very common mineral.

The well-known favorable action of gypsum as a manure, more especially for clover (see AGRICULTURE), has lately been explained by Déherain on the strength of analyses and vegetation experiments of his own, by assuming that it converts the carbonate of potash of the soil into sulphate, which, being less obstinately retained by the soil, more readily finds its way into the roots of the plants.

Chloride of Calcium (muriate of lime), $CaCl_2$, is prepared by dissolving marble or limestone in aqueous muriatic acid. The iron and manganese generally present as impurities can be eliminated, after peroxidation by chlorine water, by digestion with hydrate of lime, which also, if allowed sufficient time, removes the magnesia. The filtrate is acidified with hydrochloric acid and concentrated by evaporation, so far that, on cooling, it deposits part of the dissolved salt as crystals. These have the composition $CaCl_2.6H_2O$. They are very easily soluble in water and alcohol, and highly hygroscopic. Hence the salt is used occasionally to keep textile fibres moist and in a fit state for being woven. The crystals when kept in a basin at about 200° lose about two-thirds of their water, and leave that porous kind of chloride of calcium which analytical chemists prefer for the drying of gases. This substance, when heated to redness—which must be done in platinum to prevent contamination—loses the rest of the water and (at 723° C., Carnelley) fuses into the anhydrous salt $CaCl_2$, which on cooling hardens into a stone-like mass. In this final process of dehydration, however, part of the chlorine goes off as hydrochloric acid, so that the product obtained is contaminated with some oxychloride. This can be prevented by igniting the salt with sal-ammoniac or—more surely—by effecting the dehydration in a current of anhydrous hydrochloric acid gas. Anhydrous chloride of calcium is much used in laboratories as a powerful dehydrating agent. It combines with ammonia gas into a solid compound. It dissolves in methyl alcohol and in ethyl alcohol, forming crystallizable "alcoholates" (Graham), compounds of $CaCl_2$ with "crystal alcohol."

Nitrate of Calcium, $Ca(NO_3)_2$, crystallizing with $4H_2O$, is a very hygroscopic salt, soluble in even absolute alcohol. It is mentioned here as a material for the convenient preparation of *pure* lime—by simple ignition of the salt in a platinum crucible. Regarding *bleaching powder*, a double salt of hypochlorite and chloride of calcium Cl — Ca — (ClO), see CHLORINE, vol. v. p. 589.

Fluoride of Calcium, CaF_2, obtainable by precipitation of chloride of calcium with an alkaline fluoride, occurs in nature as FLUORSPAR (*q. v.*). Fluoride of calcium is widely disseminated throughout the mineral kingdom as an admixture with other minerals. All native forms of phosphate of lime contain it; some in considerable quantity. Traces of it are found in bones and in the ashes of most plants.

Metallic Calcium cannot be prepared by the reduction of the oxide with charcoal. It may be produced, however, by the electrolysis of the fused chloride or—more conveniently—by heating the iodide CaI_2 (seven parts) with sodium (one part) in an iron crucible. The metal has a yellow color; it is somewhat harder than lead, and very malleable and ductile (Liès-Bodart and Jobin). The specific gravity is 1·578 (Bunsen and Matthieson). It does not tarnish in *dry* air, but readily decomposes water, with evolution of hydrogen and formation of hydrate of lime. It is practically non-volatile. When heated in air or oxygen it burns with a most brilliant light into oxide, CaO.

Tests.—Solutions of ordinary calcium salts are not affected visibly by sulphuretted hydrogen, sulphide of ammonium, or pure ammonia. Carbonate of ammonia, even in the presence of sal-ammoniac, precipitates the carbonate. So far calcium behaves like barium and strontium. From the former it is distinguished by its not being precipitated by either hydrofluosilicic acid or bichromate of potash, and from both by its spectrum and the relatively large solubility of its sulphate in water. The latter is obtained from any calcium solution by addition of sulphuric acid and alcohol. The sulphate is washed with alcohol on a filter. When then boiled with water it yields a solution which, dilute as it is, gives a very distinct precipitate with oxalate of ammonia (barium and strontium sulphates in these circumstances give negative results). Oxalate of ammonia is the most delicate precipitant for calcium; the precipitate is insoluble in water, in ammonia and ammonia salts, and in acetic acid. From solutions (in acids) of phosphate or oxalate of calcium ammonia and likewise sulphide of ammonium precipitate the metal as phosphate or oxalate. To detect it in such a precipitate, dissolve in hydrochloric acid and add sulphuric acid and alcohol. The calcium is precipitated as sulphate, which can be identified as just explained.

For the phosphates of lime, see Phosphates. (W. D.)

LIME, or Linden. The lime trees, species of *Tilia*, are familiar timber trees with mellifluous flowers, rarely if ever maturing their fruit in England, which are borne on a common peduncle proceeding from the middle of a long bract. *T. europæa*, L., is indigenous to Europe, excepting the extreme north, and extends eastwards across Russian Asia to the Altai. The lime is much planted in Britain, and is probably wild in south and west England, and perhaps in Ireland. The truly indigenous form in north Europe is always a small-leaved one. The large leaved variety (*T. grandifolia*, Ehrh.) is of South-European origin (Bentham, *Handbook of the British Flora*, i. 157); *T. parvifolia*, L., is perhaps the English wild form of the Continental *T. europæa*, L.; while *T. intermedia*, D. C., probably a sub-species of *T. europæa*, L., is the so-called common lime (Hooker, *Student's Flora of the British Isles*, p. 76). For a full description of the European and American forms, see Loudon, *Arboretum*, i. p. 364, and De Candolle, *Prod.*, i. 513. The lime sometimes acquires a great size: one is recorded in Norfolk as being 16 yards in circumference, and Ray mentions one of the same girth. The famous linden tree which gave the town of Neustadt in Würtemburg the name of "Neustadt an der grossen Linden" was 9 feet in diameter.

The economic value of the tree chiefly lies in the inner bark or liber, called bast, and the wood. The former was used for paper and mats and for tying garlands by the ancients (*Od.*, i. 38; Pliny, xvi. 14, 25; xxiv. 8, 33). *T. grandifolia* and *T. parvifolia* have been found in the debris of lake dwellings in Switzerland. Bast mats are now made chiefly in Russia, the bark being cut in long strips, when the liber is easily separable from the corky superficial layer. It is then plaited into mats about 2 yards square; 14,000,000 come to Britain annually, chiefly from Archangel. The wood is used by carvers, being soft and light, and by architects in framing the models of buildings. Turners use it for light bowls, etc. The flowers, alone, are used for an infusion in Austria and elsewhere, with much success in vertigo and spasms, producing perspiration, and alleviating coughs; but the bracts and fruit are astringent.

The common lime was well known to the ancients. Theophrastus says the leaves are sweet and used for fodder for most kinds of cattle. Pliny alludes to the use of the liber and wood, and describes the tree as growing in the mountain valleys of Italy (xvi. 30). See also Virg., *Geó.*, i. 173, etc.; Ov., *Met.*, viii. 621, x. 92. The φιλύρα (Hdt., 4. 67) was the lime of the Greeks, perhaps *T. argentea* (see Pickering's *Chron. Hist. of Plants*, pp. 214, 227, 418). Allusion to the lightness of the wood is made in Aristoph., *Birds*, 1378.

For the sweet lime (*Citrus Limetta*) and lime juice, see Lemon.

LIMERICK, a maritime county of Ireland, in the province of Munster, is bounded on the N. by the estuary of the Shannon and the counties of Clare and Tipperary, on the E. by Tipperary, on the S. by Cork, and on the W. by Kerry. Its greatest length from north to south is 35 miles, and its greatest breadth east and west 54 miles. The total area comprises 662,973 acres, or 1036 square miles.

The greater part of the county is comparatively level, and rests on limestone, but in the south-east the picturesque Galtees, which extend into Tipperary, and are composed of Silurian strata overlaid by Old Red Sandstone, attain in Galtymore a height of 3015 feet, and on the west stretching into Kerry there is a circular amphitheatre of less elevated mountains composed of volcanic rocks. The Shannon is navigable to Limerick, above which are the rapids of Doonas and Castleroy. The Maig, which rises in the Galtees, and flows into the Shannon, is navigable as far as the town of Adare. Limerick includes the greater part of the Golden Vale, the most fertile district of Ireland, which stretches across the centre of the county from Cashel in Tipperary to near the town of Limerick. Along the banks of the Shannon there are large tracts of flat meadow land formed of deposits of calcareous and peaty matter, and possessing extraordinary fertility. The soil in the mountainous districts is, for the most part, thin and poor, and incapable of improvement. In 1880 there were 176,774 acres under tillage, 415,107 pasture, 8407 plantations, and 62,465 waste. The total number of holdings in 1880 was 16,286, of which 1937 were less than one acre, and 11,273 between 15 and 100 acres in extent, 1019 between 100 and 200 acres, 259 between 200 and 500 acres, and 29 above 1000 acres. The large farms occupy the low grounds, and are almost wholly devoted to grazing. The following table shows the area under the principal crops in 1855 and 1881:—

	Wheat.	Oats.	Other Cereals.	Potatoes.	Turnips.	Other Green Crops.	Flax.	Meadow and Clover.	Total.
1855	17,149	45,456	12,067	35,723	11,394	2,771	348	71,391	196,064
1881	7,257	21,440	3,003	23,035	5,520	8,994	6	112,676	176,883

The table shows a remarkable increase in the area under meadow, notwithstanding which the total area under tillage has considerably decreased. The number of horses has, since 1855, declined from 17,206 to 15,389, of which 10,228 were used for agricultural purposes. Cattle have increased from 159,710 to 201,456, an average of 28 to every 100 acres under cultivation, the average for Ireland being 25·8. The number of cows was 95,225. Sheep have diminished from 80,914 to 50,599, and pigs from 61,733 to 48,801. The number of goats was 10,012, and of poultry 428,398.

According to the corrected return of 1878, the land, exclusive of that in the county of the city of Limerick, was divided among 1676 proprietors, possessing 660,386 acres, of the annual value of £461,213, or 13s. 11d. per acre. Of the owners nearly 40 per cent. possessed less than 1 acre, the average extent being 394. The following were the largest proprietors:—Earl of Devon, 33,026; Earl of Dunraven, 14,298; Lord Ashton, 11,273; Archdeacon Goold, 10,966; Lady Louisa Fitzgibbon, 10,316; Sir Croker Barrington, 9485.

Manufactures.—The inhabitants are employed chiefly in agriculture, but coarse woollens are manufactured, and also paper, and there are a considerable number of meal and flour mills. At one time there were a number of flax-spinning and weaving mills, but that industry is now almost wholly extinct.

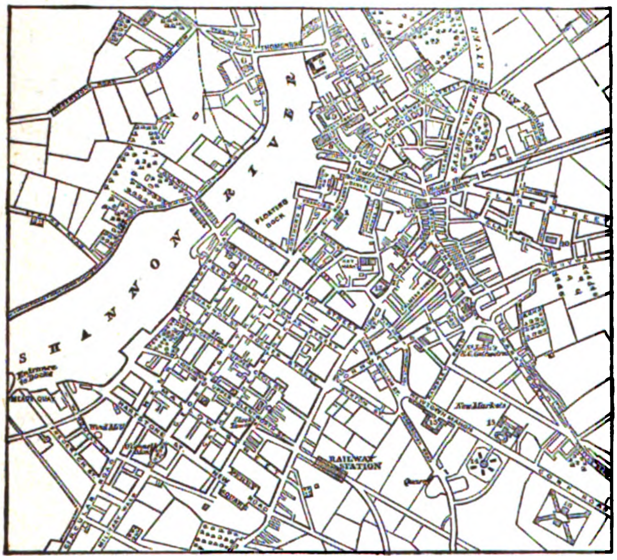
Administration and Population.—The county includes 14 baronies, 131 parishes, 2067 townlands, and the city and parliamentary borough of Limerick. The number of members returned to the Irish parliament was eight, two being returned for each of the boroughs of Askeaton and Kilmallock, in addition to the two returned as at present for the county, and the two returned for the county of the city of Limerick. There are three poor-law unions wholly within the county, and portions of four others. Assizes are held at Limerick, and quarter sessions at Bruff, Limerick, Newcastle, and Rathkeale. The county is within the Cork military district, with a brigade depôt at Tralee. The population, estimated in 1760 at 92,376, had increased in

1821 to 277,477, and in 1841 to 331,003, but since that period it has been gradually diminishing, being 217,277 in 1861, and in 1881 only 177,203, of whom 86,541 were males and 90,662 females. The decrease since 1871 has been 7·7 per cent., the decrease per cent. in Ireland being 4·7. Besides the city of Limerick, with a population in 1881 of 48,246, only two other towns, Rathkeale and Newcastle, had a population of over 2000. From 1st May, 1851, to 31st December, 1880, the number of emigrants from the county was 130,333, a proportion of 60 per cent. of the population in 1861.

History and Antiquities.—Limerick, originally inhabited by the Coriondi, was included in the kingdom of Thomond. Afterwards it had a separate existence under the name of Aine-Cliach. From the 8th to the 11th century it was partly occupied by the Danes. By Henry II. it was granted to Henry Fitzherbert, but his claim was afterwards resigned, and subsequently various Anglo-Norman settlements were made. About 100,000 acres of the estates of the earl of Desmond, which were forfeited in 1586, were situated in the county, and other extensive confiscations took place after the Cromwellian wars. In 1709 a German colony from the Palatinate was settled by Lord Southwell near Bruff, Rathkeale, and Adare.

There are only slight remains of the round tower at Ardpatrick, but that at Carrigeen is much better preserved. There are important remains of stone circles, pillar stones, and altars on Loch Gur. In several places there are remains of old moats and tumuli. Besides the monasteries in the city of Limerick, the most important monastic ruins are those of Adare Abbey, Askeaton Abbey, Kilshane Abbey, Galbally Friary, Kilflin Monastery, Kilmallock Abbey, and Monaster-Nenagh Abbey. See the *History of Limerick* by Fitzgerald and M'Gregor, 1826-27.

LIMERICK, a county of a city, parliamentary borough, and the chief town of the county of Limerick, is situated on both sides of the Shannon, at the head of its estuary, and on an island of the river, 120 miles south-west of Dublin by rail. The western bank of the river is occupied by Irish Town, the island by English Town, and the eastern bank by Newtown Pery,—the two former divisions consisting chiefly of mean houses occupied by the poorer classes, and Newtown Pery including the principal streets, shops, and public buildings. The different parts of the town are connected by several bridges, the most important of which is Wellesley bridge, erected in 1827 at a cost of £85,000. The cathedral of St. Mary, founded in 1180, and rebuilt in 1490, is a cruciform structure in the Gothic style, with an embattled tower 120 feet in height. A Roman Catholic cathedral in the First Pointed style was erected in 1860. The other principal public buildings are the court-house, the custom-house, the exchange, the chamber of commerce, the town-hall, the county jail, the city jail, the infirmary, and Barrington's hospital. There are barracks for cavalry, artillery, and infantry. Limerick as a port occupies the fourth position in Ireland, and, while possessing secure and open communication with the Atlantic, is included in a vast network of inland navigation. Vessels of 1000 tons can unload at the floating dock, and vessels of 500 tons at the quays. A graving dock, admitting vessels of 1500 tons for repair, has lately been constructed. The value of the imports in 1880 was £837,269, the average for the four years 1876–79 being £940,279, and for 1872–75, £873,533. For the same dates the value of the exports was £26,569, £9552, and £12,516. The principal industries are flax spinning and weaving, and the manufacture of lace and gloves. There are also breweries, distilleries, tanneries, and flour-mills. The population in 1851 was 48,961, which in 1871 had increased to 49,980, but in 1881 had diminished to 48,246.



Plan of Limerick.

Limerick is said to have been the ancient *Regia* of Ptolemy and the *Rosse-de-Nailleagh* of the Annals of Multifernan. There is a tradition that it was visited by St. Patrick in the 5th century, but it is first authentically known as a settlement of the Danes, who in the middle of the 9th century made it one of their principal towns, but were expelled from it in the 11th century by Brian Boroimhe. From 1106 till its conquest by the English in 1174 it was the seat of the kings of Thomond or North Munster, and, although in 1179 the kingdom of Limerick was given by Henry II. to Herbert Fitzherbert, the city was frequently in the possession of the Irish chieftains till 1195. By King John it was committed to the care of William de Burgo, who founded English Town, and for its defence erected a strong castle. The city was frequently besieged in the 13th and 14th centuries. In the 15th century its fortifications were extended to include Irish Town, and until their demolition in 1760 it was one of the strongest fortresses of the kingdom. In 1651 it was taken by General Ireton, and after an unsuccessful siege by William III. in 1690 its resistance was terminated in October of the following year by the treaty of Limerick. The town first obtained municipal privileges in 1199, and these were confirmed and extended by Edward I. and other sovereigns. In 1609 it received a charter constituting it a county of a city, and also incorporating a society of merchants of the staple, with the same privileges as the merchants of the staple of Dublin and Waterford. The powers of the corporation were remodelled by the Limerick Regulation Act of 1823. The prosperity of the city dates chiefly from the foundation of Newtown Pery by Mr. Sexton Pery in 1769. It returns two members to parliament. See the *History* by Linahan, 1866.

LIMITATION, STATUTES OF, are Acts of Parliament by which rights of action are limited to a fixed period after the occurrence of the events giving rise to the cause of action. This is one of the devices by which lapse of time is employed to settle disputed claims. There are mainly two modes by which this may be effected. We may say that the active enjoyment of a right—or possession—for a determined period shall be a good title against all the world. That is the method known generally as PRESCRIPTION (*q. v.*). It looks to the length of time during which the defendant in a disputed claim has been in possession or enjoyment of the matter in dispute. On the other hand, the principle of the statutes of limitation is to look to the length of time during which the plaintiff has been out of possession. The point of time at which he might first have brought his action having been ascertained, the lapse of the limited period after that time bars him for ever from bringing his action. In both cases the policy of the law is expressed by the maxim *Interest reipublicæ ut sit finis litium*.

The principle of limitation was first adopted in English law in connection with real actions, *i. e.*, actions for the recovery of real property. At first a fixed date was taken, and no action could be brought of which the cause had arisen before that date. By the Statute of Westminster the First (3 Edward I. c. 39), the beginning of the reign of Richard I. was fixed as the date

nitation for such actions. This is the well known
iod of legal memory" recognized by the judges in
erent class of cases to which a rule of prescription
pplied. Possession of rights in *alieno solo* from
immemorial was held to be an indefeasible title,
he courts following the statutes above mentioned
time immemorial to begin with the first year of
rd I.

period absolutely fixed became in course of time
s for the purposes of limitation, and at last the
od of counting back a certain number of years
the date of the writs was adopted in the Statute
enry VIII. c. 2, which fixed periods of thirty,
and sixty years for various classes of actions named
in. A large number of statutes since that time
established periods of limitation for different kinds
tions. Of those now in force the most important
1 James I. c. 16 for personal actions in general,
3 & 4 Will. IV. c. 27 relating to actions for the
ery of land. The latter statute has been repealed
virtually re-enacted by the Real Property Limita-
Act, 1874, which reduced the period of limitation
twenty years to twelve, for all actions brought after
lst January, 1879. The principal section of the
of Will. IV. will show the *modus operandi*:—
er the 31st December, 1833, no person shall make
ntry or distress, or bring an action to recover any
or rent *but within twenty years next after the time*
ich the right to make such entry or distress or to
such action shall have first accrued to some per-
hrough whom he claims, or shall have first accrued
e person making or bringing the same." Another
n defines the times at which the right of action or
shall be deemed to have accrued in particular
; *e. g.*, when the estate claimed shall have been
state or interest in reversion, such right shall be
ed to have first accrued at the time at which such
e or interest became an estate or interest in posses-
Thus suppose lands to be let by A to B from
for a period of fifty years, and that a portion of
lands is occupied by C from 1831 without any color
le from B or A—C's long possession would be of
ail against an action brought by A for the recovery
e land after the determination of B's lease. A
d have twelve years after the determination of the
within which to bring his action, and might thus,
action brought in 1891, disestablish a person who
been in quiet possession since 1831. What the law
to is not the length of time during which C has
ed the property, but the length of time which A
uffered to elapse since he might first have brought
ction.

is to be observed, however, that the Real Property
itation Act does more than bar the remedy. It
guishes the right, differing in this respect from the
r Limitation Acts, which, while barring the remedy,
erve the right, so that it may possibly become avail-
in some other way than by action.

y section 14 of the Act of Will. IV., "when any
owledgment of the title of the person entitled shall
been given to him or his agent in writing signed
he person in possession, or in receipt of the profits
ent, then the right of the person (to whom such
owledgment shall have been given) to make an
y or distress or bring an action shall be deemed to
first accrued at the time at which such acknow-
ment, or the last of such acknowledgments, was
n. By section 15, persons under the disability of
ncy, lunacy, or coverture, or beyond seas, and their
esentatives, are to be allowed ten years from the
nination of this disability, or death (which shall
e first happened), notwithstanding that the ordinary
od of limitation shall have expired.

y 21 James I. c. 16, actions of trespass, detinue,
er, replevin, or account, actions on the case (except
slander), actions of debt arising out of a simple con-
t, and actions for arrears of rent not due upon
ialty, shall be limited to six years from the date of the cause of action. Actions for assault, menace, battery, wounds, and imprisonment are limited to four years, and actions for slander to two years. Persons laboring under disabilities are allowed the same time after the removal of the disability. When the defendant is "beyond seas" (*i. e.*, outside the United Kingdom and the adjacent islands) a similar extension of time is allowed.

An acknowledgment, whether by payment on account or by mere spoken words, was formerly sufficient to take the case out of the statute. The Act 9 Geo. IV. c. 14, (Lord Tenterden's Act) requires any promise or admission of liability to be in writing and signed by the party to be charged, otherwise it will not bar the statute.

Contracts under seal are governed as to limitation by 3 & 4 William IV. c. 42, which provides that actions for rent upon any indenture of demise, or of covenant, or debt, or any bond or other specialty, and on recognizances, must be brought within twenty years after cause of action. Actions of debt on an award (the submission being not under seal), or for a copyhold fine, or for money levied on a writ of *fieri facias*, must be brought within six years.

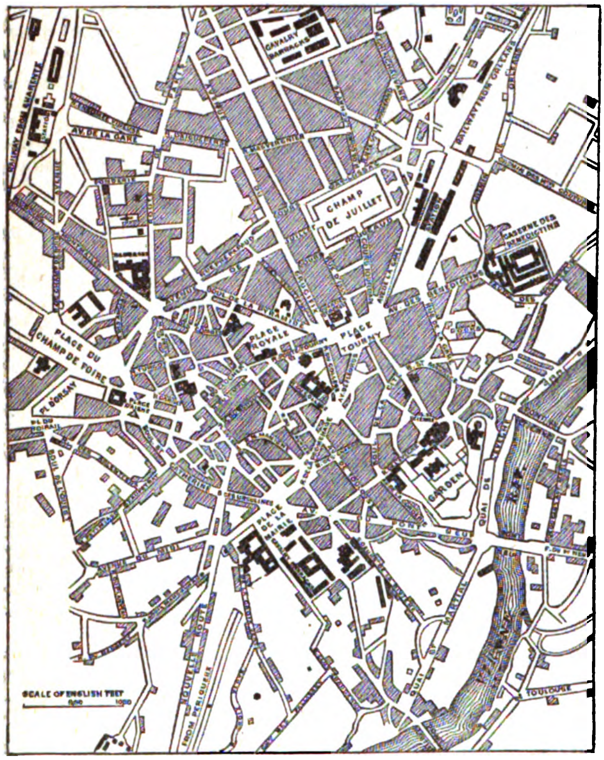
Of the miscellaneous limitations fixed by various Acts, the following may be noticed. Suits and indictments under penal statutes are limited to two years if the forfeiture is to the crown, to one year if the forfeiture is to the common informer. Penal actions by persons aggrieved are limited to two years (3 & 4 Will. IV. c. 42). Actions brought against a justice of the peace for acts done in the execution of his office are limited to six calendar months (11 & 12 Vict. c. 44). Acts done under any local or personal Act of Parliament can only be sued upon within two years (5 & 6 Vict. c. 97).

A defence under the statutes of limitations must in general be specially pleaded. Limitation is regarded strictly as a law of procedure. The English courts will therefore apply their own rules to all actions, although the cause of action may have arisen in a country in which different rules of limitation exist. This is also a recognized principle of private international law.

United States.—The principle of the statute of limitations has passed with some modification into the statute-books of every State in the Union except Louisiana, whose laws of limitation are essentially the prescriptions of the civil law drawn from the *Partidas*, or "Spanish Code." As to personal actions, it is generally provided that they shall be brought within a certain specified time—usually six years or less—from the time when the cause of action accrues, and not after, while for land the "general if not universal limitation of the right to bring action or to make entry is to twenty years after the right to enter or to bring the action accrues" (Bouvier's *Law Dictionary*, art. "Limitations"). The constitutional provision prohibiting States from passing laws impairing the obligation of contracts is not infringed by a law of limitations, unless it bars a right of action already accrued without giving a reasonable term within which to bring the action. (E. R.)

LIMOGES, capital of the department of Haute Vienne, France, and the ancient capital of Limousin, lies in the form of an amphitheatre on the right bank of the Vienne, 248 miles by rail south-south-west from Paris, on the Paris and Toulouse Railway, at its junction with the Charente line. It has also direct railway communication by Bellac with Poitiers. The population in 1876 was 59,011. In spite of many modern improvements and clearances, commencing with the administration of Turgot, in 1762, the city still contains old quarters, which are dark, wretched, and unhealthy.

The cathedral, the most remarkable building, not only in the town but in the entire province, is in the Parisian Ogival style, and occupies the site of an old heathen basilica, which, according to tradition, was transformed into a Christian church by St. Martial. The present edifice was built between 1273 and 1327, and has been quite recently restored, the north front of the transept, distinguished by the richness and perfection of its details, having been finally completed in 1851. The campanile is an elegant slightly leaning tower, 204 feet high. The interior of the church is remarkable for the boldness and elegance of its construction. It has a magnificent rood-loft, attributed to Bishop Jean de Langeac (1533); close by the choir screen is the mausoleum of the same prelate. The glass was repaired in the 16th century, but is still undergoing restoration. Under the choir is the crypt of the old Roman church, containing frescoes of the 11th century. Some of the houses still standing in Limoges date from the Middle Ages; and commemorative tablets mark the birthplace of the chancellor D'Aguesseau and of Marshals Jourdan and Bugeaud. There is a museum of painting and sculpture, and, in connection with the local industry, a very valuable ceramic museum. Limoges is the headquarters of the 12th army corps, and is also the seat of several learned societies, and of a court of appeal.



Plan of Limoges.

The principal industry is the manufacture of porcelain. The kaolin of St. Yrieix is of such superior quality that it is exported even to America; the pegmatite used for enamel is obtained at Chanteloube, about 25 miles from Limoges, on the Paris railway. Thirty-five factories with eighty furnaces and fifty-four painting rooms (800 artists) employ 5800 workers of both sexes, and produce goods to the annual value of 12 millions of francs. These are many others in the immediate neighborhood of the town. Limoges has also wool and cotton spinning-mills, and cloth factories, paper-works, foundries, etc. Shoemaking gives employment to 600 persons, and the manufacture of clogs to 250. There is an extensive trade in wine and spirits, cattle, cereals, and wood. The Vienne is navigable for rafts above Limoges, and the logs brought down by the current are stopped at the entrance of the town by the inhabitants of the Naveix quarter, who form a special guild for this industry.

Limoges was a place of importance even at the time of the Roman conquest, and sent ten thousand soldiers to the defence of Alesia. In 11 B.C. it took the name of Augustus (*Augustoritum*); but in the 4th century it was anew called by the name of *Lemovices*, whose capital it was. It then contained palaces and baths, had its own senate and the right of coinage. (Till 1837 it had a mint.) Christianity was introduced by St. Martial. In the 5th century Limoges was devastated by the Vandals and the Visigoths. Viscounts were set over it by Clovis. It suffered again in the wars between the Franks and the people of Aquitaine, from Norman invasion, and from a struggle which arose between two parties into which the city was divided, led by the abbot of St. Martial and by the bishop respectively. During the Hundred Years' War it was taken again and again by the French and English. Confiscated under John Lackland, it was again ceded by Louis IX. In 1370 the Black Prince took it by assault, and gave it up to fire and sword,—a disaster from which it was slow to recover. The religious wars, pestilence, and famine desolated it in turn, but the ravages of all these were surpassed by the plague of 1630–31, which carried off more than twenty thousand persons. The wise administrations of Henri d'Aguesseau, father of the chancellor, and of Turgot enabled Limoges to recover its former prosperity. There have been several noteworthy conflagrations, destroying whole quarters of the city, built, as it then was, of wood. That of 1790 lasted for two months, and destroyed one hundred and ninety-nine houses; that of 1864 laid under ashes an area of 10,000 square metres. Limoges celebrates every seven years a curious religious festival (Fête d'Ostension), during which the relics of St. Martial are exposed for seven weeks, attracting large numbers of visitors. It dates from the 10th century, and commemorates a pestilence (maldes ardents) which, after destroying forty thousand persons, is believed to have been stayed by the intercession of the saint.

LINACRE, or **LYNAKER, THOMAS** (1460–1524), a distinguished humanist and physician, was born at Canterbury about the year 1460. Of his parentage or descent nothing certain is known. He received his early education at the cathedral school of Canterbury, then under the direction of William of Selling, afterwards prior of Canterbury. Selling was an ardent scholar, and one of the earliest in England who cultivated Greek learning. From him Linacre must have received his first incentive to this study, in which he afterwards became eminent. Linacre entered the university of Oxford about the year 1480, and in 1484 was elected a fellow of All Souls' College. Shortly afterwards he visited Italy in the train of William of Selling, who was sent by Henry VIII. as an envoy to the papal court, and accompanied his patron as far as Bologna. There he became the pupil of Angelo Poliziano, and afterwards shared the instruction which that great scholar imparted at Florence to the youthful sons of Lorenzo de' Medici. The younger of these princes became Pope Leo X., and was in after years mindful of his old companionship with Linacre.

Among his other teachers and friends in Italy should be mentioned Demetrius Chalcondylas, Hermolaus Barbarus, Aldus Romanus the printer of Venice, and Nicolaus Leonicenus of Vicenza. Linacre took the degree of doctor of medicine with great distinction at Padua. On his return to Oxford, full of the learning and imbued with the spirit of the Italian Renaissance, he formed one of the brilliant circle of Oxford scholars, including Colet, Grocyn, and William Latimer, who are mentioned with so much warm eulogy in the letters of Erasmus.

Linacre does not appear to have practised or taught medicine in Oxford. About the year 1501 he was called to court as tutor of the young prince Arthur; and continued to act in this capacity till the prince's death in 1503. On the accession of Henry VIII. he was appointed the king's physician, an office at that time of considerable influence and importance, and practised medicine in London, having among his patients most of the great statesmen and prelates of the time, as Wolsey, Warham, and Fox.

After some years of professional activity, and when in advanced life, Linacre received priest's orders. But, as he had for some years previously held several clerical benefices, it would seem that he must have been already a deacon, and thus nominally at least a cleric, but this status would not in those days have interfered with his practising as a physician. There is no doubt, however, that his ordination as priest was connected with his retirement from active life. Literary labors, and the cares of the foundation which owed its existence chiefly to him, the Royal College of Physicians, occupied Linacre's remaining years till his death in 1524.

Linacre was more of a scholar than a man of letters, and rather a man of learning than a scientific investigator. It is difficult now to judge of his practical skill in his profession, but it was evidently highly esteemed in his own day; and several instances are recorded of his wise prognosis and judicious treatment. He took no part in political or theological questions, and died too soon to have to declare himself on either side in the formidable controversies which were even in his lifetime beginning to arise.

But his career as a scholar was one eminently characteristic of the critical period in the history of learning through which he lived. He was one of the first Englishmen who studied Greek in Italy, whence he brought back to his native country and his own university the lessons of the "New Learning." His teachers, who have already been named, were some of the greatest scholars of the day. Among his pupils was one—Erasmus—whose name alone would suffice to preserve the memory of his instructor in Greek, and others of note in letters and politics, such as Sir Thomas More, the lamented Prince Arthur, and Queen Mary. Colet, Grocyn, William Lilye, and other eminent scholars were his intimate friends, and he was esteemed by a still wider circle of literary correspondents in all parts of Europe.

Linacre's literary activity was displayed in two directions, in pure scholarship and in translation from the Greek. In the domain of scholarship he was known by the rudiments of (Latin) grammar composed in English for the use of the Princess Mary, and afterwards translated into Latin by George Buchanan, and by a work on Latin composition, *De emendata structura Latini sermonis*, which enjoyed a wide popularity. It was originally composed for the use of St. Paul's school, when founded by Dean Colet, but was set aside as unsuited for the purpose. It was, however, printed in London, in 1524, and many times reprinted on the Continent.

Linacre's only medical works were his translations. It was the cherished project of his life to make the works of Galen (and indeed those of Aristotle also) accessible to all readers of Latin. What he effected in the case of the first, though not trifling in itself, is inconsiderable as compared with the whole mass of Galen's writings; and of his translations from Aristotle, some of which are known to have been completed, nothing has survived. The following are the works of Galen translated by Linacre:—(1) *De Sanitate Tuenda*, printed at Paris in 1517; (2) *Methodus Medendi*, Paris, 1519; (3) *De Temperamentis et de Inæquali Intemperie*, Cambridge, 1521; (4) *De Naturalibus Facultatibus*, London, 1523; (5) *De Symptomatum Differentiis et Causis*, London, 1524; (6) *De Pulsuum Usu*, London, without date. He also translated for the use of his pupil Prince Arthur an astronomical treatise of Proclus, *De Sphæra*, which was printed at Venice by Aldus in 1499. The accuracy of these translations and their elegance of style were universally admitted. They have been generally accepted as the standard versions of those parts of Galen's writings and frequently reprinted, either as a part of the collected works or separately.

But the most important service which Linacre conferred upon his own profession and science was not by his writings. To him was chiefly owing the foundation by royal charter of the College of Physicians in London, which first gave the medical profession in this country a recognized legal status, and which has been the model of all the similar colleges of physicians and surgeons in the three kingdoms. He was the first president of the new college, which he further aided by conveying to it his own house, and by the gift of his library. Shortly before his death Linacre obtained from the king letters patent for the establishment of readerships in medicine at Oxford and Cambridge, and placed some valuable estates in the hands of trustees for their endowment. Two readerships were founded in Merton College, Oxford, and one in St. John's College, Cambridge, but owing to neglect and bad management of the funds, they fell into uselessness and obscurity. The Oxford foundation was revived by the university commissioners in 1856 in the form of the Linacre professorship of anatomy. Posterity has done justice to the generosity and public spirit which prompted these foundations; and it is impossible not to recognize a strong constructive genius in the scheme of the College of Physicians, by which Linacre not only first organized the medical profession in England, but impressed upon it for some centuries the stamp of his own individuality. The intellectual fastidiousness of Linacre, and his habits of minute accuracy were, as Erasmus suggests, the chief cause why he accomplished so little and left behind no more permanent literary memorials. It will be found, perhaps, difficult to justify by any extant work the extremely high reputation which he enjoyed among the scholars of his time. His Latin style was so much admired that, according to the flattering eulogium of Erasmus, Galen spoke better Latin in the version of Linacre than he had before spoken Greek; and even Aristotle displayed a grace which he hardly attained to in his native tongue. Erasmus praises also Linacre's critical judgment (vir non exacti tantum sed severi judicii). According to others it was hard to say whether he were more distinguished as a grammarian or a rhetorician. Of Greek he was regarded as a consummate master; and he was equally eminent as a "philosopher," that is, as learned in the works of the ancient philosophers and naturalists. In this there may have been, as the custom of the day was, some exaggeration; but all have acknowledged the elevation of Linacre's character, and the fine moral qualities summed up in the epitaph written by John Caius:—"Fraudes dolosque mire perosus; fidus amicis; omnibus ordinibus juxta carus."

The materials for Linacre's biography are to a large extent contained in the older biographical collections of George Lilly (in Paulus Jovius, *Descriptio Britanniæ*), Bale, Leland, and Pits, in Wood's *Athenæ Oxonienses*, and in the *Biographia Britannica*; but all are completely collected in the *Life of Thomas Linacre*, by Dr. Noble Johnson, London, 1835. Reference may also be made to Dr. Munk's *Roll of the Royal College of Physicians*, 2d ed., London, 1878, and the introduction, by Dr. Payne, to a facsimile reproduction of Linacre's version of *Galen. de Temperamentis*, published by Messrs. Macmillan, Cambridge, 1881. With the exception of this treatise, none of Linacre's works or translations have been reprinted in modern times. (J. F. P.)

LINARES, an important mining town in the province of Jaen, Spain, is situated in an arid plain, near the foot of the Sierra Morena, 24 miles north-north-east from the town of Jaen, 12 north-east from that of Baeza, and half an hour by rail from the Vadollano station of the Madrid and Cordova line. The streets are ill paved, irregular, and ugly, and, apart from a fine fountain of Roman origin, the town presents no architectural features of interest. There is some trade in the oil and wine of the neighborhood, which are excellent and plentiful; wool is exported to Catalonia and Valencia; and cattle-breeding, especially of animals for the bull-ring, is also carried on. But the population, which in 1877 numbered 36,630, and includes some 120 English, with a consul and a chaplain, is chiefly engaged in the working of the extensive lead-mines to the north-west of the town, and in various concomitant industries, such as the manufacture of gunpowder, dynamite, match for blasting purposes, rope, and the like. The mining plant is entirely imported, principally from England. In respect of the quantity and uniform excellence of their productions the lead-mines of the province of Jaen are unsurpassed. For the year 1876–77 the joint output of those of Linares, Vilches, Bailen, Carboneros, Santa Helena, and (in part) La Carolina was stated at 1,620,000 cwts. of ore worth upwards of £800,000,—the proportion of silver to lead varying from 20 to 60 grammes of the former to every 50 kilogrammes of the latter. The best class of ore is exported, chiefly to France and Belgium; the inferior classes are smelted for the most part in Spain. About 2 miles to the south of Linares is the village of Cazlona, which still shows some remains of the ancient Castulo; and the ancient mines some 5 miles to the north, which are now known as "Los Pozos de Anibal," may with some probability be assigned to the Carthaginian period.

Plate VIII.

LINCOLN, one of the four eastern maritime counties of England, lies between 52° 39′ and 53° 43′ N. lat., and 0° 22′ E. and 0° 56′ W. long. It is bounded on the N. by the Humber, E. by the German Ocean and the Wash, S.E. for 3 miles by Norfolk, S. by Cambridge and Northampton, S.W. by

Rutland, W. by Leicestershire and Notts, and N. W. by Yorkshire. Its greatest length north and south, from Barton-on-Humber to Market Deeping, is 75 miles, its greatest breadth, from Wroot on the west to Salt-fleet on the east, is 50 miles, its circuit about 260 miles. Its area is 1,767,962 acres, or about 2762 square miles, making it the second largest county in England.

Coast-Line.—The coast-line, about 110 miles in length, is low and marshy, and artificial banks for guarding against the inroads of the sea are to be found, in places, all along the coast. From Grimsby to Skegness traces of a submarine forest are visible; but while the sea is encroaching upon some parts of the coast it is receding from others, as shown by Holbeach, which is now 6 miles from the sea. Several thousand acres have been reclaimed from this part of the Wash, and round the mouth of the Nene on the south-east. The deep bay between the coasts of Lincolnshire and Norfolk, called the Wash, is full of dangerous sandbanks and silt; the navigable portion, off the Lincolnshire coast, is known as the Boston deeps. The rapidity of the tides in this inlet, and the lowness of its shores, which are generally indistinct on account of mist from a moderate offing, render this the most difficult portion of the navigation of the east coast of England.

Surface and Geology.—The surface of Lincolnshire is generally a large plain, some portions of which are below the level of the sea. The south-east parts are perfectly flat; and about one-third of the county consists of fens and marshes, intersected in all directions by artificial drains, called locally dykes, delphs, drains, becks, leams, and eaux. This flat surface is, however, broken by two ranges of calcareous hills running north and south through the county, and known as the Cliff and the Wolds. The former range, on the west, runs nearly due north from Grantham to Lincoln, and thence to the Humber, traversing the Heaths of Lincolnshire, which were formerly open moors, rabbit warrens, and sheep walks, but are now enclosed and brought into high cultivation. Parallel with this range on the east side of it runs the old Roman Ermine Street, sometimes called the Cliff Row Road. The Wolds form a ridge of bold hills extending from Spilsby to Barton-on-Humber for about 40 miles, with an average breadth of about 8 miles. Between the Wolds and the sea lie the Marshes, a level tract of rich alluvial soil extending from Barton-on-Humber to Wainfleet, varying in breadth from 5 to 10 miles. Between the Welland and the Nene in the south-east of the county are Gedney Marsh, Holbeach Marsh, Moulton Marsh, and Sutton Marsh.

The Fens, the soil of which has been formed partly by tidal action and partly by the decay of forests, occupy the Isle of Axholme on the north-west, the vale of Ancholme on the north, and most of the country south-east of Lincoln. The chief of these are the Holland, Wildmore, West, and East Fens draining into the Witham; and the Deeping, Bourn, Great Porsand, and Whaplode Fens draining into the Welland. Owing to the dead level of these districts there is perhaps more artificial drainage in Lincolnshire than in any other English county; and this part of the country resembles in many respects, especially in embankments and dykes, the continental Holland.

The drainage of the Fens appears to have early occupied attention. Shortly after the Norman Conquest Richard de Rulos, lord of Brunn, and chamberlain to William I., enclosed and drained a large part of Deeping Fen in so complete a manner that the work would not be disgraced by a comparison with the more scientific efforts of modern times. Excluding the Welland by a bank, he changed "deep lakes and impassable fens into most fruitful fields and pastures, and the most humid and moorish parts thereof into a garden of pleasure."

The drainage of the remaining levels of Lincolnshire was chiefly commenced in the reigns of James I. and Charles I. The East, West, and Wildmore Fens were contracted for in the 7th Charles I. The earl of Lindsey undertook all the fens in Holland and Kesteven, north of the river glen up to Lincoln, on the completion of which 24,000 acres were awarded to him. In the 13th of the same reign, the king declared himself the "Undertaker" of the Holland Fen, containing 22,000 acres, out of which he was to have 8000 for his share. Sir John Monson with other freeholders drained the Ancholme level in the north, and had 5827 acres assigned to them. In the same reign the Isle of Axholme was undertaken by Cornelis Vermuijden and his Dutch and Flemish followers. These operations were interrupted during the civil wars, and many of the works destroyed by the "stilt-walkers," so curiously described by Camden. Little was done towards restoring the works thus destroyed till the middle of the 18th century, when several townships, having a right of common over particular fens, began to join in procuring Acts of Parliament for their drainage, enclosure, and division. The Holland Fen was the first to be dealt with, about 1768; in spite of renewed and riotous opposition from the "stilt-walkers," all the fen lands were successfully drained and enclosed, and on the completion of the East, West, and Wildmore Fens (about 60,000 acres) the race of "stilt-walkers" became extinct. The low lands adjoining the tidal reaches of the Trent and Humber, and part of those around the Wash, have been raised above the natural level, and enriched by the process of warping, which consists in letting the tide run over the land, and retaining it there a sufficient time to permit of the deposit of the sand and mud held in solution by the waters.

The general appearance of the county is very pleasing. The level tracts are richly cultivated; the hills and dales are interspersed with wood and lawn; and many spots on the Cliff or Wolds command extensive and charming views. The charms of the Fen districts are described as "a beauty as of the sea, of boundless expanse and freedom" (Kingsley). Not a few passages in the writings of Tennyson (a native of the county) bear the impress of the scenery and colorings of the Fens.

The geological formations, for the most part, extend in parallel belts, nearly in the line of the length of the county, from north to south, and succeed one another, in ascending order, from west to east.

1. The lowest is the *Triassic* or *New Red Sandstone* found in the Isle of Axholme and the valley of the Trent in the form of marls, sandstone, and gypsum. The presence of the peroxide of iron which tinges the beds red seems to have been prejudicial to animal life; therefore few fossils are found. Fish scales and teeth, with bones and footprints of the *Labyrinthodon*, are to be met with in the sandstone. The red clay is frequently dug for brick-making. The beds dip gently towards the east. At the junction between the Trias and Lias are series of beds termed Rhætics, which seem to mark a transition from one to the other. These beds are in part exposed in pits near Newark, and extend north by Gainsborough, to where the Trent flows into the Humber, passing thence into Yorkshire. The characteristic shells are found at Lea, 2 miles south of Gainsborough, with a thin stratum of bone bed full of fish teeth and scales.

2. The *Lower Lias* comes next in order, with a valuable bed of ironstone now largely worked. This bed is about 27 feet in thickness, and crops out at Scunthorpe, where the workings are open and shallow. The *Middle Lias*, which enters the county near Woolsthorpe, is about 20 or 30 feet thick, and is very variable both in thickness and mineralogical character. The *Upper Lias* enters the county at Stainby, passing by Grantham and Lincoln. It forms the west slope of the Cliff range, and is thickest upon the highest hills. The Lias thus occupies a band about 8 or 10 miles in width in the south, narrowing until on the Humber it is about a mile wide.

3. To this succeed the three Oolite formations. The *Lower Oolite*, somewhat narrower than the Lias, extends from the boundary with Rutland due north past Lincoln to the vicinity of the Humber. The *Middle Oolite*, very narrow in the south near Wilsthorpe, widening gradually about Sleaford, and then suddenly contracting again south of Lincoln, sends out a narrow band south-east towards Spilsby. It then proceeds north from Lincoln with decreasing width to the vicinity of the Humber. The *Upper Oolite* and Kimmeridge clay start from the vicinity of Stamford, and after attaining their greatest width near Horncastle, run north-north-west to the Humber.

4. In the *Cretaceous* system of the Wolds, the Lower Greensand runs nearly parallel with the Upper Oolite past South Willingham to the Humber. The Upper Greensand and Gault run north-west from Irby, widening out as far as Kelstern on the east, and cross the Humber. The Chalk formation, about equal in breadth to the three preceding extends from Burgh across the Humber.

All the rest of the county, comprising all its south- portions between the Middle Oolite belt and the sea, s north-east portion between the Chalk belt and the and a narrow tract up the course of the Ancholme :, consists of alluvial deposits or of reclaimed marsh.

inerals.—Gypsum is dug in the Isle of Axholme, ing is made from the chalk near the shores of the nber, and lime is made on the Wolds. Freestone arried around Ancaster, and good oolite building e is quarried near Lincoln and other places. Iron- e is found and worked at Claxby near Caistor, and ied into Yorkshire to be smelted; it is also worked rodingham, 9 miles north-north-west of Brigg.

ivers.—The Humber separates Lincolnshire from kshire. Its ports on the Lincolnshire side are Bar- New Holland, and Grimsby. The Trent divides Isle of Axholme from Lindsey, and falls into the nber about 30 miles below Gainsborough. Like the ern, it is noted for a tidal phenomenon called the ger" or bore, which at spring tides rises to the ht of from 6 to 8 feet. The Witham rises on the h-west border of the county, flows north past Grant- to Lincoln, and thence east and south-east to Bos- after a course of about 80 miles. This river was noted for its pike. The Welland rises in north- t Northamptonshire, enters the county at Stamford, , after receiving the Glen, flows through an artificial nnel into the Fossdyke Wash. The Nene on the th-east has but a small portion of its course in Lin- shire; it flows due north through an artificial out- called the Wisbech Cut.

anals.—The principal canals are—the Stainforth Keadby, connecting the Trent with the Yorkshire l-field; the Louth Navigation, from Louth to Tet- Haven; the Sleaford Navigation, connecting Slea- l with the Witham; and the Grantham Canal, n that town to the Trent at Nottingham. The re- inder are chiefly small rivers artificially deepened l embanked.

limate.—The climate of the higher grounds is now ed for its salubrity, and meteorological observation s not justify the reputation for cold and damp often en to the county as a whole. The mean annual perature of the Fens as given by ten years' obser- ion (1864–73) is 47°·9, 1°·6 below that of Greenwich. e rainfall of the Fen district is very small as com- ed with other parts of England. While the aver- of the whole country was little over 30 inches, at ston the average fall from 1830 to 1849 was 23·58 hes, and from 1850 to 1869 22·08. At Wisbech th-west winds prevail on an average six months in year, and north-east winds barely two months.

Soil and Agriculture.—The soils vary considerably, ording to the geological formations; ten or twelve ferent kinds may be found in going across the coun- from east to west. A good sandy loam is common the Heath division; a sandy loam with chalk, or a ty loam on chalk marl, abounds on portions of the olds; an argillaceous sand, merging into rich loam, s on other portions of the Wolds; a black loam and ich vegetable mould cover most of the Isle of Ax- lme on the north-west; a well-reclaimed marine rsh, a rich brown loam, and a stiff cold clay vari- sly occupy the low tracts along the Humber, and be- een the north Wolds and the sea; a peat earth, a ep sandy loam, and a rich soapy blue clay occupy st of the east and south Fens; and an artificial soil, obtained by "warping," occupies considerable low strips of land along the tidal reaches of the rivers. The wide grazing lands of Lincolnshire have long been famous, and the arable lands are specially adapted for the growth of wheat and beans. There is no generally recognized rotation of crops. The cattle raised are the Shorthorns and improved Lincolnshire breeds. The dairy, except in the vicinity of large towns, receives little attention. The sheep are chiefly of the Lincolnshire and large Leicestershire breeds, and go to the markets of Yorkshire and the metropolis. Lincolnshire has long been famous for a fine breed of horses both for the saddle and draught. Horse fairs are held every year at Horncastle and Lincoln. Large flocks of geese were formerly kept in the Fens, but their number has been diminished since the drainage of these parts. Where a large number of them were bred, nests were constructed for them one above another; they were daily taken down by the goose-herd, driven to the water, and then reinstated in their nests, without a single bird being misplaced. Decoys were once numerous in the undrained state of the Fens.

According to the agricultural returns for 1881, the total area under crops comprehended 1,498,676 acres, a percentage of 84·7 instead of 81·7 in 1870; corn crops had an area of 611,977 acres, a percentage of 34·6 instead of 34·9 in 1870; green crops, 238,719 acres, a percentage of 13·5 instead of 13·2 in 1870; rotation grasses, 167,252 acres, a percentage of 9·5 instead of 9·4; permanent pasture, 440,422 acres, a percentage of 24·9 instead of 23·0. The area under crops is thus more than three times the amount under pasturage. The area under woods in 1881 was 39,431 acres and under orchards 1788, under market gardens 660, under nursery grounds 137. Of the corn crops the most largely grown is wheat, which in 1881 occupied 245,645 acres,—barley or bere, grown mostly on the Wolds and the Heath districts, coming next with 199,900 acres; then oats, 113,564 acres; lastly rye, 1300 acres. Beans occupied 41,073 acres, pease 10,495 acres. Of the green crops the most largely grown in 1881 were turnips and swedes, 142,300 acres, mostly on the Wolds and Lincoln Heath. Potatoes occupied 39,794 acres; mangold, 21,438; vetches and other green crops, except clover or grass, 18,615 acres; cabbage, kohl-rabi, and rape, 15,057 acres; carrots, 1515 acres. Onions are raised to a great extent in the Isle of Axholme, and under good management have been known to return £50 per acre. Flax occupied 353 acres, and hops 3. The bare fallow or uncropped arable land in 1881 was 39,950 acres. In 1870, 81·7 per cent. of the entire area of Lincolnshire was returned as cultivated, in 1879, 84·1 per cent., and in 1880, 84·5. The number of horses used solely for agriculture in 1881 was 49,656; mares and unbroken horses, 15,171—total, 64,827. The number of cows and heifers in milk or in calf in 1881 was 53,499, and of other cattle 156,706. The number of sheep was 1,336,147, or 90·2 for every 100 acres, the average for Great Britain being 76·3, for England 62·4. Pigs in 1881 numbered 82,497.

The agriculture of Lincolnshire is only second to that of East Lothian, by which alone it is excelled in the use of fixed steam-engines upon its farmsteads. In the south part of the county small proprietors abound. According to the landowner's returns for 1872–73, the land in the county of Lincoln was divided among 30,497 owners, and its gross estimated rental was £3,173,825. Of the owners, 13,768, or more than 45 per cent., possessed less than 1 acre; the average value per acre was £1, 19s. 6½d. There were four proprietors possessing over 20,000 acres each:—Earl of Yarborough, 55,272 acres; Lady Willoughby de Eresby, 24,696 acres; Henry Chaplin, M.P., 23,370 acres; and Christopher Turnor, 20,664 acres.

The following table gives a classification of holdings according to size as returned on the 25th June, 1875, and the 4th June, 1880:—

lass of holding.	50 Acres and under.		50 to 100 Acres.		100 to 300 Acres.		300 to 500 Acres.		500 to 1000 Acres.		1000 Acres and upwards.		Total.	
	1875.	1880.	1875.	1880.	1875.	1880.	1875.	1880.	1875.	1880.	1875.	1880.	1875.	1880.
umber	19,706	20,263	2,181	2,196	2,888	2,826	817	833	370	388	28	36	25,990	26,542
rea in acres......	221,837	224,826	156,085	155,559	511,042	500,575	313,136	318,612	239,468	249,538	33,879	45,516	1,475,447	1,494,626

Manufactures and Trade.—The manufactures are w and comparatively small. There are, however, me large agricultural machine and steam-engine factories in and around Lincoln; and similar works exist at Boston, Gainsborough, Grantham, and Louth. At Frodingham there are extensive iron-works. At Little

Bytham a very hard brick, called the adamantine clinker, is made of the silicious clay that the Romans used for their manufactures of pottery. At Louth there is a carpet manufactory, also several tanneries and iron foundries. Bone crushing, leather working, the manufacture of oil-cake for cattle, rope making, and sack weaving are carried on in various places. The chief ports are Grimsby, Boston, Sutton, Bridge, and Gainsborough, the first being by far the most important. For the fisheries of GRIMSBY see vol. ix. p. 217.

Railways.—The first line opened in the county was the Midland Railway to Lincoln, in August, 1846. The Manchester, Sheffield, and Lincolnshire Railway, first opened in 1848–49, goes from Lincoln north-east to Market Rasen, and thence, by way of Barnetby and Ulceby junctions, to Grimsby and Cleethorpes. A second branch runs north-east from Gainsborough to New Holland and Barton on the Humber, and a third from Barnetby due west to the Yorkshire coal-fields. The Great Northern main line runs through the south-west of the county past Grantham to Newark, and throws off several branches. A loop line connecting Spalding, Boston, and Lincoln with the direct line from London to York was opened in 1848. The East Lincolnshire Railway (leased to the Great Northern) runs from Boston to Grimsby.

Administration.—The primary divisions of Lincolnshire are three trithings or ridings. The north division constitutes the Parts of Lindsey, the south-west the Parts of Kesteven, and the south-east the Parts of Holland. Each of these divisions had before the Norman Conquest its own trithing gerefa or reeve, and to this day each has its separate magistrates, quarter sessions, clerk of the peace and treasurer, but they are all under one lord-lieutenant and one sheriff, and subject to the court of assize held at Lincoln. These "Parts" are again subdivided into wapentakes, sokes, and hundreds. The trithings do not in any way coincide with parliamentary divisions. The Parts of Lindsey comprise more than half the county, and contain seventeen wapentakes. The Parts of Kesteven, exclusive of the soke and borough of Grantham and the borough of Stamford, comprise nine wapentakes. The Parts of Holland comprise three wapentakes only. Before the passing of the Reform Act of 1832 Lincolnshire sent twelve members to parliament—two for the county, two for the city of Lincoln, and two each for the boroughs of Great Grimsby, Boston, Grantham, and Stamford. After the passing of that Act the county returned four members, and Grimsby lost one. In 1867 Stamford also lost a member, and the representation of the county, newly divided into Mid, North, and South Lincolnshire, was increased to six, each new division returning two members. Lincolnshire comprises one city, Lincoln (population 37,312), which is also a municipal and parliamentary borough; four other municipal and parliamentary boroughs—Boston (18,867), Grantham (17,345), Great Grimsby (45,373), Stamford, partly in Northampton (8995); and one municipal borough—Louth (10,690).

The county belongs to the midland circuit. Besides the winter and summer assizes held at Lincoln, there are spring assizes held at the same place for Lincoln and Notts, and autumn assizes at Nottingham for Notts and Lincoln. Quarter sessions for the Parts of Lindsey are held at Lincoln and Spilsby, for the Parts of Kesteven at Bourn and Sleaford, for the Parts of Holland at Boston and Spalding. The county is divided into seventeen county court districts, many of which coincide with the unions. For the convenience of rating there are eighteen poor law unions; five of these, however, include eighty parishes in the adjacent counties. Ecclesiastically the county, with that of Nottingham, forms the diocese of Lincoln, which is divided into the three archdeaconries of Lincoln, Stow, and Nottingham, the latter place giving title to a suffragan bishop without a see.

Education.—The educational resources of the county in 1881 embraced one theological and one training college, both at Lincoln, and fourteen endowed grammar schools at the following places:—Alford (founded 1565), Boston (1554), Bourn (1636), Caistor (1630), Donington (1701), Gainsborough (1589), Grantham (1528), Horncastle (1571), Lincoln (1583), Louth (1551), Moulton (1561), Sleaford (1604), Spalding (1588), Spilsby (1550).

Population.—In 1881 the population of the county was 469,994 (235,014 males and 234,980 females); in 1861 it had been 412,246, and 436,599 in 1871. The figures for nine of the principal towns, in addition to the boroughs already given, are as follows:—Bourn (7121), Caistor (8793), Gainsborough (10,964), Glandford Brigg (3107), Holbeach (5190), Horncastle (4814), Sleaford (4967), Spalding (9260), and Spilsby (7082).

History and Antiquities.—It is highly probable that the territory now forming Lincolnshire was first settled by a tribe of the Belgæ, who, however, at the time of the invasion by Cæsar, had become a mixed race with the real Britons. This territory was unaffected by Cæsar's first invasion, and even after the reduction of Britain by Claudius the Fenland remained intact. The county was conquered about 70 A. D., and formed part of the province of Flavia Cæsariensis. The tribes which occupied Lincolnshire, according to Ptolemy, were the Coritani, who had Lindum and Ratæ (Leicester) for their towns. The date of the introduction of Christianity is uncertain, but we learn from Bede (*Hist. Eccles.*, ii. 16) that Adelphius of Colonia Londinensium, which has been mistaken for London, attended the council of Arles (314). Under the Saxon kingdom of Mercia, Lindsey, which probably extended nearly or quite over the modern county of Lincoln, appears to have been a dependent state. Under Edward of Northumbria, the conqueror of Mercia, Christianity was reintroduced by Paulinus of York, and Bede tells us that Blæcca, the governor of Lincoln, was, with his household, among the first converts (628).

Early in 870 the Danes or Northmen landed at Humberstone near Grimsby, and ravaged Lindsey and the famous monastery of Bardney on the Witham. Lincolnshire passed permanently into the hands of the Danes about 877, and was included within the boundary of the "Danelage" of Danish jurisdiction as settled by the treaty of 878. Probably the greatest changes consequent upon the Danish invasion are, first, the supplanting of the Anglo-Saxon names of places by those of the Danish termination ending in *by*, which are numerous, and the substitution of the wapentake for the earlier division of the hundred; the ancient British laws and those of the Danes were otherwise not dissimilar. In time the two populations became amalgamated and came under the dominion of the Anglo-Saxon crown. The subsequent history of the county under the Normans is associated more or less with the city of Lincoln. In the civil war between Stephen and the empress Matilda a battle was fought near Lincoln in 1141. In 1174 the Isle of Axholme was the scene of the struggle between Roger de Mowbray one of the adherents of Prince Henry, and the forces sent against him by his father Henry II. The issue was decided by the Lincolnshire men in favor of the king. In 1216 occurred King John's march across the county, when he lost all his baggage and jewels in the Fossdyke Wash on his way to Swineshead Abbey. In the reign of Edward IV. Sir Robert Wells, at the head of 30,000 Lincolnshire men, was defeated at Losecoat Field near Stamford, March, 1470. At the suppression of the monasteries a rebellion broke out at Louth headed by Makerel, the last prior of the abbey of Barlings Oxney, October, 1536. The prior was hanged, and the shire for the trouble it gave to King Henry VIII. was designated in a state paper as "one of the most brute and beestalie of the whole realm." During the civil wars the county was a scene of numerous contests, the most famous of which was the battle at Grantham in 1643, won by Cromwell over the royalists. The advantage that was taken by the Fenmen to destroy the efforts made to drain and enclose the remaining levels of Lincolnshire during this stormy period has been already noticed. Riots broke out at intervals, and were continued down to the middle of the 18th century.

Remains of British camps are found at Barrow, Folkingham, Ingoldsby, Revesby, and Well. Traces of Roman camps are found at Alkborough, Caistor, Gainsborough, Gedney Hill near Holbeach, Honington near Grantham, South Ormsby, and Yarborough. The Roman roads are nearly perfect,—Ermine Street, on the east side of the Cliff hills, and the Fossway running south-west from Lincoln. The crown of these remains is without doubt the famous Roman arch called the Newport Gate at Lincoln. Tesselated pavements have been found at Denton, Horkstow, Lincoln, Scampton, and Winterton. Coins of the emperors Nero, Vespasian, and Julian have been found at Lincoln and Ancaster, and two Roman altars to the west of Stow.

There are remains of feudal castles at Boston, Lincoln, Sleaford, Somerton, Tattershall, and Torksey. The seats worthy of note (chiefly modern) are Appleby Hall, Aswarby Hall, Belton House, Blankney Hall, Brocklesby, Bulby House, Burghley House (near Stamford), Burton Hall, Casewick House, Denton Hall, Easton Hall, Hackthorn Hall, Haverholm Priory, Lea Hall, Leadenham House, Manby Hall, Newton House, Nocton Hall, Normanby Hall, Norton Place, Panton Hall, Riby Grove, Somerby Park, Stourton, Syston Park, Thonock House, Thurlby Hall, Uffington, and Willingham by Stow.

At the time of the suppression of the monasteries in the reign of Henry VIII. there were upwards of one hundred religious houses; and among the Fens rose some of the finest abbeys held by the Benedictines. The Gilbertines were a purely English order which took its rise in Lincolnshire, the canons following the Austin rule, the nuns and lay brothers that of the Cistercians. They generally lived in separate houses, but formed a community having a common church in which the sexes were divided by a longitudinal wall. These houses were at Alvingham, Catley, Holland Brigg, Lincoln, before the gate of which was erected the first Eleanor Cross, Newstead in Lindsey, Sempringham, the chief house of the order, founded by St. Gilbert of Gaunt in 1139, Stamford (a college for students), and Welles. There were nunneries of the order at Haverholm, Nun Ormsby, and Tunstal.

The following are a few of the most famous abbeys. (1) Barlings Oxney (Premonstratensian), founded 1154, for fourteen canons. The tower, Decorated, with arcading pierced with windows, and the east wall of the south wing remain. (2) The Benedictine Mitred Abbey of Crowland, founded 716, refounded in 948. The foundations of the new church in 1114 were laid on massive piles of oak. Part of the west front was repaired in 1255–81, with beautiful Early English sculpture of the legend of St. Guthlac and saints; this, with the Perpendicular north-west tower, 1460–70, remain. (3) Swineshead Abbey (Carthusian), colonized from Furness in 1134 by eleven monks. (4) Thornton-upon-Humber Abbey (Black Canons), founded in 1139. There remain a fragment of the south wing of the transept, two sides of the decagonal chapter-house (1282), and the beautiful west gate-house, Early Perpendicular (1382–88), with an oriel window on the east.

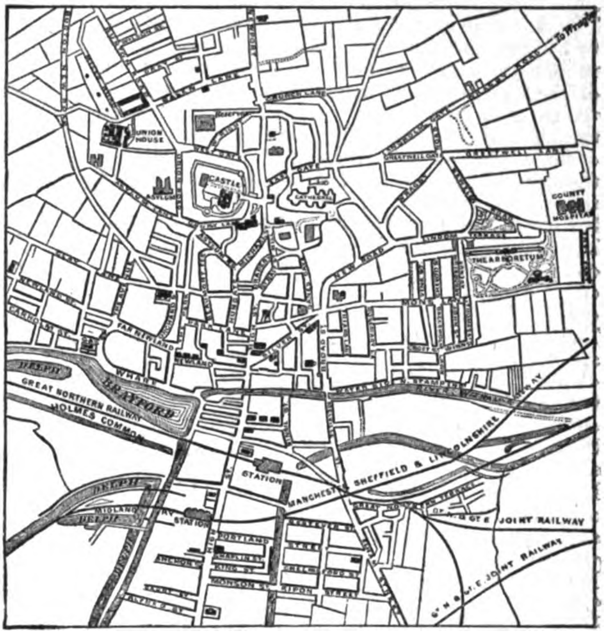
The general beauty of the parish churches of Lincolnshire is proverbial, but it is incorrect to suppose that they are equally good in every part of the county. In the Parts of Lindsey, though there are some of considerable beauty and interest, the churches can scarcely be considered above the average; several though small and mean present curious early features, particularly the well-known tower of St. Peter, Barton-on-Humber, supposed to be of the Saxon period, and those of Crowle, Heapham, and Stowe. Those of Grimsby and Wainfleet are cruciform.

In the Parts of Kesteven the churches are not only elegant but well finished, built of excellent stone which abounds at Ancaster and near Sleaford. The church of St. Andrew Heckington is the best example of Middle Pointed architecture in the county; it is famed for its Easter sepulchre and fine sedilia. The largest and finest church in this division is doubtless that of St. Wolfran at Grantham, 200 by 87 feet, with three collateral naves, and steeple, 271 feet high, of the 14th century.

It is principally in the Parts of Holland that we are to look for the finest churches in the county; they are not to be equalled by those of any other district in the kingdom, which is the more remarkable as the district is comprised wholly of marsh land, and is without stone of any kind. It is highly probable that the churches of the south part of this district owe their origin to the munificence of the abbeys of Crowland and Spalding. The earliest specimen of Norman architecture is that of Long Sutton, which has been called the counterpart of Christ Church, Oxford. St. Mary and Nicholas at Spalding, 157 feet by 95, has the uncommon feature of a double aisle on each side of the nave, as well as a transept. The glory of the division of Holland is beyond question the church of St. Botolph, Boston.

Lincoln, the capital of the county of that name, is a city and county in itself, and is also a municipal and parliamentary borough. It is picturesquely situated on the summit and south slope of the limestone ridge of the Cliff range of hills which rises from the north bank of the river Witham, at its confluence with the Foss Dyke, to an altitude of 200 feet above the banks of the river. It is 132 miles north-west from London by road, and 138 miles by rail; 53° 15′ N. lat., 32′ W. long.

Lincoln is one of the most ancient and interesting cities in England. The ancient British town occupied the crown of the hill beyond the Newport or North Gate of the subsequent Roman town, the ancient earthworks and ditches of which are nearly conterminous with the present boundaries of the parish of St. John. The Roman town consisted of two parallelograms of unequal length, the first of which extended west from the Newport gate to a point a little west of the castle keep. The second parallelogram extended due south from this point down the hill towards the Witham as far as Newland, and thence in a direction due east as far as Broad Street. Returning thence due north, it joined the south-east corner of the first and oldest parallelogram in what was afterwards known as the Minster yard, and terminated its east side upon its junction with the north wall in a line with the Newport gate. This is the oldest part of the town, and is named "above hill." After the departure of the Romans, the city walls were extended still further in a south direction across the Witham as far as the great bar gate, the south entrance to the High Street of the city; the junction of these walls with the later Roman one was effected immediately behind Broad Street. These three divisions comprise the boundaries of the municipal and parliamentary boroughs, which are conterminous. The "above hill" portion of the city is not well built, but consists of narrow irregular streets, some of which are too steep to admit of being ascended by carriages. The south portion, which is named "below hill," is much more commodious, and contains the principal shops and inns, with many elegant buildings and private residences. Here also are the Great Northern and Midland Railway stations.



Plan of Lincoln.

The glory of Lincoln is its noble minster. As a study to the architect and antiquary this stands unrivalled, not only as the earliest purely Gothic building in Europe, but as containing within its compass every variety of style from the simple massive Norman of the west front, to the Late Decorated of the east portion. The building material is the oolite and calcareous stone of Lincoln Heath and Haydor, which has the peculiarity of becoming hardened on the surface when tooled. In former days the cathedral had three spires, all of wood or leaded timber. The spire on the central tower was blown down in 1547. Those on the two western towers, 101 feet high, were removed in 1808; good representations of them will be found in the well-known views by Hollar and Buck. The ground plan of the first church, adopted from that of Rouen, was laid by

Bishop Remigius in 1086, and the church was consecrated four days after his death, May 6, 1092; the central west front and the font are of this period. The approximate dates of the remaining portions of the fabric may be assigned as follows:—the three west portals and the Norman portion of the west towers above the screen to the top of the third story, about 1148; the nave, its aisles, and the north and south chapels of the west end, completed 1220; the Early English portion of the west front, and the upper parts of the north and south wings, with pinnacle turrets, 1225; the west porch of the main transept, 1220; the crossing, and lower part of the central tower, 1235; the upper part, 1307; the west door of the choir aisles, 1240. The south porch of the presbytery dates 1256. The east window, the finest of its style in England, 57 by 34 feet, dates 1258–88. The choir screens date 1280, the Easter sepulchre 1290. The gables and upper parts of the main transept, the parapets of the south side of the nave, south wing, and west front, and the screen in the south aisle, all date from 1225. The upper parts of the west towers date from 1365; their upper stories, the west windows and parapet of the galilee porch, and the chapel screens in the transept, 1450. The vaulted lantern of the central tower is 127 feet above the floor. The main transept has two fine rose windows; the one on the north called the Dean's Eye is 30 feet in diameter. The Bishop's Eye to the south is very fine Decorated (*c.* 1350). The rood screen is mainly *c.* 1340.[1] The other buildings in the close that call for notice are the chapter-house of ten sides, 60 feet diameter, 42 feet high, with a fine vestibule of the same height built in 1225, and the library, 104 by 17 feet, which contains a little museum. Among the most famous bishops were St. Hugh, who died 1200; Grosseteste, died 1253; Flemming, died 1431, founder of Lincoln College, Oxford; Smith, died 1521, founder of Brasenose, Oxford; Wake; and Gibson. Every stall has produced a prelate or cardinal; among those who have been capitular members may be named Walter Mapes, Henry of Huntingdon, Polydore Vergil, W. Grocyn, W. Outram, George Herbert, S. Pegge, W. Paley, Cartwright, inventor of the power-loom, and O. Manning the topographer. Lincoln, the enormous diocese of which in early times extended from the Thames to the Humber, was one of the thirteen cathedrals of the old foundation served by secular canons.

History.—The name of Lincoln is a hybrid of Celtic and Latin. It appears in the Ravenna geographer in the form of Lindum Colonia, and in Bede as Lindocolina. Lindum is purely Celtic, and exactly describes the early British settlement as the "hill fort by the pool." Lindum Colonia was founded on the site of what is now the castle and cathedral, about 100 A.D. It was besieged by Saxons in 518, and became one of the chief cities of Mercia. After being frequently ravaged by the Danes, Lincoln was recovered by Edmund II. in 1016. Lincoln Castle was built by William I. in 1086, which occasioned the removal of one hundred and sixty-six houses. Great and destructive fires occurred in 1110, 1123, and 1141. King Stephen besieged the Empress Matilda in the castle in 1140. Henry II. was crowned there in the following year, as was King Stephen at Christmas, 1147; David, King of Scots, did homage to King John, 1201. Lincoln was captured by King John in 1216, and invested by the barons in 1217. The battle of Lincoln Fair took place in 1218. The city was sacked in 1266. John of Gaunt, Earl of Lincoln, married there in 1396 Lady Swinford, Chaucer's sister-in-law; in virtue of his title he held the castle, but built himself a winter house in the lower part of the city. A parliament of Henry VI. met at Lincoln in 1466. The town was stormed by Earl Manchester on behalf of the Parliament in 1644.

Antiquities.—One of the most perfect specimens of genuine Roman architecture in England is the Newport or North Gate of Lincoln. It is sunk fully 11 feet below the present level of the street, and has two smaller arches on each side, the one to the west being concealed by an adjoining house. The Roman Ermine Street passes through this gate, and runs north from it for 11 or 12 miles as straight as an arrow. Many Roman coins, etc., have been found in the immediate vicinity of the gate. The other gates within the city worthy of notice are the Exchequer Gaté, a fine specimen of 13th century work, one of the bosses of the north arch having upon it a carved representation of the crucifixion, Pottergate and Stonebow at the top of High Street, over which is the guildhall. The castle shows traces of Norman work, the foundations of which consisted of massive beams of wood and grouting. The hall of the old episcopal palace is 90 feet by 60 wide, and had two rows of gray marble pillars. The modern palace is at Riseholme, 3 miles north of Lincoln. In the cloister garden are preserved a tesselated pavement and the sepulchral slab of a Roman soldier; the splendidly carved stone coffin-lid of Bishop Remigius found there has recently been removed into the cathedral. The ancient conduits of St. Mary le Wigford, picturesque Gothic, and "the Grayfriar's goodly conduit" in the High Street, may also be noticed. The St. Mary's Guild near St. Peters at Gowts is a fine specimen of Norman architecture; another fine relic of the domestic architecture of this period is the Jews' House, the mouldings of which are identical with those of the west portals of the cathedral (*c.* 1148). Near this is Dunestall, where the little Lincoln boy, afterwards known as Little St. Hugh, was crucified by Jews in August, 1255. There were formerly three small priories, five friaries, and four hospitals in or near Lincoln. The preponderance of friaries over priories of monks is explained by the fact that the cathedral was served by secular canons. The famous Bishop Grosseteste was the devoted patron of the friars, particularly the Franciscans, who were always in their day the town missionaries.

There were fifty-two churches in the city before the Reformation, all the names of which are preserved. Fourteen remain or have been rebuilt. There are fifteen benefices in the city, consisting of three rectories and twelve vicarages. There are fourteen Nonconformist places of worship.

The charities comprise the new county hospital, general dispensary, lunatic asylum, penitent females' home, and institute for nurses. The educational institutions comprise a theological college (formerly old county hospital), grammar school (formerly Grayfriars), blue coat school, training college for mistresses (Newport), St. Martin's parochial schools, British schools (in Newland), Wesleyan school, and a school of art. Of other institutions may be named the Lincolnshire agricultural society, permanent library, mechanics' institute, county newsroom (above hill), city newsroom, and choral society. The remaining public buildings are the new corn exchange and masonic hall, county assembly-room and theatre in High Street. The public park is near the cattle market, and the racecourse beyond Newland. Population in 1811, 7000; in 1871, 26,766; in 1881, 37,312.

For the county and city of Lincoln see Wm. White, *History of Lincolnshire*, 1872; Sir C. H. J. Anderson, *Lincoln Pocket Guide*, 1880; J. P. Faunthorpe, *Geography of Lincolnshire*, 1872; Prof. W. Bright, *Early English Church History*, 1878; Sir Wm. Dugdale, *Monasticon Anglicanum*, 1673–82; J. Geikie. *Prehistoric Europe*, 1881; S. H. Miller and S. B. J. Skertchly, *The Fenland Past and Present*, 1878; Rev. M. C. Walcott, *Memorials of Lincoln*, 1866, and *English Minsters*, 1879, 2 vols. (C. H. C.)

LINCOLN, a city of the United States, capital of Logan county, Illinois, is situated near Salt Creek, at the junction of three railways, 145 miles south-west of Chicago. It has fifteen churches, three banks, a high school, a telephone exchange, a coal-mine, two foundries, three flour-mills, five newspapers, and several grain elevators. It is the seat of Lincoln university (Cumberland Presbyterian) and of the State asylum for feeble-minded youth. A portion of the town dates from 1835, but the newer part was named in honor of Abraham Lincoln, and was incorporated in 1853. Population in 1880, 5639.

LINCOLN, a city of the United States, county seat of Lancaster county, Nebraska, and capital of the State. It is pleasantly situated about 50 miles west of the Missouri river, at the junction of several railroads, in the midst of a highly fertile and healthful region of undulating prairie, and near rich salt springs. Lincoln is the seat of the following State institutions:—university, State prison, insane asylum, and home for the friendless. The prison and the asylum grounds, occupying several hundred acres, are 3 miles from the centre of the city, and 2 miles from each other. The United States Government has lately completed, at a

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[1] The dimensions of the cathedral internally are—nave, 252 × 79·6 × 80 feet; choir, 158 × 82 × 72 feet; angels' choir, which includes presbytery and lady chapel, 166 × 44 × 72 feet; main transept, 220 × 63 × 74 feet; choir transept, 166 × 44 × 72 feet. Externally the west front is 173 feet broad by 130 feet; the west towers are 206 feet high; the central tower, from which booms the new Great Tom of Lincoln (5 tons 8 cwts.), is 262 feet high.

st of $200,000, a massive building for collection of venue, United States courts, and post-office. ith its broad streets, its public park, and the State ouse and other grounds, the healthful ventilation f Lincoln is amply provided for. It has three aily papers, four banks, one of the largest printing d publishing houses west of the Mississippi, and veral prosperous wholesale stores. Although but irteen years old, it has a population (1880) of ,003.

ABRAHAM LINCOLN.

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INCOLN, **Abraham**, who shares with Washington the distinction of supreme fame in American history, came from that old English uaker stock which contributed so many other men f worth to the making and upbuilding of this Reublic. The family name is a common one in New ngland, and it is not improbable that all the incolns in America in colonial days were more or ss closely related. The earliest known ancestors f Abraham Lincoln in America, however, were ettled in Bucks County, Pennsylvania, whence they emoved to Virginia. In anti-Revolutionary days braham Lincoln, the paternal grandfather of the resident, removed from Virginia to Kentucky, here he was a comrade of his brother-in-law Danl Boone. There he was killed by the Indians. He ft a son, named Thomas Lincoln, who grew up in e Kentucky frontier country and was all his life poor and obscure man. Thomas Lincoln married ancy Hanks, a woman of Virginian parentage, ho also belonged to a poor and humble family. o them was born, on February 12, 1809, a son to hom they gave the name of Abraham, after his randfather, and who became the sixteenth Presient of the United States, the emancipator of the egro race in America, and the savior of the United tates from dissolution. On that same day Charles arwin was born, and in the same year Gladstone, ennyson and a number of other illustrious men aw the light; but we may well doubt if any of hem merits a higher place in the history of the orld and in the affection and honor of the human ace, than this offspring of struggling Kentucky ioneers, born in a log cabin in the western wilderess.

Lincoln was born at Nolin's Creek, near Hodgensille, in Hardin (now Larue) County, Kentucky. t six and seven years of age he went for a short ime to a backwoods school, where his only textook was a second-hand copy of "Dilworth's Spellg Book," and where he learned little more than to ead and write. When he was eight years old he as taken by his parents to Indiana, to escape the light of slavery. Thomas Lincoln realized that in State where negro slavery prevailed, as it did in entucky, while the well-to-do white man might row rich, there was no hope for the poor white an but to sink to a level below even that of the laves — as witness the condition of the "poor white rash" of the Southern States. He did not propose o suffer such fate without a struggle; so he packed p his few belongings and set out for the country orth of the Ohio river, which under the Ordinance f 1787 was forever to be a free country. He crossed he river on a rude raft of logs, and made his way o Little Pigeon Creek, near Gentryville, in Spencer ounty, Indiana. At that time that was an unroken wilderness, far more primitive than Kenucky, and it is told that Thomas Lincoln literally ad to cut a road with his axe through the forest to each the spot where he made his home. His little og cabin of two rooms was several miles from any ther human habitation. In that place the future resident could go to no school. There was none ithin many miles. But his mother, a woman of ine mind and pious soul, taught him what she ould, and added to his lessons the simple religious raining that marked all his after life. Two years after the removal to Indiana, however, she died, and the boy was left to the companionship of his hard-working father. A year later the father married again, his second wife being a widow, Mrs. Sarah Johnston (born Bush), of Kentucky. Happily, she proved to be a true mother to her stepson, giving him a wealth of affection, together with all possible instruction and right guidance. A couple of years later a neighboring settler, named Crawford, opened a school in his own cabin, and young Lincoln attended it for some time. There he studied arithmetic and other primary branches, his studies making up in thoroughness what they lacked in scope and variety. He also read a number of books which profoundly influenced his mind for life. These were Bunyan's "Pilgrim's Progress," Æsop's "Fables," a life of Washington, and some others. Books were scarce in that country in those days, and such as were obtainable were read and reread many times. The traces of his readings of Bunyan's matchless work are evident in all of Lincoln's speeches and letters.

When he was nineteen years old, in 1828, Lincoln made his first considerable journey. He went to New Orleans on a flatboat on the Mississippi river, in company with the son of the owner of the boat, a youth of his own age. The two were entrusted by the owner not only with the boat but also with a valuable cargo. On the way down they were attacked by a gang of robbers, whom they succeeded in beating off, and then made the rest of the trip in safety. Two years later Lincoln assisted his father to make another removal of his home, this time to Decatur, Illinois, and himself built a rail fence around the new homestead, from which circumstance came the name of "The Rail-Splitter," by which he was afterward known. For two years he lived there, working on the farm, hunting, and serving as clerk in a country store. He also built a flat-boat for use on the Sangamon river, and himself navigated it. On one trip the boat got stuck upon a bar in the river, and Lincoln devised an ingenious mechanical arrangement for lifting it over the obstruction, upon which he afterward obtained a patent. With this boat he made another trip to New Orleans, and there, seeing some slaves grossly ill-treated, was confirmed in the hatred of slavery which he had inherited from his father. When the Black Hawk Indian war broke out in 1832, he promptly enlisted in the army, and was made a Captain of volunteers, but his active service was confined to marching, no real fighting falling to his lot. After the war he was a candidate for the Illinois Legislature, and polled a large vote, but was defeated. He then settled at New Salem, on the Sangamon river, and was a grocer, surveyor and postmaster. He also was pilot of the first steamboat on the Sangamon. He studied law, maintained his interest in politics, and became known as an effective "stump" speaker. In 1834 he was elected to the State Legislature of Illinois, and there showed himself a forcible debater. Finally, in 1836, he was admitted to practice at the bar, and removed to Springfield, the State capital, where he opened a law office, at the same time keeping a close watch upon the progress of political affairs. His law partner was John T. Stuart, and the firm soon became well known, while Lincoln won a fine personal reputation, especially as a pleader, in both civil and criminal cases.

He was urged to accept a nomination for the Legislature in 1840, but declined it in favor of a nomination for Presidential Elector on the Whig ticket. He was again a candidate for Elector in 1844, and in that year canvassed Illinois in support of Henry Clay, of whom he was a warm admirer. Already, it is to be noted, he had outgrown mere State politics, and aspired to a place in National affairs. His ambition was gratified in 1846, in his election as a Representative in Congress. At Washington he made no attempt to distinguish himself as a speaker, but he conspicuously committed himself in favor of receiving anti-slavery petitions, in favor of the abolition of slavery in the District of Columbia, in favor of the Wilmot Proviso, and in earnest opposition to the Mexican war. On these and other questions he acted sometimes with his party, but sometimes with entire independence. His Congressional term of office lasted from 1847 to 1849, and during that time he was actively interested in National politics. He was a member of the National Whig Convention which nominated General Taylor for the Presidency, in 1848, and he canvassed Illinois upon the stump in favor of Taylor's election. The following year he was a candidate for the United State Senatorship from Illinois, but was defeated, the Democrats securing a majority of each house of the Legislature. Then, at the expiration of his term in Congress, he retired for a time from politics and devoted himself to the practice of his profession. Amid his law work, however, he kept a close watch upon the progress of National politics, and held himself in instant readiness to re-enter the arena whenever opportunity should seem favorable.

The opportunity came in 1854. That was, indeed, the year which marked the turning point in American political affairs. In May the infamous Nebraska bill was enacted, and the Missouri Compromise was repealed. Thus the way was prepared for Civil war in Kansas. More than that, the eyes of the free State men of the North were opened to the necessity of resisting the aggressions of the Slave power. Hitherto Illinois, though a free State, had been strongly Democratic and had supported proslavery policies. The doings of 1854 revolutionized it and made it anti-Democratic. Lincoln promptly recognized his opportunity, closed his law books, and threw himself into the forefront of the political fight. The author of the Nebraska bill and of the repeal of the Missouri Compromise was Stephen A. Douglas, who had been Lincoln's colleague and political opponent in the Illinois Legislature years before, and who now was a United States Senator, the Democratic leader of Illinois, and a probable candidate for the Presidency. Lincoln entered the campaign to carry the State Legislature for the Whigs, and thus to give Douglas a Whig Senator for his colleague. In that the Whigs were successful. They carried the Legislature, and for a time were divided in counsel, whether to elect Lincoln or Lyman Trumbull to the United States Senate. The dispute was ended by Lincoln himself, who already had his eye on a more important place than the Senatorship. With equal tact and generosity he withdrew from the contest, and persuaded his friends to vote for Trumbull, who was thus elected. Trumbull was Senator, but Lincoln was the popular leader of the Whig party in Illinois. But the Whig party was rapidly going to pieces. Lincoln did not seek to prevent but rather hastened the process, and upon its ruins the Republican party was founded. In 1856 the first National Convention of the new party was held. Lincoln was the candidate of the Illinois delegation for the Vice-Presidency, and received 110 votes in the Convention for that nomination. He might have been nominated had it not been considered wise to select an eastern man to go on the ticket with Fremont, in order to make the strongest possible appeal to all parts of the country; so Dayton, of New Jersey, was chosen instead.

Lincoln was not disappointed. Indeed it is doubtful if he really desired the Vice-Presidential nomination. He took an active part in the campaign, and was first on the list of Presidential Electors from Illinois. Two years later another Senatorial campaign came on. Douglas's term was to expire in 1859, and the Legislature chosen in 1858 would elect his successor. It was customary in those days for the State Convention to select a Senatorial candidate, whom the Legislature would elect if that party was victorious at the polls. The Republican State Convention, in June, 1858, thus selected Lincoln as its candidate for Douglas's seat in the Senate. The Democrats, of course, chose Douglas, the "Little Giant," as a candidate to succeed himself. In accordance with custom, also, the two candidates went upon the stump and canvassed the State. The question of slavery and its extension was the dominant one in the campaign. Douglas was the champion of "squatter sovereignty" and had to bear the burden of the Nebraska bill and the repeal of the Missouri Compromise. Lincoln sounded the keynote of his side in his speech accepting the nomination, when, following his frequent habit of quoting Scripture, he declared that the Union could not permanently remain half slave and half free, for "a house divided against itself cannot stand." Douglas spoke at Chicago on July 9, and Lincoln followed him there the next day. A week afterward both spoke on the same day at Springfield. Then, on July 24, Lincoln challenged Douglas to a series of public debates. Douglas accepted, insisting, however, that he should both open and close each debate, thus having four speeches to Lincoln's three, an advantage which Lincoln unhesitatingly gave him.

In this historic contest each had an opponent worthy of him. Douglas, then at the height of his splendid powers, was by far the more cultivated and highly educated, and was by far the better known to the nation at large. He had, moreover, a marvelous gift for putting himself in touch with the people, and appealing to their hopes and fears, their passions and prejudices. Lincoln, on the other hand, had a mastery of logic and of epigram such as few orators in any land or time have had. Moreover, he had a strategic ability that was simply unrivaled. The two met in debate seven times, in various parts of the State, between August 21 and October 15. The debates were fully reported, and were followed with absorbing interest by the whole country. The general verdict was that Lincoln had the better of them. The result at the polls was that the Republicans carried the State by 5,000 majority, though the unequal apportionment of seats gave the Democrats control of the Legislature and Douglas was re-elected to the Senate. That result was, however, not a disappointment to Lincoln. On the contrary, it was foreseen and expected by him. Indeed, he actually courted it. In his opening debate he demanded of Douglas an answer to the question: "Can the people of a Territory, in a lawful way, against the wish of any citizen of the United States, exclude Slavery from that Territory, prior to its adoption of a State Constitution?" His friends tried to dissuade him from putting this question. Douglas, they said, would answer it in the affirmative, and thus please the people of Illinois, and win the election. Lincoln replied that that was just what he wanted. He was aiming at bigger game than the Senatorship. He saw that Douglas would be the most formidable Democratic candidate for the Presidency in 1860. But to be elected President, Douglas must carry Illinois and must also have the support of the Slave States. But the question Lincoln proposed to ask him would put him in a dilemma. If he answered it in the negative, he would offend the free soil sentiment of Illinois and lose not only the Senatorship but also the support of his own State for the Presidency, which latter would be fatal to him. On the other hand, if he answered it in the affirmative, as Lincoln assumed he would, he might win the favor of Illinois and retain the Senatorship, but he would certainly offend the Slave States and forfeit their support for the Presidency. It was a shrewd device, and it was successful. Lincoln put the fatal question to Douglas, at Freeport. Douglas unhesitatingly answered it in the affirmative. That gave Douglas the Senatorship. But it lost him the Presidency two years later, for the Southern States refused to support him, and split the Democratic party asunder.

Having thus compassed the destruction of his great rival's Presidential prospects, Lincoln set about assuring his own, by making the country outside of Illinois acquainted with him. He visited New York and New England, and also went as far west as Kansas, during 1859, making many speeches and producing a profound impression. His speech in New York was accepted as the most authoritative exposition thus far made of the principles and policy of the new Republican party, and it served as a text-book for innumerable other speakers in the campaign of 1860. He made another notable speech at Cincinnati, in the spring of 1860, to an audience composed chiefly of Kentuckians. These men he addressed as a fellow Kentuckian, who had been driven out of that State by the evils of the slave system. In May, 1860, the Republican National Convention met in Chicago. There were numerous candidates for the Presidency, but the contest soon centred around two, Lincoln, and William H. Seward of New York. Upon the third ballot Lincoln was nominated, receiving 354 out of 465 votes. Thereupon William M. Evarts, the leader of the Seward forces, moved that Lincoln's nomination be made unanimous. This was done, and a few days later Lincoln accepted the nomination in a particularly graceful and inspiring letter. The Democratic party, meantime, was split asunder, as Lincoln had planned it should be. The progressive wing of the party at the regular National Convention nominated Douglas. The extreme pro-slavery men at a seceding convention put Breckinridge forward. Also the remnant of the old Whig party, which had not yet been absorbed by the Republicans, nominated Bell as a "Constitutional Union" candidate. The campaign was exceptionally earnest, the whole nation apparently realizing the tremendous issues at stake. On November 6 the election occurred. Lincoln received a popular vote of 1,857,610, Douglas of 1,291,574, Breckinridge of 850,082, and Bell of 646,124. In the electoral college the result was Lincoln, 180; Breckinridge, 72; Bell, 39; and Douglas, 12.

So Lincoln was elected, through the very strategy he himself had planned. And then the Civil War began. The Slave States affected to regard his election as a menace to their constitutional rights, and long before he was actually inaugurated they seceded from the Union. Indeed, before Lincoln left his home in Illinois to go to Washington and become President, six of the Southern States had organized themselves into a Confederacy and had chosen Jefferson Davis to be their President. It was on February 11, 1861, that Lincoln left Springfield, Illinois, to go to Washington and assume the office of President of the distracted country. He made the trip by a roundabout way, visiting Indianapolis, Cincinnati, Columbus, Cleveland, Pittsburg, Buffalo, Albany, New York, Trenton, Philadelphia, and Harrisburg. He thus met the Legislatures of Indiana, Ohio, New York, New Jersey, and Pennsylvania, and made addresses to them, the dominant note of which was that if the people would stand by the Constitution and the Union, no power on earth could overthrow them. Beyond doubt, these visits and speeches were of incalculable value in consolidating the sentiment of the North in support of the Union and in giving the Nation confidence in its new Chief of State. At Harrisburg he learned that a plot had been formed to assassinate him as he passed through Baltimore, then a hotbed of pro-slavery sentiment, but the only precautions he took were to travel on a train a little earlier than the one he had intended taking, and to have the telegraph wires guarded. On February 23 he reached Washington in safety, and on March 4 was inaugurated President of the United States.

We have said the secession of at least six of the Southern States occurred before he even went to Washington. That action was thus taken not because of anything he had done, or indeed was likely to do, but probably as part of a prearranged or predetermined plan to secede in any event, the moment it was evident the Slave States could no longer dominate the Federal Government. How little Lincoln, even with his strong anti-slavery convictions, proposed to meddle with State institutions and State rights, may be seen from his first inaugural address, which is here reproduced practically in full, as the best possible exposition of the policy with which he entered upon his administration.

Thereafter the history of Lincoln was the history of the United States, which is rehearsed fully elsewhere in these volumes. It needs only to be said that he was the real head of the government, dominating with his marvelous personality every department of it, and with his unfailing tact and sound common sense harmonizing differences and smoothing down difficulties which might well have wrecked the administration of any other man. With all due credit to his associates in the Cabinet, his supporters in Congress, and his champions in the army and navy, it was he above them all who saved the Union from disruption and restored it to integrity, as it was he who spoke the word of freedom to a race of slaves. A few of his more notable public utterances must be quoted in full, partly because of their beauty and strength as specimens of English composition, and partly because they depict, better than any words of ours could do, the character, motives and policy of the man. His first inaugural address, on March 4, 1861, was a plain, direct discussion of the great issues then before the nation, and an unequivocal declaration of his intended policy. Its salient portions were as follows:

FIRST INAUGURAL ADDRESS.

"Apprehension seems to exist among the people of the Southern States that by the accession of a Republican Administration their property and their peace and personal security are to be endangered. There has never been any reasonable cause for such apprehension. Indeed, the most ample evidence to the contrary has all the while existed and been open to their inspection. It is found in nearly all the published speeches of him who now addresses you. I do but quote from one of those speeches when I declare that "I have no purpose, directly or indirectly, to interfere with the institution of slavery in the States where it exists. I believe I have no lawful right to do so, and I have no inclination to do so.' Those who nominated and elected me with full knowledge that I have made this and many similar declarations, and have never recanted them. And more than this, they placed in the platform for my acceptance, and as a law to themselves and to me, the clear and emphatic resolution which I now read:

"*Resolved*, That the maintenance inviolate of the rights of
" the States, and especially the right of each State to order
" and control its own domestic institutions according to its
" own judgment exclusively, is essential to the balance of
" power on which the perfection and endurance of our politi-
" cal fabric depend, and we denounce the lawless invasion by
" armed force of the soil of any State or Territory, no matter
" under what pretext, as among the gravest of crimes."

"I now reiterate these sentiments; and, in doing so, I only press upon the public attention the most conclusive evidence of which the case is susceptible, that the property, peace, and security of no section are to be in anywise endangered by the now incoming Administration. I add, too, that all the protection which, consistently with the Constitution and the laws, can be given, will be given to all the States when lawfully demanded, for whatever cause — as cheerfully to one section as to the other.

"There is much controversy about the delivering up of fugitives from service or labor. The clause I now read is as plainly written in the Constitution as any other of its provisions:

"No person held to service or labor in one State, under the
" laws thereof, escaping into another, shall, in consequence
" of any law or regulation therein, be discharged from such
" service or labor but shall be delivered up on the claim of
" the party to whom such service or labor may be due."

"It is scarcely questioned that this provision was intended by those who made it for the reclaiming of what we call fugitive slaves; and the intention of the law-giver is the law. All members of Congress swear their support to the whole Constitution — to this provision as much as any other. To the proposition, then, that slaves, whose cases come within the terms of this clause, 'shall be delivered up,' their oaths are unanimous. Now, if they would make the effort in good temper, could they not, with nearly equal unanimity, frame and pass a law by means of which to keep good that unanimous oath? . . .

"I take the official oath to-day with no mental reservations, and with no purpose to construe the Constitution or laws by any hypercritical rules. And while I do not choose now to specify particular acts of Congress as proper to be enforced, I do suggest that it would be much safer for all, both in official and private stations, to conform to and abide by all those acts which stand unrepealed, than to violate any of them, trusting to find impunity in having them held to be unconstitutional.

"I hold that, in contemplation of universal law, and of the Constitution, the union of these States is perpetual. Perpetuity is implied, if not expressed, in the fundamental law of all National Governments. It is safe to assert that no Government proper ever had a provision in its organic law for its own termination. Continue to execute all the express provisions to our National Constitution, and the Union will endure forever — it being impossible to destroy it, except by some action not provided for in the instrument itself.

"Again, if the United States be not a Government proper, but an association of States in the nature of the contract merely, can it, as a contract, be peaceably unmade by less than all the parties who made it? One party to a contract may violate it — break it, so to speak; but does it not require all to lawfully rescind it?

"Descending from these general principles, we find the proposition that, in legal contemplation, the Union is perpetual, confirmed by the history of the Union itself. The Union is much older than the Constitution itself. It was formed in fact by the Articles of Association in 1774. It was matured and continued by the Declaration of Independence in 1776. It was further matured, and the faith of all the then thirteen States expressly plighted and engaged that it should be perpetual, by the Articles of Confederation in 1778. And, finally, in 1787, one of the declared objects for ordaining and establishing the Constitution was 'to form a more perfect union.' But if destruction of the Union, by one, or by a part only, of the States, be lawfully possible, the Union is less perfect than before, the Constitution having lost the vital element of perpetuity.

"It follows, from these views, that no State, upon its own mere motion, can lawfully get out of the Union; that resolves and ordinances to that effect are legally void, and that acts of violence, within any State or States, against the Authority of the United States are insurrectionary or revolutionary, according to circumstances. I, therefore, consider that, in view of the Constitution and the laws, the Union is unbroken, and, to the extent of my ability, I shall take care, as the Constitution itself expressly enjoins upon me, that the laws of the Union be faithfully executed in all the States. Doing this I deem to be only a simple duty on my part; and I shall perform it, so far as practicable, unless my rightful masters, the American people, shall withhold the requisite means, or, in some authoritative manner, direct the contrary. I trust this will not be regarded as a menace, but only as the declared purpose of the Union that it will constitutionally defend and maintain itself.

"In doing this, there need be no bloodshed or violence, and there shall be none, unless it be forced upon the national authority. The power confided to me will be used to hold, occupy, and possess the property and places belonging to the Government, and to collect the duties and imposts; but, beyond what may be necessary for these objects, there will be no invasion, or using of force against or among the people anywhere. Where hostility to the United States, in any interior locality, shall be so great and universal as to prevent competent resident citizens from holding the federal offices, there will be no attempt to force obnoxious strangers among the people for that object. While the strict legal right may exist in the Government to enforce the exercise of these offices, the attempt to do so would be so irritating, and so nearly impracticable with all, I deem it better to forego, for the time, the uses of such offices. . . .

"That there are persons in one section or another who seek to destroy the Union at all events, and are glad of any pretext to do it, I will neither affirm nor deny; but if there be such I need address no word to them. To those, who really love the Union, may I not speak? . . .

"My countrymen, think calmly and well upon this whole subject. Nothing valuable can be lost by taking time. If there be an object to hurry any of you, in hot haste, to a step which you would never take deliberately, that object will be frustrated by taking time; but no good object can be frustrated by it. Such of you as are now dissatisfied, still have the old Constitution unimpaired, and, on the sensitive point, the laws of your own framing under it; while the new administration will have no immediate power, if it would, to change either. If it were admitted that you who are dissatisfied hold the right side in the dispute, there still is no good reason for precipitate action. Intelligence, patriotism, christianity, and a firm reliance on Him who has never yet forsaken this favored land, are still competent to adjust, in the best way, all our present difficulty. In your hands, my dissatisfied countrymen, and not in mine, is the momentous issue of civil war. The Government will not assail you. You can have no conflict without being yourselves aggressors. You have no oath registered in Heaven to destroy the Government, while I shall have the most solemn one to 'preserve, protect and defend it.'

"I am loth to close. We are not enemies, but friends. We must not be enemies. Though passion may have strained, it must not break our bonds of affection. The mystic chords of memory, stretching from every battlefield and patriot grave to every living heart and hearthstone, all over this broad land, will yet swell the chorus of the Union, when again touched, as surely they will be, by the better angels of our nature."

This clearly expressed policy, to maintain the Union, the Constitution, and the laws, was unswervingly followed. It brought upon Lincoln much censure from the extreme Abolitionists and others who were prone to be "expecting all things in an hour." There were even some of the wisest and soundest thinkers who for a time questioned the propriety of his course. To one of these Lincoln made the following reply, repeating with epigrammatic force the chief features of his policy:

Letter to Horace Greeley.

"Executive Mansion,
"Washington, Friday, August 22nd, 1862.

"Hon. Horace Greeley: *Dear Sir:* —

"I have just read yours of the 19th instant, addressed to myself through the New York Tribune.

"If there be in it any statements or assumptions of fact which I may know to be erroneous, I do not now and here controvert them.

"If there be any inferences which I may believe to be falsely drawn, I do not now and here argue against them.

"If there be perceptible in it an impatient and dictatorial tone, I waive it in deference to an old friend whose heart I have always felt to be right.

"As to the policy 'I seem to be pursuing,' as you say, I have not meant to leave anyone in doubt. I would save the Union. I would save it the shortest way under the Constitution.

"The sooner the national authority can be restored the nearer the Union will be — the Union as it was.

"If there be those who would not save the Union unless they could at the same time save slavery, I do not agree with them.

"If there be those who would not save the Union unless they could at the same time destroy slavery, I do not agree with them.

"My paramount object is to save the Union and not either to save or destroy slavery.

"If I could save the Union without freeing any slave, I would do it — and if I could save it by freeing all the slaves, I would do it — and if I could save it by freeing some and leaving others alone, I would also do that.

"What I do about slavery and the colored race, I do because I believe it helps to save the Union, and what I forbear, I forbear because I do not believe it would help to save the Union.

"I shall do less whenever I shall believe what I am doing hurts the cause, and shall do more whenever I believe doing more will help the cause.

"I shall try to correct errors when shown to be errors, and I shall adopt new views so fast as they shall appear to be true views.

"I have here stated my purpose according to my view of official duty, and I intend no modifications of my oft-expressed personal wish that all men everywhere could be free.

Yours, "A. Lincoln."

The Emancipation Proclamation, abolishing slavery in the seceded States, was issued, as a "war measure," on January 1, 1863, its purpose being to aid the work of suppressing the rebellion and of restoring the Union. Later in the same year, on November 10, 1863, he made his brief but, most memorable address at the consecration of the National Cemetery on the battlefield of Gettysburg, of which the keynote was devotion to the maintenance of the Union. That address was as follows:

Gettysburg Oration.

"Fourscore and seven years ago our fathers brought forth upon this Continent a new nation, conceived in Liberty, and dedicated to the proposition that all men are created equal.

"Now, we are engaged in a great civil war, testing whether that nation, or any nation so conceived and so dedicated, can long endure. We are met on a great battlefield of that war. We are met to dedicate a portion of it as the final resting place of those who here gave their lives that that nation might live. It is altogether fitting and proper that we should do this.

"But in a larger sense we cannot dedicate, we cannot consecrate, we cannot hallow this ground. The brave men, living and dead, who struggled here, have consecrated it far above our power to add or detract. The world will little note nor long remember what we say here, but it can never forget what they did here. It is for us, the living, rather to be dedicated here to the unfinished work that they have thus far so nobly carried on. It is rather for us to be here dedicated to the great task remaining before us,— that from these honored dead we take increased devotion to the cause for which they here gave the last full measure of devotion,— that we here highly resolve that the dead shall not have died in vain, that the nation shall, under God, have a new birth of freedom, and that the government of the people, by the people, and for the people, shall not perish from the earth."

In the fall of 1864 Lincoln was re-elected President, by a good majority of the popular vote and by an overwhelming majority of the electoral college. On March 4, 1865, he was inaugurated for his second term, and on that occasion delivered what we must consider as not only the greatest address of his own career but perhaps the greatest ever uttered by mortal man. The strain of spiritual exaltation which pervades and dominates it is comparable with nothing less than that of one of the greatest of the old Hebrew prophets, and it seems instinct with an unexpressed premonition of his impending doom and even to anticipate the ineffable vision that awaited him beyond the veil of the unfathomed and unknown. Its full text follows:

Second Inaugural Address.

"Fellow-Countrymen: At this second appearing to take the oath of the Presidential office, there is less occasion for an extended address than there was at the first. Then, a statement, somewhat in detail, of a course to be pursued, seemed fitting and proper. Now, at the expiration of four years, during which public declarations have been constantly called forth on every point and phase of the great contest which still absorbs the attention and engrosses the energies of the nation, little that is new could be presented. The progress of our arms, upon which all else chiefly depends, is as well known to the public as to myself; and it is, I trust, reasonably satisfactory and encouraging to all. With high hope for the future, no prediction in regard to it is ventured.

"On the occasion corresponding to this four years ago, all thoughts were anxiously directed to an impending civil war. All dreaded it—all sought to avert it. While the inaugural address was being delivered from this place, devoted altogether to saving the Union without war, insurgent agents were in the city seeking to destroy it without war—seeking to dissolve the Union, and divide effects, by negotiation. Both parties deprecated war; but one of them would make war rather than let the nation survive; and the other would accept war rather than let it perish. And the war came.

"One-eighth of the whole population were colored slaves, not distributed generally over the Union, but localized in the southern part of it. These slaves constituted a peculiar and powerful interest. All knew that this interest was, somehow, the cause of the war. To strengthen, perpetuate and extend this interest was the object for which the insurgents would rend the Union, even by war; while the Government claimed no right to do more than to restrict the territorial enlargement of it. Neither party expected for the war the magnitude or the duration which it has already attained. Neither anticipated that the cause of the conflict might cease with, or even before, the conflict itself ceases. Each looked for an easier triumph, and a result less fundamental and astounding. Both read the same Bible, and pray to the same God; and each envokes his aid against the other. It may seem strange that any man should dare to ask a just God's assistance in wringing their bread from the sweat of other men's faces; but let us judge not, that we be not judged. The prayers of both could not be answered—that of neither has been answered fully. The Almighty has His own purposes. 'Woe unto the world because of offences, for it must needs be that offences come; but woe to that man by whom the offence cometh.' If we shall suppose that American slavery is one of those offences which, in the Providence of God, must needs come, but which, having continued through His appointed time, He now wills to remove, and that He gives to both North and South this terrible war, as to woe due to those by whom the offence came, shall we discern therein any departure from those divine attributes which the believers in a living God always ascribe to Him? Fondly do we hope—fervently do we pray—that this mighty scourge of war may speedily pass away. Yet, if God wills that it continue until all the wealth piled by the bondmen's two hundred and fifty years of unrequited toil shall be sunk, and until every drop of blood drawn with the lash shall be paid by another drawn with the sword, as was said three thousand years ago, so still it must be said, 'The judgments of the Lord are true and righteous altogether.'

"With malice toward none; with charity for all; with firmness in the right, as God gives us to see the right, let us strive on to finish the work we are in; to bind up the nation's wounds, to care for him who shall have borne the battle, and for his widow and his orphan—to do all which may achieve and cherish a just and a lasting peace among ourselves, and with all nations."

After this, the end soon came. The Confederacy fell. Richmond surrendered, and Lincoln visited it and walked through its once defiant precincts, more as redeemer than conqueror. A few days later Lee surrendered. It was planned to raise the National banner again over the ruins of Fort Sumter on April 14, the fourth anniversary of the day which had witnessed the pulling down of that flag and the raising of the Confederate flag in its place. That date also marked the end of the savior of the Union. His work was done. Cares were beginning to relax. Peace had come at last. And then, suddenly, through one more brief storm, came eternal peace. On the evening of April 14, 1865, an assassin entered the box in which he sat at a theatre, and shot him through the brain. Before morning he was dead. The tragedy was a part of a plot to destroy a number of the chief officers of the Government. It was organized and carried out by a party of Southern sympathizers, more in sheer revenge for the defeat of secession than in any hope of thus revivifying the "Lost Cause." Of all who were aimed at, however, Lincoln alone was killed. His assassin, John Wilkes Booth, was soon after slain while resisting arrest; four of his accomplices, Payne, Atzerot, Harold, and Mrs. Surratt, were hanged; three, Arnold, Mudd, and McLaughlin, were imprisoned for life; and one, Spangler, was imprisoned for six years. The nation was plunged into such mourning as it never before had known; in which it commanded the sympathy of the whole civilized world. The body of the martyr was borne from Washington to Springfield by almost exactly the same route he had followed in going to Washington four years before, and imposing ceremonies were held at every important point along the way. Not until May 4 did the funeral train reach the cemetery at Springfield, where the dust of the Great Emancipator was consigned to the dust from whence it sprung, while the Spirit had returned to God who gave it.

May, 1904. W. Fletcher Johnson.

LINDAU, a town in the government district of Swabia and Neuburg, Bavaria, and the central point of the transit trade between that country and Switzerland, is situated on two islands off the north-eastern shore of Lake Constance, in 47° 34′ N. lat., 9° 43′ E. long. The town is a terminus of the Vorarlberg Railway, and of the Munich-Lindau line of the Bavarian State Railway, and is connected with the mainland both by a wooden bridge and by a railway embankment of stone erected in 1853. There are Roman Catholic and Lutheran churches, a royal château, an old town-hall, classical, commercial, and industrial schools, and also manufactories for surgical and musical instruments, a fishery, and a fine harbor provided with a lighthouse and much visited by steamers from Constance and other places on the lake. Opposite the custom-house is a bronze statue of King Maximilian II., erected in 1856. The trade is chiefly in grain, fruit, wine, cherry-brandy, fish, cheese, and lard. In January, 1882, the population was about 5350.

On the site which the town now occupies there is believed to have been formerly an ancient Roman camp, *Castrum Tiberii*. Authentic records of Lindau date back to the end of the 9th century. In 1531 it joined the Smalkald league, and in 1647 was ineffectually besieged by the Swedes. From 1275 to 1803 it was a free imperial town. In 1804 it passed to Austria, and in 1805 to Bavaria.

LINDLEY, John (1799–1865), botanist, was born on February 5, 1799, at Catton near Norwich, where his father, George Lindley, author of *A Guide to the Orchard and Kitchen Garden*, owned a nursery garden. He was educated at Norwich grammar school, and early manifested a taste for the studies in which he afterwards gained distinction. His first publication, in 1819, a translation of the *Analyse du Fruit* of Richard, was followed in 1820 by an original *Monographia Rosarum*, with descriptions of new species, and drawings executed by himself, and in 1821 by *Monographia Digitalium*, and by "Observations on Pomaceæ" contributed to the *Transactions of the Linnean Society*. Shortly afterwards he went to London, where he was engaged by Loudon to write the descriptive portion of the *Encyclopædia of Plants*. In the course of his labors on this undertaking, which was completed in 1829, and of which the "botanical merits" are in the preface assigned by the editor to Lindley, he became thoroughly convinced of the superiority of the "natural" system of Jussieu, as distinguished from the "artificial" system of Linnæus followed in the *Encyclopædia*; the conviction found expression in *A Synopsis of British Flora, arranged according to the Natural Order* (1829) and in *An Introduction to the Natural System of Botany* (1830). In 1829 Lindley, who since 1822 had been assistant secretary to the Horticultural Society, was appointed to the chair of botany in University College, London; he lectured also on botany from 1831 at the Royal Institution, and from 1835 at the Botanic Gardens, Chelsea. During his professoriate of more than thirty years he wrote many scientific and popular works, besides contributing largely to the *Botanical Register*, of which he was editor for many years, and to the *Gardener's Chronicle*, in which he had charge of the horticultural department from 1841. He became a fellow of the Royal, Linnean, and Geological Societies, and had the honor of being admitted to a large number of foreign scientific bodies. He resigned his chair in 1860, and died of apoplexy at Turnham Green on November 1, 1865.

Besides those already mentioned, the works of Lindley include *An Outline of the First Principles of Horticulture* (1832), *An Outline of the Structure and Physiology of Plants* (1832), *A Natural System of Botany* (1836), *The Fossil Flora of Great Britain* (the joint work of Lindley and Hutton, 1831–37), *Flora Medica* (1838), *The Vegetable Kingdom* (1846), *Theory of Horticulture* (2d ed., 1855), *Folia Orchidacea* (1852), *Descriptive Botany* (1858), a *Ladies' Botany*, a *School Botany*, the volume *Botany* in the Library of Useful Knowledge, and most of the botanical articles in the *Penny Cyclopædia*. See BOTANY, vol. iv. p. 71.

LINDSEY, THEOPHILUS (1723–1808), an English theological writer, was born in Middlewich, Cheshire, on June 20, 1723, was educated at the Leeds Free School, and in 1741 entered St. John's College, Cambridge, of which, after graduating with distinction, he became a fellow in 1747. For some time he held a curacy in Spitalfields, London, and from 1754 to 1756 he travelled on the Continent in the capacity of tutor to the young duke of Northumberland. On his return he was presented to the living of Kirkby-Wiske in Yorkshire, and after exchanging it for that of Piddletown in Dorsetshire he in 1763 removed to Catterick in Yorkshire. Meanwhile he had begun to entertain anti-Trinitarian views, and to be troubled in conscience about their inconsistency with the creed he had repeatedly subscribed; since 1769 the intimate friendship of Priestley had served to foster his scruples, and in 1771 he united with Archdeacon Blackburne (his father-in-law), Jebb, Wyvell, and Law in preparing a petition to parliament with the prayer that clergymen of the church, and graduates of the universities, might be relieved from the burden of subscribing to the thirty-nine articles, and "restored to their undoubted rights as Protestants of interpreting Scripture for themselves." After two hundred and fifty signatures to the document had, with six months of vast effort on Lindsey's part, been obtained, it was, in February, 1772, rejected in the House of Commons by a majority of two hundred and seventeen to seventy-one; the adverse vote was repeated in the following year, and in the end of 1773, seeing no prospect of obtaining within the church the relief which his conscience demanded, Lindsey resigned his vicarage and took leave of a warmly attached congregation. In April, 1774, he began to conduct a Unitarian service in a room in Essex Street, Strand, London; four years later he removed to a chapel built for him in the same street. Here he continued to labor till 1793, when he resigned his charge in favor of Disney, who like himself had left the established church, and had become his colleague. His active interest in the Unitarian movement continued, however, until his death, which took place on November 3, 1808.

Lindsey's chief work is *An Historical View of the State of the Unitarian Doctrine and Worship from the Reformation to our own Times*, 1783; in it he claims, amongst others, Burnet, Tillotson, S. Clarke, Hoadly, and Sir I. Newton for the Unitarian view. His other publications, mostly occasional, include *Apology on Resigning the Vicarage of Catterick* (1774), and *Sequel to the Apology* (1776); *The Book of Common Prayer reformed according to the plan of the late Dr. Samuel Clarke*, 1774; *Dissertations on the Preface to St. John's Gospel and on praying to Jesus Christ*, 1779; *Vindiciæ Priestleianæ*, 1788; *Conversations upon Christian Idolatry*, 1792; and *Conversations on the Divine Government, showing that everything is from God, and for good to all*, 1802. Two volumes of *Sermons, with appropriate prayers annexed*, were published posthumously in 1810; and a volume of *Memoirs*, by Thomas Belsham, appeared in 1812.

LINEN MANUFACTURES. Under this term are comprehended all yarns spun and fabrics woven from flax fibre. The cultivation and preparation of the fibre, and its treatment till it reaches the market as a commercial product, are dealt with under FLAX, vol. ix. p. 256.

From the earliest periods of human history till almost the close of the 18th century the linen manufacture was one of the most extensive and widely disseminated of the domestic industries of European countries. The preparation and spinning of yarn gave occupation to women of all classes; and the operations of weaving employed large numbers of both sexes. The industry was most largely developed in Russia, Austria, Germany, Holland, Belgium, the northern provinces of France, and certain parts of England, in the north of Ireland, and throughout Scotland; and in these countries its importance was generally recognized by the enactment of special laws, having for their object the protection and extension of the trade. The inventions of Arkwright, Hargreaves, and Crompton in the latter part of the 18th century, benefiting as they did, almost exclusively, the art of cotton spinning, and the unparalleled development of that branch of textile manufactures, largely due to the ingenuity of these inventors, gave the linen trade as it then existed a fatal blow. Domestic spinning, and with it hand-loom weaving, immediately began to shrink; a large and most respectable section of the operative classes in western Europe found their employment dwindling away, and the wages they earned from their diminished labor insufficient to ward off starvation. The trade which had supported whole villages and provinces entirely disappeared, and the linen manufacture, in attenuated dimensions and changed conditions, took refuge in special localities, where it resisted, not unsuccessfully, the further assaults of cotton, and, with varying fortunes, rearranged its relations in the community of textile industries. The linen industries of the United Kingdom were the first to suffer from the aggression of cotton; more slowly the influence of the rival textile travelled across Continental countries; and even to the present day, in Russia, and in other regions remote from great commercial highways, the domestic manufacture of linens holds its place almost as it has done from the earliest period. In 1810 Napoleon I., with a view partly to promote Continental linen industries, and partly to strike a blow at the great British manufacture of cotton, issued a proclamation offering a reward of one million francs to any inventor who should devise the best machinery for the spinning of flax yarn. Within a few weeks thereafter Philippe de Girard patented in France important inventions for flax spinning by both dry and wet methods. His inventions, however, did not receive the promised reward, and were indeed neglected in his native country. In 1815 he was invited by the Austrian Government to establish a spinning-mill at Hirtenberg near Vienna, which was run with his machinery for a number of years, but ultimately it failed to prove a commercial success. In the meantime, however, English inventors, stimulated rather than daunted by the success of cotton machinery, had applied themselves to the task of adapting machines to the preparation and spinning of flax. The foundation of machine spinning of flax was laid by John Kendrew and Thomas Porthouse of Darlington, who, in 1787, secured a patent for "a mill or machine upon new principles for spinning yarn from hemp, tow, flax, or wool." These machines, imperfect as they were, attracted much notice, and were introduced in various localities both in England and Scotland into mills fitted specially for flax spinning. By innumerable successive improvements and modifications, the invention of Kendrew and Porthouse developed into the perfect system of machinery with which, at the present day, spinning-mills are furnished; but progress in adapting flax fibres for mechanical spinning, and linen yarn for weaving cloth by power-loom, was much slower than in the corresponding case of cotton.

The implements used in the preparation of linen yarn in ancient and modern times, down to the end of the 18th century, were of the most primitive and inexpensive description. Till comparatively recent times, the

pinning implements were the spindle and distaff.
pindle, which is the fundamental apparatus in all
ing machinery, was nothing more nor less than a
stick or rod of wood about 12 inches in length,
ng towards each extremity, and having at its upper
notch or slit into which the yarn might be caught
ed. In general, a ring or "whorl" of stone or
vas passed round the upper part of the spindle to
t momentum and steadiness when in rotation. The
f, or rock, was a rather longer and stronger bar or
around one end of which, in a loose coil or ball,
brous material to be spun was wound. The other
mity of the distaff was carried under the left arm,
ed in the girdle at the left side, so as to have the
f flax in a convenient position for drawing out to
A prepared end of yarn being fixed into the
, the spinster, by a smart rolling motion of the
le with the right hand against the right leg, threw
from her, spinning in the air, while, with the left
she drew from the rock an additional supply of
which was formed into a uniform and equal strand
the right. The yarn being sufficiently twisted was
ed from the notch, wound around the lower part
spindle, and again fixed in the notch at the point
iciently twisted; and so the rotating, twisting, and
ng out operations went on till the spindle was full.
ersistent is an ancient and primitive art of this
iption that to the present day, in remote districts
otland,—the country where machine spinning has
ed its highest development,—spinning with rock
pindle is yet practised;[1] and, rude as these imple-
s are, yarn of extraordinary delicacy, beauty, and
ity has been spun by their agency. The first im-
ment on the primitive spindle was found in the
ruction of the hand-wheel, in which the spindle,
ted in a frame, was fixed horizontally, and rotated
band passing round it and a large wheel, set in the
framework. Such a wheel became known in
pe about the middle of the 16th century, but it
ars to have been in use for cotton spinning in the
from time immemorial. At a later date, which
ot be fixed, the treadle motion was attached to the
ing wheel, enabling the spinster to sit at work with
hands free; and the introduction of the two-handed
uble-spindle wheel, with flyers or twisting arms on
spindles, completed the series of mechanical im-
ements effected on flax spinning till the end of the
century. The common use of the two-handed
l throughout the rural districts of Ireland and
and is a matter still within the recollection of mid-
ged people; but spinning wheels are now seldom

e modern manufacture of linen divides itself into
branches, spinning and weaving, to which may be
d the bleaching and various finishing processes,
h, in the case of many linen textures, are laborious
rtakings and important branches of industry.
ax, when received into the mills, has to undergo a
of preparatory operations before it arrives at the
of being twisted into yarn. The whole operations
rn manufacture comprise (1) heckling, (2) prepar-
and (3) spinning.
eckling.—This first preparatory process consists not
in combing out, disentangling, and laying smooth
parallel the separate fibres, but also serves to split
nd separate into their ultimate filaments the strands
ore which, up to this point, have been agglutinated
ther. The heckling process was until recent times
by the hand; and it was one of fundamental im-
ance, requiring the exercise of much dexterity and
gment. The broken, ravelled, and short fibres,
h separate out in the heckling process, form tow,
rticle of much inferior value to the spinner; and
proportion of tow made in the process of hand-
ling varies according to the skill and knowledge
he heckler. A good deal of hand-heckling is still practised, especially in Irish and Continental factories; and it has not been found practicable, in any case, to entirely dispense with a rough preparation of the fibre by hand labor. In heckling by hand, the heckler takes a handful or "strick" of rough flax, winds the top end around his hands, and then, spreading out the root end as broad and flat as possible, by a swinging motion dashes the fibre into the teeth or needles of the rougher or "ruffer" heckle. The rougher is a board plated with tin, and studded with spikes or teeth of steel about 7 inches in length, which taper to a fine sharp point. The heckler draws his strick several times through this tool, working gradually up from the roots to near his hand, till in his judgment the fibres at the root end are sufficiently combed out and smoothed. He then seizes the root end and similarly treats the top end of the strick. The stricks, as finished, are carefully piled up in a regular manner, keeping each handful separate for convenience of future treatment. The same process is again repeated on a similar tool, the teeth of which are 5 inches long, and much more closely studded together; and for the finer counts of yarn a third and a fourth heckle may be used, of still increasing fineness and closeness of teeth. In dealing with certain varieties of the fibre, for fine spinning especially, the flax is, after roughing, broken or cut into three lengths—the top, middle, and root ends. Of these the middle cut is most valuable, being uniform in length, strength, and quality. The root end is more woody and harsh, while the top, though fine in quality, is uneven and variable in strength. From some flax of extra length it is possible to take two short middle cuts; and, again, the fibre is occasionally only broken into two cuts according to the judgment and requirement of the manufacturer. Flax so prepared is known as "cut line" in contradistinction to "long line" flax, which is the fibre unbroken. The subsequent treatment of line, whether long or cut, does not present sufficient variation to require further reference to these distinctions.

In the case of heckling by machinery, the flax is first roughed and arranged in stricks, as above described under hand heckling. Considerable variations are presented in the construction of heckling machines, but the general principles of those now most commonly adopted, such as the machines of Combe, of Horner, or of Cotton, etc., are identical. These are known as vertical sheet heckling machines (fig. 1), their essential features being a set of endless leather bands or sheets *f*, *g* revolving over a pair of rollers *c*, *h* in a vertical

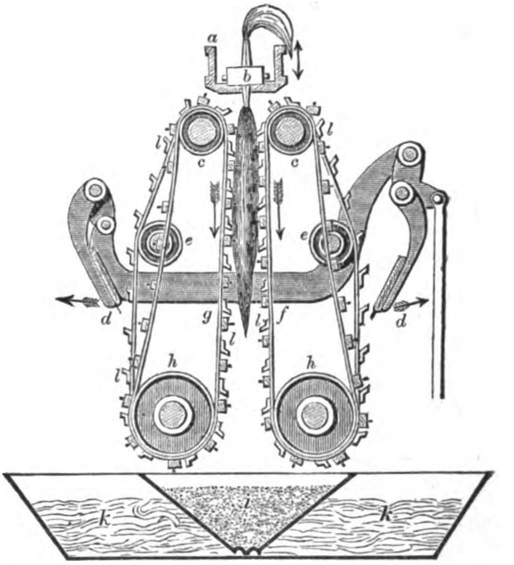

FIG. 1.—Section of Combe's Heckling Machine.

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[1] e Dr. Arthur Mitchell's *The Past in the Present*, Edinburgh,

direction. These sheets are crossed by iron bars, to which heckle stocks, furnished with teeth, are screwed. The heckle stocks on each separate sheet are of one size and gauge, but each successive sheet in the length of the machine is furnished with stocks of increasing fineness, so that the heckling tool at the end where the flax is entered is the coarsest, while that to which the fibre is last submitted has the smallest and most closely set teeth. Thus the whole of the endless vertical revolving sheet presents a continuous series of heckle teeth, and the machines are furnished with a double set of such sheets revolving face to face, so close together that the pins of one set of sheets intersect those on the opposite stocks. Overhead, and exactly centred between these revolving sheets, is the head or holder channel *a*, from which the flax hangs down while it is undergoing the heckling process on both sides. The flax is fastened in a holder *b*, consisting of two heavy flat plates of iron, between which it is spread and tightly screwed up. The holder is 11 inches in length, and the holder channel is fitted to contain a line of six, eight, or twelve such holders, according to the number of separate bands of heckling stocks in the machine. The head or holder channel has a falling and rising motion, by which it first presents the ends and gradually more and more of the length of the fibre to the heckle teeth, and, after dipping down the full length of the fibre exposed, it slowly rises and lifts the flax clear of the heckle stocks. By a reciprocal motion the whole of the holders are then moved forward one length; that at the last and finest set of stocks is thrown out, and place is made for filling in an additional holder at the beginning of the series. Thus with a six-tool heckle, or set of stocks, each holder full of flax from beginning to end descends into and rises from the heckle teeth six times in travelling from end to end of the machine. The root ends being thus first heckled, the holders are shot back along an inclined plane, the iron plates unclamped, the flax reversed, and the top ends are then submitted to the same heckling operation. The tow made in the heckling process is cleared from the heckle teeth, as they revolve, by doffers *l*, *l*, which in travelling upwards are, by passing over special guide rollers *e*, *e*, projected out from the line of the heckle teeth. The doffers themselves are cleared by fixed combs *d*, *d*, and the tow falling down is collected in troughs *k*, *k* on each side of the machine. Tow, which is a much less valuable substance than dressed line, undergoes a somewhat different preparing process, and is used only for the lower numbers of yarn.

Preparing.—The various operations in this stage have for their object the proper assortment of dressed line into qualities fit for spinning the different counts or sizes of yarn for which it may be suitable, and the drawing out of the fibres to a perfectly level and uniform continuous ribbon or sliver, containing throughout an equal quantity of fibre in any given length. From the heckling the now smooth, glossy, and clean stricks are taken to the sorting room, where they are assorted into different qualities by the "line sorter," who judges by both eye and touch the quality and capabilities of the fibre. So sorted, the material is passed to the spreading and drawing frames, a series or system of machines all similar in construction and effect. The essential features of the spreading frame are—(1) the feeding cloth or creeping sheet, which delivers the flax to (2) a pair of "feed and jockey" rollers, which pass it on (3) to the gill frame or fallers. The gill frame consists of a series of narrow heckle bars, with short closely studded teeth, which travel between the feed rollers and the drawing or "boss and pressing" rollers to be immediately attended to. They are, by an endless screw arrangement, carried forward at the rate at which the flax is delivered to them, and when they reach the end of their course they fall under, and by a similar screw arrangement are brought back to the starting point; and thus they form an endless moving level toothed platform for carrying away the flax from the feed rollers. The drawing rollers grip the fibre as it leaves the gill, and, as they revolve much more rapidly than the feeding rollers, the fibre is drawn out through the gill teeth say to twenty or thirty times the length it had on the feeding board, and is consequently reduced to a sliver or loose ribbon of correspondingly greater tenuity. The sliver from the drawing frame is delivered into a tin can which holds 1000 yards, and the machine automatically rings a bell when that length is delivered. From the spreading frame the cans of sliver pass to the drawing frames, where from four to twelve slivers combined are passed through feed rollers over gills, and drawn out by drawing rollers to the thickness of one. A third and fourth similar doubling and drawing may be embraced in a preparing system, so that the number of doublings the flax undergoes, before it arrives at the roving frame, may amount to from one thousand to one hundred thousand, according to the quality of yarn in progress. Thus, for example, the doublings on one preparing system may be $6 \times 12 \times 12 \times 12 \times 8 = 82,944$. The slivers delivered by the last drawing frame are taken to the roving frame, where they are singly passed through feed rollers and over gills, and, after drafting to sufficient tenuity, slightly twisted by flyers and wound on bobbins, in which condition the material—termed "rove" or "rovings"—is ready for the spinning frame.

The preparation of tow for spinning differs in essential features from the processes above described. Tow from different sources, such as scutching tow, heckle tow, etc., differs considerably in quality and value, some being very impure, filled with woody shives, etc., while other kinds are comparatively open and clean. A preliminary opening and cleaning is necessary for the dirty much-matted tows, and in general thereafter they are passed through two carding engines called respectively the breaker and the finisher cards till the slivers from their processes are ready for the drawing and roving frames. In the case of fine clean tows, on the other hand, passing through a single carding engine may be sufficient. The processes which follow the carding do not differ materially from those followed in the preparation of rove from line flax.

Spinning.—The spinning operation, which follows the roving, is done in two principal ways, called respectively dry spinning and wet spinning, the first being used for the lower counts or heavier yarns, while the second is exclusively adopted in the preparation of fine yarns up to the highest counts manufactured. The spinning frame does not differ in principle from the throstle spinning machine used in the cotton manufacture (see COTTON, vol. vi. p. 440). The bobbins of flax rove are arranged in rows on each side of the frame (the spinning frames being all double) on pins in an inclined plane A (fig. 2). The rove passes downwards through an eyelet or guide *l* to a pair of nipping rollers *p*, *p*, between which and the final drawing rollers *c*, *c*, placed in the case of dry spinning from 18 to 22 inches lower down, the fibre receives its final draft while passing over and under cylinders *d* and guide-plate *g*, and attains that degree of tenuity which the finished yarn must possess. From the last rollers the now attenuated material, in passing to the flyers *f*, receives the degree of twist which compacts the fibres into the round hard cord which constitutes spun yarn; and from the flyers it is wound on the more slowly rotating spool *e* within the flyer arms, centred on the spindle S. In wet spinning the general sequence of operations is the same, but the rove, as unwound from its bobbin, first passes through a trough of water heated to about 120° Fahr.; and, moreover, the interval between the two pairs of rollers in which the drawing out of the rove is accomplished is very much shorter. The influence of the hot water on the flax fibre appears to be that it softens the gummy principle which binds the separate cells together, and thereby allows the elementary cells to a certain extent to be drawn out without breaking the continuity of the fibre; and further it makes a finer, smoother, and more uniform strand than can be obtained by dry spinning. The extent to which the

strick of flax as laid on the feeding roller for
ı production of a 50 lea yarn is, by doublings
vings, extend-
ın it reaches
ıning spindle,
stated thus:—
on spreading
15 times on
ıwing frame,
ıs on second
frame, 14
third drawing
5 times on rov-
e, and 10 times
ıing frame, in
7,500 times its
length, with
16 = 1536 dou-
on the three
frames. That
y, 1 yard of
line fed into
eading frame
ıd out, mixed
ıer fibres, to a
of about 9400
yarn. In the
fine yarns, by
litional draw-
ven, the dou-
nd elongations
much greater.
ıext operation
g from the bob-
o hanks. By
Parliament,
out the United
m the standard
of flax yarn
"lea," called
Scotland the
of 300 yards.
k is wound or reeled on a reel having a circum-
of 90 inches (2½ yards) making "a thread,"
hundred and twenty such threads form a lea.
st or quality of all fine yarns is estimated by the
of leas in a pound; thus "50 lea" indicates
ere are 50 leas or cuts of 300 yards each in a
of the yarn so denominated. With the heavier
n Scotland the quality is indicated by their
per "spindle" of 48 cuts or leas; thus "3 ℔
n" is such as weighs 3 ℔ per spindle, equiva-
'16 lea."

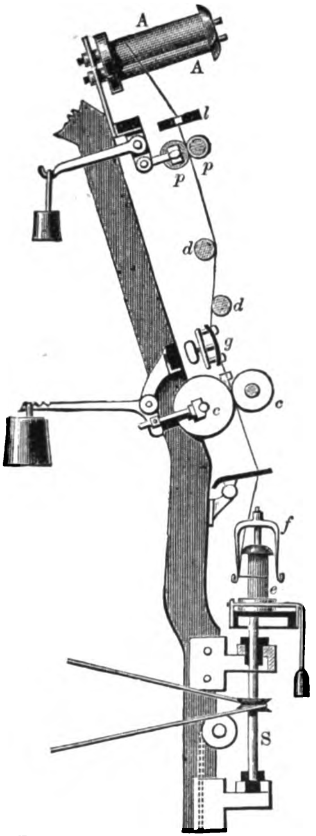

FIG. 2.—Section of Dry Spinning Frame.

hanks of yarn from wet spinning are either
a loft with artificial heat, or, in rural localities,
over ropes in the open air. When dry they
sted back and forward to take the wiry feeling
the yarn, and made up in bundles for the
as "gray yarn." English and Irish spinners
p their yarns into "bundles" of 20 hanks, each
ntaining 10 leas; Scotch manufacturers, on the
ıand, adhere to the spindle containing 4 hanks
ıts or leas.

ıercial qualities of yarn range from about 6 ℔ tow
lea) up to 160 lea line yarn. Very much finer yarn
to 400 lea may be spun from the system of machines
ı many factories; but these higher counts are only
fine thread for sewing and for the making of lace.
hest counts of cut line flax are spun in Irish facto-
the manufacture of fine cambrics and lawns which
acteristic features of the Ulster trade. Exceedingly
unts have sometimes been spun by hand, and for
ıaration of the finest lace threads it is said the Bel-
ıd spinners must work in damp cellars, where the
is guided by the sense of touch alone, the filament
o fine to be seen by the eye. Such lace yarn is said
been sold for as much as £240 per ℔. In the Great
ion of 1851 yarn of 760 lea, equal to about 130 miles
vas shown which had been spun by an Irish woman
four years of age. In the same exhibition there was
shown by a Cambray manufacturing firm hand-spun yarn equal to 1200 warp and 1600 weft or to more than 208 and 278 miles per pound respectively.

A large proportion of the linen yarn of commerce undergoes a more or less thorough bleaching before it is handed over to the weaver. Linen yarns in the green condition contain such a large proportion of gummy and resinous matter, removable by bleaching, that cloths which might present a firm close texture in their natural unbleached state would become thin and impoverished in a perfectly bleached condition. Manufacturers allow about 20 per cent. of loss in weight of yarn in bleaching from the green to the fully bleached stage; and the intermediate stages of "creamed," "half-creamed," "milled," and "improved," all indicating a certain degree of bleaching, have corresponding degrees of loss in weight. The differences in color resulting from different degrees of bleaching are taken advantage of for producing patterns in certain classes of linen fabrics.

Linen thread is prepared from the various counts of fine bleached line yarn by winding the hanks on large spools, and twisting the various strands, two, three, four, or six cord as the case may be, on a doubling spindle similar in principle to the yarn spinning frame, excepting, of course, the drawing rollers. A large trade in linen thread has been created by its use in the machine manufacture of boots and shoes, saddlery, and other leather goods, and in heavy sewing-machine work generally. The thread industry is largely developed at Lisburn near Belfast, at Johnstone near Glasgow, and at Paterson, New Jersey, United States. Fine cords, net twine, and ropes are also twisted from flax.

Weaving.—The application of the power-loom to the weaving of linen was hindered by many obstacles which were not met with in dealing with the weaving of cotton and woollen fabrics. The principal difficulty arose through the hardness and inelasticity of the linen wefts, owing to which the yarn frequently broke under the sharp sudden jerk with which the picker throws the shuttle in power-loom weaving. The difficulties in the way of power-loom linen weaving, combined with the obstinate competition of distressed hand-loom weavers, delayed the introduction of factory weaving of linen fabrics for many years after the system was fully applied to other textiles. Competition with the hand-loom against the power-loom is conceivable, although it is absolutely impossible for the work of the spinning wheel to stand against the rivalry of drawing, roving, and spinning frames. To the present day, in Ireland especially, a great deal of fine weaving is done by hand-loom; and the persons who first applied machinery to the weaving of linen damasks in Scotland are yet (1882) alive. Power was applied on a small scale to the weaving of canvas in London about 1812; in 1821 power-looms were started for weaving linen at Kirkcaldy, Scotland; and in 1824 Maberly & Co. of Aberdeen had two hundred power-looms erected for linen manufacture. The power-loom has been in uninterrupted use in the Broadford factory, Aberdeen, which then belonged to Maberly & Co., down to the present day, and to that firm may be awarded the credit of being the effective introducers of power-loom weaving in the linen trade.

The various operations connected with linen weaving, such as winding, warping, dressing, beaming, and drawing-in, do not differ in essential features from the like processes in the case of cotton weaving, etc., neither is there any significant modification in the looms employed. Dressing is a matter of importance in the preparation of linen warps for beaming. It consists in treating the spread yarn with flour paste, applied to it by cylinders, the lowermost of which revolves in a trough of paste. The paste is equalized on the yarn by brushes, and dried by passing the web over steam-heated cans before it is finally wound on the beam for weaving. See WEAVING.

For the bleaching and calendering of such linen fabrics as undergo these processes see BLEACHING vol. iii. p. 713; CALENDER, vol. iv. p. 605.

Linen fabrics are numerous in variety and widely different in their qualities, appearance, and applications, ranging from heavy sailcloth and rough sacking to the most delicate cambrics and lawns. The heavier manufactures include as a principal item sailcloth, with canvas, tarpaulin, sacking, and carpeting. The principal seats of the manufacture of these linens are Dundee, Arbroath, and Forfar. The medium weight linens, which are used for a great variety of purposes, such as tent-making, towelling, covers, outer garments for men, linings, upholstery work, etc., include duck, huckaback, crash, tick, dowlas, osnaburg, low sheetings, and low brown linens. Plain bleached linens form a class by themselves, and include principally the materials for shirts and collars and for bed sheets. Under the head of twilled linens are included drills, diapers, and dimity for household use; and damasks for table linen, of which two kinds are distinguished—single or five-leaf damask, and double or eight-leaf damask, the pattern being formed by the intersection of warp and weft yarns at intervals of five and eight strands of yarn respectively. The fine linens are cambrics, lawns, and handkerchiefs; and lastly, printed and dyed linen fabrics may be assigned to a special though not important class. Numerous local, fancy, and temporary names are frequently attached to linen fabrics; but in the above list are only included such articles as occupy a standing position in the great markets. In a general way it may be said regarding the British industry that the heavy linen trade centres in Dundee; medium goods are made in most linen manufacturing districts; damasks are chiefly produced in Dunfermline and Perth; and the fine linen manufactures have their seat in Belfast and the north of Ireland. Leeds is the centre of the linen trade of England.

Linen fabrics have several advantages over cotton, resulting principally from the microscopic structure and length of the flax fibre. The cloth is much smoother and more lustrous than cotton cloth; and, presenting a less "woolly" surface, it does not soil so readily, nor absorb and retain moisture so freely, as the more spongy cotton; and it is at once a cool, clean, and healthful material for bed-sheeting and clothing. Bleached linen, starched and dressed, possesses that unequalled purity, gloss, and smoothness which make it alone the material suitable for shirt-fronts, collars, and wrist-bands; and the gossamer delicacy, yet strength of the thread it may be spun into fits it for the fine lace-making to which it is devoted. Flax is a heavier material than cotton, but weight for weight it is much stronger, single yarn having proportionate strength in the ratio of 3 to 1·83, doubled yarn 3 to 2·26, and cloth 3 to 2·13. Of course cotton, on the other hand, has many advantages peculiarly its own.

Trade and Commerce.—The application of machine power to the entire range of linen manufactures has greatly improved the position and developed the resources of the industry, so that linen now occupies a well-defined and important position among the principal textiles. Had it not been for the sudden and unprecedented growth of the jute trade, no doubt the coarser and heavier branches of the trade would have attained much greater dimensions; and the development of the jute industry of Scotland fully accounts for the comparatively inelastic condition of the Scottish linen trade.

The following table indicates the extent of the linen industries in the United Kingdom at the various dates specified:—

	1856.	1861.	1870.	1880.
Number of factories	417	399	500	...
" spindles	1,288,000	1,217,000	1,558,000	1,367,000
" power-looms	8,689	14,792	35,301	41,990
Horse-power—Steam	14,387	31,727	52,017	...
" Water	8,985	4,854	4,978	...
Persons employed—Ireland	28,753	33,525	55,089	...
" " Scotland	31,722	33,599	49,917	...
" " England	19,787	20,305	19,816	...
Total	80,262	87,429	124,772	...

It is only in Ireland that the linen industries during the above period have exhibited a healthy expansion. To that country alone the following figures apply:—

	1856.	1861.	1870.	1880.
Number of factories	118	217	312	...
" spindles	568,000 (1859)	593,000	867,000 (1871)	911,000
" power-looms	3,633	4,933	14,509	21,153

The number of flax spindles and power-looms in the European factories in 1881 is given in the *Annual Report of the Irish Flax Supply Association* as follows:—

	Spindles.	Power-Looms.		Spindles.	Power-Looms.
Ireland	879,835	21,177	Russia	180,000	8,000
Scotland	265,268	16,756	Italy	59,228	722
England	190,808	4,031	Switzerland	9,000	...
France	470,000	22,000	Holland	7,700	1,200
Austria-Hungary	380,440	500	Sweden	3,810	93
Germany	318,467	8,000	Spain	...	1,000
Belgium	295,140	4,755			

In all these returns no account is taken of the hand-looms in use, although in most of the Continental districts hand-loom weaving is more common than weaving by power.

The amount and declared value of the exports of linens, linen yarn, etc., from the United Kingdom at intervals extending over fifty years is thus stated from official sources:—

Year.	Linen Manufactures.		Thread, etc.	Yarns.	
	Yards.	Value in £.	Value in £.	lb.	Value in £.
1831	69,283,892	2,400,043	61,661	...	...
1841	90,321,761	3,194,827	111,261	17,733,575	822,876
1851	129,106,753	3,822,985	284,461	18,841,326	951,426
1861	116,322,469	3,571,181	269,778	27,981,042	1,622,216
1871	220,467,476	6,911,228	592,598	36,235,625	2,218,129
1881	178,858,300	5,163,669	680,269	18,285,500	1,057,172

The principal consumers of British linen manufactures are indicated in the following table, showing the exports for the year 1881:—

Country.	Piece Goods.		Yarns.	
	Yards.	Value in £	lb.	Value in £
United States	82,050,900	2,344,916	...	...
Spanish West Indies	19,038,500	447,658	...	...
Australia	13,526,200	404,917	...	...
Germany	4,980,900	209,223	2,476,500	209,16
British North America	6,281,600	155,227	...	...
France	3,318,000	178,924	1,527,200	182,164
Holland	298,800	11,241	2,438,100	102,264
Belgium	...	...	1,629,500	125,619
Spain and Canaries	...	...	6,552,600	280,212
Other countries	35,550,600	1,089,477	3,661,600	157,64
Total.	165,045,500	4,836,582	18,285,500	1,057,172
To which add:—				
Damasks, checked and printed linens	5,499,800	161,115	...	...
Sailcloth and sails	8,308,000	165,972	...	...
Thread for sewing	...	...	2,587,100	329,98
Unenumerated	...	...	...	350,2
			...	...
Total linen manufactures	178,858,300	5,163,669		
" yarn, thread, etc.	...	1,737,482	...	1,737,4
" value of exports	...	6,901,101		

(J. PA.)

LING (*Molva vulgaris*), a fish of the cod-fish family (*Gadidæ*), readily recognized by its long body, two dorsal fins (of which the anterior is much shorter than the posterior), single long anal fin, separate caudal fin, a barbel on the chin, and large teeth in the lower jaw and on the palate. Its usual length is from 3 to 4 feet, but larger individuals of 5 or 6 feet in length, and some seventy pounds in weight, have been taken. The ling is found in the North Atlantic, from Spitzbergen and Iceland southwards to the coast of Portugal. Its proper home is the German Ocean; especially on the coasts of Norway, Denmark, Great Britain, and Ireland it occurs in great abundance, generally at some distance from the land, in depths varying between 50 and 100 fathoms. During the winter months it approaches the shores, when great numbers are caught by means of long lines. On the American side of the ocean it is less common, although generally distributed along the south coast of Greenland, and on the banks of Newfoundland. This fish is one of the most valuable species of the cod-fish family; a certain number are consumed fresh, but by far the greater portion are prepared for exportation to various countries on the Continent (Germany, Spain, Italy). They are either salted and sold as "salt-fish," or split from head to tail and dried, forming, with

rly prepared cod and coal-fish, the article of which
g Lent immense quantities are consumed in Ger-
and elsewhere under the name of "stock-fish."
he oil is frequently extracted from the liver and
by the poorer classes of the coast population for
mp or as medicine.

NG. See HEATH.

NGARD, JOHN (1771-1851), the Roman Catholic
ian of England, was born of humble parentage at
hester on February 5, 1771. His intellectual abili-
egan to manifest themselves at a very early age,
1782 he was sent to the English college at Douay,
he continued until shortly after the declaration
r by England (1793). For some time after his
to England he lived as tutor in the family of
Stourton, but in October, 1794, he settled along
seven other former members of the old Douay col-
t Crook Hall near Durham, where on the comple-
f his theological course he became vice-president
reorganized seminary. In 1795 he was ordained
, and soon afterwards undertook the charge of the
of natural and moral philosophy. In 1808 he
panied the community of Crook Hall to the new
nore commodious buildings at Ushaw, Durham,
1811, after declining the presidency of the col-
t Maynooth, he withdrew to the secluded mission
rnby in Lancashire, where for the rest of his life
und the leisure which his literary pursuits de-
d. In 1817 he visited Rome, where he made
researches in the Vatican Library, and also nego-
some business connected with the English Col-
In 1821 Pope Pius VII. created him doctor of
ty and of canon and civil law; and in 1825 Leo
is said to have made him cardinal *in petto*. He
t Hornby on July 17, 1851.

gard was the author of a considerable number of
nal and ephemeral writings of an avowedly contro-
character. He also wrote *The Antiquities of the*
Saxon Church (1806), of which a third and greatly
ed edition appeared in 1845 under the title *The His-*
d Antiquities of the Anglo-Saxon Church; containing an
of its origin, government, doctrines, worship, revenues,
rical and monastic institutions; but the work with
his name is chiefly associated is *A History of Eng-*
rom the first invasion by the Romans to the commence-
the reign of William III., which appeared originally
ols. at intervals between 1819 and 1830. Three suc-
subsequent editions had the benefit of extensive
n by the author; a fifth edition in 10 vols. 8vo ap-
in 1849, and a sixth, with life of the author by
y prefixed to vol. x., in 1854-55. Soon after its
ance it was translated into French, German, and
. It is a work of ability and research; and, though
al Wiseman certainly claimed too much for its
when he called him "the only impartial historian
country," yet the candid and dispassionate student
ways find it profitable to learn from the pages of
d the aspects which the events of English history
ted to the mind of an able and intense Roman Cath-
the earlier decades of the 19th century.

KÖPING, a city of Sweden, the see of a bishop,
e chief town of the province of East Gothland, is
d in a fertile plain 21 miles by rail south-west of
olm, and communicates with Lake Roxen (½ mile
north) and the Gata and Kinda canals by means
now navigable Stångå. Most of the houses are
d. The cathedral (1150-1499), a Romanesque
g with a Gothic choir, is, next to the cathedral
sala, the largest church in Sweden, and since the
ral of Trondhjem has lost so many of its treas-
presents the richest variety of objects of interest
student of mediæval art in the country. In the
of St. Lawrence, also called the Church of the
s, are some paintings by Hörberg, the Swedish
t artist. Other buildings of note are the mas-
ld episcopal palace (1470-1500), afterwards a
palace, and the old gymnasium founded by Gus-
Adolphus in 1627, which contains a valuable
(30,000 volumes) of old books and manuscripts,
rly kept in the cathedral. The population, 3285
0, was 8706 in 1878.

Linköping early became a place of mark, and was already a bishop's see in 1082. It was at a council held in the town in 1153 that the payment of Peter's pence was agreed to at the instigation of Nicholas Breakspeare, afterwards Adrian IV. The coronation of Birger Jarlsson Waldemar took place in the cathedral in 1251; and in the reign of Gustavus Vasa several important diets were held in the town. A large portion of it was burned down in 1700.

LINLITHGOW, or **WEST LOTHIAN**, a county of Scotland, stretching for 17 miles along the south coast of the Firth of Forth, and bounded E. and S. E. by Edinburghshire or Midlothian, S. W. by Lanarkshire, and W. by Stirlingshire. It lies between 55° 49′ and 56° 1′ N. lat., and 3° 18′ and 3° 51′ W. long. According to the ordnance survey the area is 127 square miles, or 81,114 acres, a considerable increase on previous estimates. The longest straight line that can be drawn within the county is one of about 22 miles from north-east to south-west, but the average length does not exceed 16 miles, and the average breadth is about 7. To the east and west the boundaries are in the main natural, following in the one case the Almond and the Breich Water (except in the neighborhood of Mid Calder, where Edinburgh encroaches on Linlithgow), and in the other the Avon and Drumtassie Burn. To the south they are more conventional, the line of the watershed between the Clyde and the Forth being disregarded, and a good deal assigned to Lanarkshire which physically belongs to the Lothians. The whole county lies in the basin of the Forth, and there is a general slope upwards from the shore of the firth to the hilly district in the south-west. The surface is diversified by hill and dale, and with the exception of the upland moors on the borders of Lanarkshire, there is no extensive tract of level ground. A kind of irregular valley stretches across the county from east to west, affording the most convenient route for road, canal, and railway. Between this valley and the firth runs a line of crags and hills often beginning to rise immediately behind the shore; the more prominent are Dalmeny, Dundas, the Binns, and Glowerow'rem or Bonnytounhill, the last a rounded eminence 559 feet above the sea, crowned by a conspicuous monument to General A. Hope, who fell in the Indian mutiny of 1858. To the south of the valley the ground rises pretty rapidly towards the west, more gradually towards the east. Between Bathgate and Linlithgow a general height is obtained of from 600 to 700 feet,—the principal eminences being Knock (1017 feet), Cairnpaple or Cairnnaple (upwards of 1000), the Torphichen Hills, Bowden (749), and Cockleroy (942). Farther east come the Riccarton Hills; and the range may be said to terminate with Binny Craig, a striking crag-and-tail similar to those of Stirling and Edinburgh. To the south-east stands the isolated Dechmont Law (686 feet).

There is no stream of any considerable size belonging exclusively to the county. The Almond rises in Lanarkshire, enters Linlithgowshire near Polkemmet, receives the White Burn and the Black Burn, and joining the Breich Water (also from Lanarkshire) passes Livingston, Mid Calder (Midlothian), and Kirkliston, and reaches the firth across the Drum Sands at Cramond. The Avon, which is already nearly as large as it ever becomes when it reaches the borders of the county below Muiravonside, passes Linlithgow bridge and Kinneil, and falls into the firth some distance below Inveravon. With the exception of Lochcoot, the only lake in the county is Linlithgow Loch, a sheet of water covering 102 acres to the north of the town, well-known as a meeting place for curling and skating clubs. The eastern end is not more than 10 feet deep, but in the western portion there is one place about 50 feet deep. Eels are still caught in great numbers; and the perch and the worthless roach, locally called the braise, are abundant. See LAKE, p. 221.

"The eastern portion of the county," says Mr. H. M. Cadell, "consists of Lower Carboniferous Sandstones, thin estuarine limestones, and shales. The

Carboniferous Limestone series, to which the strata in the western portion belong, is separated from the underlying Calciferous Sandstone series by the Carboniferous or Mountain Limestone, which dips westward and is well exposed along the outcrop in the disused lime-quarries of Hillhouse, Silvermine, and Bathgate. The overlying rocks consist of sandstones, shales, and coal-seams, which are worked at Bathgate and Bo'ness. above which come the three upper marine bands named respectively the Index, the Calmy or Janet Peat, and the Castlecary or Levenseat Limestone, the last of which is taken as the top of the Carboniferous Limestone series and the base of the Millstone Grit. The strata containing most of the workable coals at Bo'ness have a thickness of about 150 fathoms, measuring from the Index Limestone to the lowest seam. The extensive sheets of contemporaneous volcanic rocks (basalts, dolerites, and tuffs) form a remarkable feature in the geology of the county. The high ground between Linlithgow and Bathgate is formed of an almost uninterrupted pile of these rocks about 2000 feet in thickness. They thin out towards the north and south, and on the shore of the firth they occur regularly interbedded with the seams of the Bo'ness coal-field, which are usually in no degree injured by their presence. The tuffs or ash beds are well seen at Preston Burn, Carriden House, and St. Magdalen's near Linlithgow, while Binns Hill near Blackness is the remnant of an old volcano of Lower Carboniferous age. Trap dykes rise through the strata and run in an east and west direction, one of which can be traced for 4 miles between Parkly Craigs and the Avon." A few mineral springs, sulphurous and chalybeate, are known to exist in the county, but none of them are now of medical repute. In 1875 a salt spring was discovered in the volcanic rocks to the west of the town of Linlithgow, boring having been prosecuted to the depth of 451 feet in search of drinking water. (See *Proc. Roy. Soc. Edin.*, 1875.) Coal-mining has been prosecuted in the county probably from the time of the Romans; and the earliest document extant in regard to coal-pits in Scotland is a charter granted about the end of the 12th century to William Oldbridge of Carriden. In 1871 it was estimated by the Government commissioners that the Linlithgow coal-fields still contained 127,621,800 tons of coal accessible at depths not exceeding 4000 feet. About 1440 miners were employed in the twenty coal-mines in 1881, and the output for the year was 504,338 tons. At the same date there were six iron-mines in operation, with 926 miners and an output of 180,194 tons. The Kinneil Company, which is the largest in this department, employs about 700 persons. Fire-clay is worked in connection with the coal; at Kinneil 60,000 bricks can be turned out per week. Since their value was made apparent by Mr. Young about 1850, the shales have been the object of an extensive industry at Broxburn, Uphall, Dalmeny, and Hopetoun. The six mines in 1881 employed 691 miners, and the output was 353,826 tons. Limestone, freestone, and whinstone are all quarried within the county, and the Binny freestone has been used for the Royal Institution, the National Gallery, and many of the principal buildings of both Edinburgh and Glasgow. As a manufacturing district Linlithgow does not stand high,—the chief establishments, apart from those mentioned in connection with the town, being grist-mills, distilleries, chemical works, glass works, spade and shovel works, and a pottery.

The climate of the county hardly differs from that of the western portion of Midlothian. The annual rainfall, however, is somewhat greater, and is a fifth more than that of East Lothian: for the twenty-one years ending 1880 the mean at Linlithgow was 31·76 inches, while at East Linton (east of Haddington) it was 26·52.[1]

Linlithgow is classed as a mixed agricultural and pastoral county; the agricultural element, however, preponderates largely, though the area of permanent pasture has been increasing. It is calculated that of the total area of 81,114 acres about 20,000 acres consist of the best sorts of clay (carse, etc.), 22,700 of clay on a cold bottom, 9500 of loam, as much of light gravel and sand, 14,000 of moorland and high rocky ground, and 1500 of peat. Only a very small part of the arable land remains unreclaimed; the parish of Livingston, which in the beginning of last century was nearly covered with heath and juniper, is now all under rotation. Bathgate and Torphichen contain patches of peat moss and swamp. In Carriden and Dalmeny, and generally along the coast, the soil is light and early, though in some parts it varies so often that no single term is applicable to any considerable area. According to the agricultural returns for 1881, the corn crops occupied 17,347 acres, green crops 7264, clover and grass under rotation 12,980, permanent pasture (exclusive of heath or mountain land) 21,289. Oats are the most important of the cereals, 10,348 acres; and barley comes next with 4874 acres, an increase on the 3787 acres of 1856. Wheat has been steadily losing ground; while 1856 showed 4643 acres, 1881 gives only 1450. Beans, which used to occupy about 1000 acres, are now reduced to 655. An increasing area is devoted to clover and grasses for hay; but on the other hand the turnip area has been considerably reduced—5142 acres in 1856, 3861 in 1881. The extent of land under potatoes has slightly increased,—3052 acres for 1881, 2355 being the average for 1866–75. Cattle breeding is not much attended to, but a considerable number of animals are bought and fattened, and dairy farming is largely prosecuted, the fresh butter and churn milk being sent mainly to Edinburgh, but also to Newcastle, etc. Very little cheese is made. As a sheep-farming county Linlithgow stands very low—the returns giving 17,605 head in 1881, 23,070 in 1866. But few horses are bred, and the number of those in the county has remained wonderfully steady for the last fifteen years. Pigs have grown greatly fewer—3166 in 1866, and only 1442 in 1881.

The average extent of the farms is 108 acres, rather less than in Midlothian; of the total 542 more than 200 do not exceed 50 acres, and only 35 rise above 300. Very little of the land is rented at more than £3 per acre; an average of £2 to £2 10s. for the best districts, of 30s. to 35s. for medium soils, and 15s. to 25s. for the worst land, will not be wide of the mark. "The leases of the arable lands are almost invariably for nineteen years, and grass lands are usually let annually by public auction, though in some instances they are taken for a period of three or five years."[2]

Though it is only in the neighborhood of the principal mansions that large stretches of wood exist, the county as a tree-growing district rises considerably above the average for Scotland,—the woodland area being returned as 4899 acres in 1881, or one-sixteenth of the whole (Edinburgh shows one-twentieth). The finest woods are those of Hopetoun (where the beech avenues are especially noteworthy), Newliston, Kinneil, and Dalmeny. Much of the old timber has been recently cut down, but replanting has been vigorously prosecuted.

The valued rent of the county in 1649 was £75,027 Scots, or about £6252 sterling. In 1806 the real rent was £64,518 sterling, and in 1811, £88,745. Exclusive of railways, the valuation was £189,198 in 1876–77, and £216,011 in 1881–82. In the beginning of the century the county was practically in the hands of between thirty and forty landowners (Trotter). According to the Government return for 1872–73, the total number of owners was 1535, of which 287 possessed upwards of 1 acre. The proprietors holding estates above 2000 acres were as follows:—Earl of Hopetoun, 11,870 acres; Earl of Rosebery, 5680; Sir William Baillie of Polkemmet, 4320; Duke of Hamilton's Trustees, 3694; Lord Cardross, 2995; William Cowan of Linburn, 2231; Robert H. J. Stewart of Champfleurie, 2036; Dundas's Trustee, 2082.

Hopetoun House, the seat of the earl of Hopetoun, and the grandest mansion in the county, occupies a fine position between Queensferry and Blackness. Begun about 1696 by Sir William Bruce of Kinross, and completed long afterwards by Mr. Adam, it practically occupies the site of the old castle of Abercorn, which was taken from the Douglas family by James II. in 1455. Dalmeny Park (earl of Rosebery) lies about 1½ miles west of Cramond; the neighboring ruins of Barnbougle Castle, an ancient seat of the Mowbrays, have been incorporated with a modern building. Almondell House (earl of Buchan) is situated on the Almond, not far from Mid Calder. Kinneil, a now deserted residence of the dukes of Hamilton, associated with memories of Colonel Lilburn and Dugald Stewart, is a short distance to the south-west of Bo'ness. On a trap rock jutting out into the firth stands Blackness Castle, now used as a powder magazine, but once one of the "keys of the kingdom," with a busy little port under its protection. Niddry Castle (often called West or Seton Niddry), one of the resting places of Queen Mary, is now a mere ruin. Newliston (now owned by T. A. Hog) was for many years the residence of Lord Stair, who first introduced the field cultivation of cabbage, and is said to have laid out the woods according to the plan of the battle of Dettingen. Dundas Castle was the original seat of the Dundas family. Pardovan recalls the memory of Walter Steuart, author of the *Collections concerning the Worship, etc., of the Church of Scotland*, and Philipstoun that of John Dundas, another Scottish ecclesiastical lawyer. Kincavel was the birthplace and family mansion of Patrick Hamilton.

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[1] For earlier notices of rainfall, etc., see Trotter's *Agriculture of West Lothian*.

[2] See Thomas Farrall, in *Trans. of Highland and Agric. Soc. of Scotland*, 1877.

There are two royal burghs in the county—Linlithgow and Queensferry, and, besides the towns Bathgate, Borrowstounness or Bo'ness, Armadale, a number of thriving villages.

The Union Canal connecting the Forth and Clyde Canal with Edinburgh passes along the central valley, and crosses the Almond and Avon by bridges designed by Thomas Telford. The North British Railway has two lines between Edinburgh and Glasgow, which pass through the county *via* Linlithgow and Bathgate respectively. Queensferry and Bo'ness are both connected with the system by branch lines, and Bathgate is a junction of some importance.

The population of West Lothian has increased from 17,844 in 1801 to 43,198 (22,436 males and 20,762 females) in 1881. The greatest increase (8601) took place in the decennial period 1851-1861, the least (606) in 1811-21. The females were in excess of the males in every census down to 1841; since then the preponderance has been on the other side. The total population was 23,291 in 1831, 26,872 in 1841, 30,044 in 1851, 38,645 in 1861, and 40,965 in 1871.

Traces of the prehistoric occupation of the county are fairly numerous. On Bowden Hill is an earthwork connected by Mr. Glennie and others with the Arthurian contest. On Cairnpaple may be seen a circular building of unknown but early origin, and at Kipps is a cromlech once surrounded by circles of stones. Stone cists have been discovered at Carlowrie, Dalmeny, Newliston, etc. Near Inveravon is a vast accumulation of shells considered by several geologists to be a natural bed, but claimed by antiquaries as an artificial mound, either a kitchen midden or a heap for the manufacture of lime (see David Grieve, *Proc. Sc. Soc. of Ant.*, 1870-71). The Wall of Antoninus lies for a considerable distance within the county, and is believed to give origin to the names Carriden and Walton (see an account of a detailed exploration of the wall in *Builder*, 1877, pp. 1023-25). A fine legionary tablet was discovered at Bridgeness in 1868 (*Proc. Sc. Soc. of Ant.*, vol. viii.). Roman camps can be distinguished in several places.

At Torphichen[1] are the remains of a preceptory of the Knights of St. John of Jerusalem, partly used as a parish church. The churches of Dalmeny, Abercorn, Kirkliston, Uphall, and South Queensferry are of early origin,—Romanesque and Norman Gothic.

Linlithgow, the county town of the above county, and a royal and parliamentary burgh, situated in the central valley, 18 miles by rail from Edinburgh, consists almost exclusively of a single street running east and west along both sides of the highway; gardens behind the houses stretch down to the lake or climb the lower slopes of the rising grounds, on which a considerable number of suburban residences have been erected. In the early part of the century the general aspect of the street was antique and picturesque, but the greater proportion of the frontage has been rebuilt or modernized. Apart from the palace and the contiguous church of St. Michael, the only edifices of any note are an ancient towerlike building near the railway station, which tradition regards as a mansion of the Knights Templars, the town-house (1688), and the county courts (1865). "Linlithgow for wells" is a proverbial expression; and the cross well in the public square in front of the town-house is a striking piece of grotesque carved work in stone, originally erected, it is believed, in the reign of James V., but rebuilt in 1807. The burgh school goes back to the pre-Reformation times. Shoemaking and tanning are the leading industries; but a large distillery and (in the neighborhood) two paper mills, glue works, and a soap factory add considerably to the business of the place. Linen bleaching is altogether a thing of the past. A grain market is held every Friday. The riding of the marches of the burgh is still performed annually by the magistrates and trades. The population of the burgh was 2282 in 1792-93, 3843 in 1861, 3690 in 1871, and 3913 in 1881.

Linlithgow Palace is by general consent the finest ruin of its kind in Scotland. Heavy but effective, the sombre walls rise above the green knolls of the promontory which divides the lake into two nearly equal portions. In plan it is almost square (168 by 174 feet), enclosing a court (91 by 88 feet), in the centre of which stands the ruined fountain used as a model for that erected in front of Holyrood Palace. At each corner there is a tower with an internal spiral staircase,—that of the north-west angle being crowned by a little octagonal turret known as "Queen Margaret's Bower," from the tradition that it was there that the consort of James IV. sat and watched for his return from Flodden. The oldest portion of the building is probably the west side, whose massive masonry, hardly broken by a single window, is supposed to date in part from the time of James III.; but the larger part of the south and east sides belongs to James V., about 1535; and the north side was rebuilt in 1619-20. Of James V.'s portion, which is architecturally the richest, the main apartments are the Lyon chamber or parliament hall, and the chapel royal. The grand entrance, approached by a drawbridge, was on the east side; above the gateway are still some weather-worn remains of rich allegorical designs, once resplendent with color. A few yards to the south of the palace is the church of St. Michael, a Gothic (Scottish Decorated) building (180 feet long internally excluding the apse and the steeple, by 62 in breadth excluding the transepts) probably founded in 1242, but mainly built in the 15th century. The central west front steeple was till 1821 topped by a crown like that of St. Giles, Edinburgh.[2]

Linlithgow (wrongly identified with a Roman Lindum) was a royal burgh with a royal castle and an endowed church as far back as the reign of David I. Edward I., who had encamped there the night before the battle of Falkirk (1298), wintered at Linlithgow in 1301, and next year built "a pele (castle) mekill and strong," which in 1313 was captured by the Scots through the assistance of William Bunnock or Binning and his famous hay-cart. Later in the century (1369) the customs of Linlithgow yielded more than those of any other chief town except Edinburgh; and the burgh was taken along with Lanark to supply the place of Berwick and Roxburgh in the court of the Four Burghs (1368). Robert II. granted it a charter of immunities, the oldest still preserved, in 1384. The palace becoming a favorite residence of the kings of Scotland, and often forming part of the marriage settlement of their consorts (Mary of Guelders, 1449; Margaret of Denmark, 1468; Margaret of England, 1503), is frequently mentioned in Scotch history. James V. was born within its walls in 1512, and his daughter Mary, December 7, 1542. In 1570 the Regent Murray was assassinated in the High Street by Hamilton of Bothwellhaugh. In 1600 the title Earl of Linlithgow was bestowed on Alexander, Lord Livingston, by James VI., who, after his accession to the English throne, retained an affection for the palace, and visited it again in 1617. The University of Edinburgh took refuge at Linlithgow from the plague in 1645-46; and in the same year the national parliament, which had often sat in the palace, was held there for the last time. The public burning of the Covenant (1661), the passing of Prince Charles through the town in 1745, and the burning of the palace by Hawley's dragoons in 1746 are the chief remaining facts in the local annals. Most of the privileges which Linlithgow enjoyed have dropped away. The rise of Bo'ness gave the last blow to the prosperity of its port at Blackness; its burgh lands have all been sold; and, after gaining its case three times in the Court of Session, it was deprived (1859) by the House of Lords of any claim to levy bridge toll and custom from the Edinburgh and Glasgow Railway.

Besides the *Statist. Account of Scotland*, see Sir Robert Sibbald's *Hist. of the Sheriffdoms of Linlithgow and Stirlingshire*, Edinburgh, 1710; Penney, *Hist. Account of Linlithgowshire*, Edinburgh, 1832, extracted from Chalmer's *Caledonia;* J. Trotter, *General View of Agriculture of W. Lothian*, Edinburgh, 1794, new and enlarged edition, 1810; J. P. Wood, *The Ancient and Modern State of the Parish of Cramond*, Edinburgh, 1794; James Collie, *The Royal Palace of Linlithgow*, with architectural plates, Edinburgh, 1840; George Waldie, *Hist. of the Town and Palace of Linlithgow*, Linlithgow, 3d ed., 1879.

LINNÆUS (1707-1778). Carl von Linné, better known under his earlier name of Carolus Linnæus, was born 13th May, 1707, o. s., at Råshult, in the parish of Stenbrohult, in the province of Småland, Sweden.[1] His parents were Nils Linnæus, the comminister, afterwards pastor, of the parish, and Christina, the daughter of Brodersonius, the previous incumbent; Carl, the subject of our notice, being their eldest child. When only four years old he was much impressed with his father's conversation with some of his people concerning the properties and names of certain of the local plants of economic value; from that time he constantly asked his father about the quality and nature of every plant he met with, often asking more than his father could answer; at other times, having forgotten the information previously given him, he was threatened with a refusal to answer his queries unless he promised to remember what he was told. To this early discipline Linnæus afterwards ascribed his tenacious memory, which, added to his extreme sharpness of sight, laid the foundations of his eminence as a reforming naturalist.

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[1] See *Abstract of the Charters . . . in the Chartulary of Torphichen* ed. 1830).

[2] See Billing's *Antiquities;* Collie's monograph; and *Characteristics of Old Church Architecture of Scotland*, 1861.

His formal education began in 1714, when he was put under the private tuition of Telander, and three years later he entered the primary school at Wexiö. In 1719 he was committed to the care of Gabriel Hök, who afterwards married his pupil's sister Anna Maria; this preceptor had greater skill as a teacher than his predecessors, and was less severe; still he was unable to overcome the distaste the youth had acquired for ordinary scholastic studies. During his last years at school Linnæus took advantage of the greater liberty then allowed him to ramble in search of plants.

In 1724 he passed from the school to the gymnasium, carrying with him the same dislike for all those studies which were considered necessary for admission to holy orders, his father's intention being to bring up his son in his own profession. Botany, a science at that time entirely neglected, almost wholly engrossed his attention; he formed a small library of the few Swedish writers who had treated of plants, which he was constantly poring over, although unable to comprehend all he found in their volumes.

In 1726 his father came to Wexiö, hoping to hear a good report of the two years' study of his son; but, whilst there was no complaint as regards his moral deportment, his progress in the prescribed studies had been so unsatisfactory that his father was recommended to apprentice him to a tailor or shoemaker, in preference to giving him a learned education, for which he was evidently unfitted. The old clergyman, deeply grieved at this poor return for his struggles to keep his son at school during the previous twelve years, went to visit Dr. Rothman, a medical practitioner and lecturer on physics in the town, to consult him regarding a bodily ailment from which he was suffering. In the course of conversation he mentioned his mortification at his son's dulness, when Rothman expressed his confident belief that he could end the troubles of both father and son, and that Carl, though extremely backward in theological studies, would yet distinguish himself in medicine and natural history. Rothman further offered to board and lodge Carl during the twelvemonth more which must be passed in the gymnasium. A short time after this, Rothman gave his pupil a course of private instruction in physiology with great success, the young man acquitting himself excellently on examination. His tutor also gave him hints as to the proper manner of studying plants, and directed his attention to Tournefort's system of arrangement, which was founded on the differences in the flowers.

He proceeded to the university of Lund in 1727, bearing a dubiously worded testimonium from Nils Krok, the rector of the gymnasium, to the effect that shrubs in a garden may disappoint the cares of the gardener, but if transplanted into different soil may prosper, therefore the bearer was sent to the university, where, perchance, he might find a more propitious climate. His former preceptor Hök kept back this doubtful recommendation, and presented Linnæus to the rector and dean as his own private pupil, thus procuring his matriculation.

Whilst studying here, Linnæus lodged at the house of Dr. Kilian Stobæus, afterwards professor of medicine, and physician to the king, who possessed an excellent museum of minerals, shells, birds, and dried plants; the methods of preservation here adopted were as a revelation to the young student, and taught him how to prepare his own acquisitions. Stobæus suffered greatly from ill-health, he was also lame, and one-eyed; but he was an amiable and extremely able man, having a large practice among the wealthier classes in the province of Skåne. Linnæus was sometimes called upon to assist the physician by writing the prescriptions, but as he wrote a bad hand, he was frequently sent away again. In those days physicians wrote legibly.

A German student named Koulas also lodged with Stobæus, and amongst the indulgences he enjoyed was that of access to the library of his landlord; with his fellow-student Linnæus formed a close friendship, and in return for instruction in the physiology which Linnæus had learned of Dr. Rothman, Koulas supplied him with volumes from the book-shelves of Stobæus, which were read by him stealthily at night. The mother of Stobæus, who was old and wakeful, noticed that there was constantly a light in Linnæus's room, and, being afraid of fire, desired her son to reprimand the young man for his carelessness. Two nights afterwards, Stobæus went into Linnæus's chamber at eleven o'clock, expecting to find him asleep, but was astonished to find him poring over books. He was forced to confess whence these were obtained, and was at once ordered to bed; but the next morning, being further questioned, he was granted full liberty to use the library, and perfect familiarity was accorded by the doctor, who, having no children, held out hopes of making the young student his heir.

Whilst botanizing in the spring of 1728, Linnæus was attacked by what he considered to be a venomous animal, afterwards named by him *Furia infernalis*, in allusion to the torment and danger he suffered from it; after his recovery, he passed the summer at his father's house in Småland. Here he again met Rothman, who strongly advised him to quit Lund and to go to Upsala, where he would find greater facilities for the prosecution of his medical studies, and possibly obtain some scholarship to eke out his scanty means. Linnæus adopted his patron's advice, and started for Upsala with a sum of £8 sterling, that being all he was to expect from his parents. At this seat of learning his slender funds were soon exhausted; being young and unknown, he found no means of earning money by lecturing or teaching; he became dependent on chance generosity for a meal, and had to repair his shoes with folded paper. He could not well return to Lund, for Stobæus had taken offence at his departing without consulting him; and, besides, the journey required money which he did not possess.

In the autumn of this year, 1729, Linnæus was engaged intently examining some plants growing in the academical garden, when a venerable clergyman asked him what he was studying, whether he understood botany, whence he came, and how long he had been busied in the study. After being questioned at length, he was requested to follow his companion home; there he discovered him to be Dr. Olaf Celsius, professor of theology, at that time working at his *Hierobotanicon*, which saw the light nearly twenty years later. When the professor saw Linnæus's collections he was still more impressed, and, finding him necessitous, he offered him board and lodging; he afterwards admitted him to close intimacy, and allowed him the free use of his rich library. The temporary adjunctus of the faculty of medicine being incompetent, Linnæus, by the rec-commendation of Celsius, was able to get some private pupils, and thereby to assume a more creditable appearance.

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[1] The new style being then in process of gradual adoption in Sweden, the year 1704 was regarded as a common year in that country, consequently the true date of Linnæus's birth, according to our present reckoning, was 23d May, 1707, the commonly received date, 24th May, being an error due to supposing the calendar in Sweden and Russia at that time to be identical.

At this time there was only one medical student who distinguished himself by diligence in study, and that was Peter Arctedius, who afterwards styled himself Artedi. A close friendship sprang up between the two young men; they studied in concert, and vied with each other in their attainments, with perfect good temper, though of very diverse dispositions. Linnæus was sovereign in ornithology, entomology, and botany, Artedi reserving to himself the umbelliferous plants, fishes, and amphibia. A silence, almost total, prevailed in the university at this time on topics of natural history; during his whole curriculum Linnæus did not hear a single public lecture delivered on anatomy, botany, or chemistry.

During this period of intense receptivity, he came upon a critique which ultimately led to the establishment of his artificial system of plant classification. This was a review of Vaillant's *Sermo de Structura Florum*, Leyden, 1718,[1] a thin quarto in French and and Latin; it set him upon examining the stamens and pistils of flowers, and, becoming convinced of the paramount importance of these organs, he formed the idea of basing a system of arrangement upon them. Another work by Wallin, *Γάμος φύτων, sive Nuptiæ Arborum Dissertatio*, Upsala, 1729, having fallen into his hands, he drew up a short treatise on the sexes of plants, and showed it to Dr. Celsius, who put it into the hands of the younger Olaf Rudbeck, at that time professor of botany in the university. In the following year Rudbeck, whose advanced age compelled him to lecture by deputy, appointed Linnæus his adjunctus; in the spring of 1730, therefore, the latter began his lectures, and was accompanied by many pupils on his botanical excursions. The academic garden was entirely remodelled under his auspices, and furnished with many rare species, he being now in a position to direct the gardener, whereas in the year before he had actually solicited appointment to the vacant post of gardener, which was refused him on the ground of his capacity for better things.

His evenings were now devoted to the preparation of his epoch-making books, which were issued several years afterwards in the Netherlands. His position at the university having become unpleasant, he readily undertook to explore the little known country of Lapland, at the cost of the Academy of Sciences of Upsala. He started thence on May 12, 1732, O. S., carrying all his luggage on his back, journeying at first on horseback along the road skirting the coast to Umeå, thence by boat up the river to Lyksele within the Arctic Circle, penetrating to what he terms Olycksmyran (*i. e.*, the unlucky marsh) in spite of the melting of the ice, which made travelling in that part almost impossible. Unable to penetrate farther into the interior, he returned to Umeå, still skirting the sea-shore by Piteå to Luleå. From this latter place he made a long excursion to the north-west by Jockmock and Qvickjock; then, crossing the mountain range, he came out upon the coast of Finmark. He retraced his steps to Luleå, and at Calix he learned the art of assaying "in two days and a night," continuing his journey through Torneå, and the eastern coast of the gulf of Bothnia to Abo; there he rested eight days, and finally reached Upsala by sea. The distance traversed in this tour was upwards of 4600 English statute miles; the cost of his journey is given at 112 silver dollars, or less than £25 sterling. His own account of the journey was published in English by Sir J. E. Smith, under the title *Lachesis Lapponica*, in 1811; the scientific results were published in his *Flora Lapponica*, Amsterdam, 1737. In 1733 Linnæus was engaged in teaching the method of assaying ores, and hoped to be allowed to lecture on botany; but a quarrel broke out between a rival, Rosen, and himself, the former having, by private influence, contrived to get a prohibition put on all private lectures on medicine in the university. Linnæus, enraged at finding his livelihood thus cut off, went so far as to draw his sword upon Rosen, but was prevented from harming his antagonist. At this juncture the governor of Dalecarlia invited Linnæus to travel through his province, as he had done through Lapland. Whilst on this journey he lectured at Fahlun to large audiences; Browallius, the chaplain there, afterwards bishop of Åbo, now strongly urged Linnæus to go abroad and take his degree of M. D. at a foreign university, by which means he could afterwards settle where he pleased. Linnæus, having become attached to the eldest daughter of Dr. Moré or Moræus, left Sweden in 1735 to seek his fortune in the manner stated, and to return to claim her hand.

He travelled by Lübeck and Hamburg; detecting a seven-headed hydra to be a fabrication at the latter, he was obliged to quit the town in haste to avoid the wrath of its possessor. From Altona he went by sea to Amsterdam, staying there a week; he then proceeded to Harderwijk, where he went through the requisite examination, and defended his thesis on the cause of intermittent fever. His scanty funds were now nearly spent, but he passed on through Haarlem to Leyden; there he called on Gronovius, who, returning the visit, was shown the *Systema Naturæ* in MS., and was so greatly astonished at it that he sent it to press at his own expense. The first edition was in eight folio sheets; the subsequent editions were in 8vo; and the twelfth immensely enlarged edition appeared during the author's lifetime. This famous system, which, artificial as it was, substituted order for confusion, largely made its way on account of the lucid and admirable laws, and comments on them, which were issued almost at the same time. See BOTANY, vol. iv. p. 70. Boerhaave, whom Linnæus saw after waiting eight days for admission, recommended him to Burmann at Amsterdam, where he stayed a twelvemonth, living at the house of the professor. While there he issued his *Fundamenta Botanica*, an unassuming small octavo, which has exercised immense influence. The wealthy banker Cliffort having invited Linnæus to visit his magnificent garden at Hartecamp, he remained there, living like a prince, but working most assiduously in the garden and library, both of which were kept up without regard to cost. His *Flora Lapponica* was now printed, containing a description of the genus *Linnæa*, by his friend Gronovius; he selected this plant to bear his name, from a similarity, as he thought, between it and himself. Whilst living with Cliffort, Linnæus met with his old fellow-student Artedi, who was quite destitute, having spent all his money in London; Linnæus introduced him to Seba, then working at fishes, Artedi's chief object of study; he worked hard at describing them, until only six remained undescribed, when he unfortunately fell into a canal at night, and was drowned. Linnæus persuaded Cliffort to redeem the manuscript, and he published it as a memorial of his deceased friend.

In 1736 Linnæus visited England. He was warmly recommended by Boerhaave to Sir Hans Sloane, but the old collector seems to have received him coldly. A better reception awaited him at Oxford, where Dr. Shaw welcomed him cordially; Dillenius, the professor of botany there, was icy at first, but afterwards thawed completely, kept him a month, and even offered to share the emoluments of the chair with him. At Chelsea he saw Philip Miller, and took some plants thence to Cliffort; but certain other stories which are current about Linnæus's visit to England are of very doubtful authenticity.

On his return to the Netherlands he completed the printing of his *Genera Plantarum*, a volume which must be considered the starting point of modern systematic botany; Tournefort formed many genera, but Linnæus was the first to circumscribe them. During the same year, 1737, Linnæus finished arranging Clifford's collection of plants, living and dried; these were described in the *Hortus Cliffortianus*, a folio illustrated with engravings by Ehret; this book was entirely written in nine months. During the compilation he used to "amuse" himself with drawing up the *Critica Botanica*, also printed in the Netherlands. But this strenuous and unremitting labor told upon him; the atmosphere of the Low Countries seemed to oppress him beyond endurance; he resisted all Clifford's entreaties to remain with him, and started homewards.

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[1] This work has a serious mistake on both title pages; it is corrected in the errata, but the correction seems to have escaped the notice of every bibliographer.

Van Royen managed to detain him a year at Leyden, to help in rearranging the garden, thereby offending Clifford, whom he had quitted on the plea of hastening back to Sweden. Linnæus now published his *Classes Plantarum*, and almost at the same time appeared Van Royen's *Hortus Leydensis* and Gronovius's *Flora Virginica*, both of these being drawn up on the Linnæan system. In 1738 Boerhaave pressed Linnæus to accept a post at Surinam; he declined this for himself, but passed it on to Johan Bartsch of Königsberg, a member with himself of a select club of naturalists at Leyden. Bartsch ultimately fell a victim to the climate of that colony.

While residing at Leyden Linnæus was warned that one of his acquaintance was endeavoring to supplant him in the affections of Sara Moré; he intended to set out at once, but was attacked by ague before he could start. Clifford, hearing of this, took Linnæus to his own house again, and would not suffer him to depart until he was sufficiently well. His complete recovery, however, did not take place until he had gained the higher country of Brabant, where in one day he felt himself entirely renovated. He continued his journey to Paris, where he visited Antoine and Bernard de Jussieu, botanizing with the latter. Abandoning all notion of returning through Germany, he went to Rouen, sailed for Sweden, and landed at Helsingborg.

Linnæus established himself in September, 1738, as physician in Stockholm, but, being unknown as a medical man, no one at first cared to consult him, a great change from the attention paid to him abroad; he himself declared "that, had he not been in love, he would certainly have left his native country." By degrees he found patients, was then appointed naval physician at Stockholm, with minor appointments, and was married on the 26th June, 1739.

Early in 1740 Rudbeck died, and Roberg resigned; the chairs of botany and medicine at Upsala being thus vacant, Rosen and Linnæus were chosen respectively to fill them. The former rivals afterwards agreed to exchange professorships to their mutual benefit; in 1741, previous to this exchange, Linnæus travelled through Oland and Gothland, by command of the state, publishing his results in *Oländska och Gothländska Resa*, 1745. The index to this volume shows the first employment of trivial names in nomenclature.

Henceforward his life was a continuous course of prosperity, his time being taken up by teaching and the preparation of other works. In the year 1745 he issued his *Flora Suecica* and *Fauna Suecica*, the latter having occupied his attention during fifteen years; afterwards, two volumes of observations made during journeys in Sweden, *Wästgöta Resa*, Stockholm, 1747, and *Skånska Resa*, Stockholm, 1751. He examined the collections made many years before in Ceylon by Hermann, the full publication taking place in his *Flora Zeylanica*, Stockholm, 1747. In 1748 he brought out his *Hortus Upsaliensis*, showing that he had added eleven hundred species to those formerly in cultivation in that garden. In 1750 his *Philosophia Botanica* was given to the world; it consists of a commentary on the various axioms he had published in 1735 in his *Fundamenta Botanica*, and was dictated to his pupil Löfling, while the professor was confined to his bed by an attack of gout so violent as to threaten his life; he attributed his recovery to eating plentifully of wood-strawberries, a regimen he afterwards carefully observed. A much slighter attack in the following year was mainly cured by the pleasure caused by Kalm bringing home many new plants from Canada.

He catalogued the Queen's Museum at Drotningholm, and the King's at Ulrichsdal, but the most important work of this period of his life is unquestionably his *Species Plantarum*, Stockholm, 1753,—a second edition being issued in 1762. In this volume the trivial names are fully set forth; although they had been previously shadowed forth by Linnæus and others, yet to him belongs the merit of establishing the use of a single epithet in addition to the generic name. In the same year Linnæus was created knight of the Polar Star, the first time a scientific man had been raised to that honor in Sweden.

In 1755 he was invited by the king of Spain to settle in that country, with a liberal salary, and full liberty of conscience, but he declined on the ground that whatever merits he possessed should be devoted to his country's service; Löfling was sent instead, but died within two years. He was enabled now to purchase the estates of Söfja and Hammarby; at the latter he built his museum of stone, to guard against loss by fire. His lectures at the university drew men from all parts of the world; the normal number of students at Upsala was five hundred, whilst he occupied the chair of botany there it rose to fifteen hundred. In 1761 a patent of nobility was granted, antedated to 1757, from which time Linnæus was styled Carl von Linné; his arms were those now borne by the Linnean Society of London. To his great delight the tea plant was introduced alive into Europe in 1763; this year also his son Carl was allowed to assist his father in his professorial duties, and to be trained as his successor.[1] At the age of sixty Linné's memory began to fail; an apoplectic attack in 1774 greatly weakened him; two years after he lost the use of his right side; and he died 19th January, 1778, of an ulceration of the bladder. He was buried in the cathedral of Upsala, with every token of universal regret.

In person Linnæus was described as of medium height, with large limbs, brown piercing eyes, and acute vision, and quick-tempered. He was accustomed to sleep five hours in summer and ten in winter. He lived simply, acted promptly, and noted down his observations at the moment. His handwriting was peculiar, and not very easy to read; copies of his own books were interleaved and copiously annotated, every new discovery being posted into its proper place at once, so that new editions were readily prepared when wanted.

With him arrangement seems to have been a passion; he delighted in devising classifications; not only did he systematize the three kingdoms of nature, but even drew up a treatise on the *Genera Morborum*. He found biology a chaos; he left it a cosmos. When he appeared upon the scene, new plants and animals were in course of daily discovery in increasing numbers, due to the increase of trading facilities; he devised schemes of arrangement by which these acquisitions might be sorted provisionally, until their natural affinities should have become clearer. He made many mistakes; but the honor due to him for having first enunciated the true principles for defining genera and species, and his uniform use of trivial names, will last so long as biology itself endures. His style is terse and laconic; he methodically treated of each organ in its proper turn; he had a special term for each, the meaning of which did not vary, so that the term did not suggest two ideas at once. The reader cannot doubt the author's intention; his sentences are business-like and to the point. The omission of the verb in his descriptions was an innovation, and gave an abruptness to his language which was foreign to the writing of his time; but it probably by its succinctness added to the popularity of his works.

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[1] Carl von Linné the younger, the elder son of the distinguished naturalist, was born at Fahlun, 20th January, 1741. Delicate in constitution, he seemed to be oppressed with his father's reputation and his having to support it. He published two decades of new plants, and three dissertations, contributing also some descriptions to the first edition of Aiton's *Hortus Kewensis*, at the time of his visit to England. He died unmarried at Upsala, 1st November, 1783; and, his only brother Johan having died in infancy, the succession became extinct in the male line. His mother sold the collections and books of father and son to Dr. J. E. Smith, the first president of the Linnean Society of London. When Smith died in 1828, a subscription was raised to purchase the herbarium and library for the Society, whose property they now remain. Smith sold the collection of minerals in 1796, and added many insects to the Linnean types, but the herbarium is practically in the same state as when the elder Linné himself last used it. The manuscripts of most of his publications, and the letters he received from his contemporaries, are likewise in the possession of the Society.

By his force of character he shifted the scientific centre of gravity during his life to a small town in Sweden; he was constantly receiving presents and praise from crowds of correspondents in every civilized country and in every station of life; hence it is not surprising that this universal homage should have bred the vanity which disfigures the latter part of his diary.

No modern naturalist has impressed his own character with greater force upon his pupils than did Linnæus. He imbued them with his own intense acquisitiveness, reared them in an atmosphere of enthusiasm, trained them to close and accurate observation, and then dispatched them to various parts of the globe. His students being drawn from many quarters, he had an extensive choice; some fell victims to fatigue and unkindly climates, but there was no lack of successors. With these young enthusiasts their master's lore was like a gospel; they were eager to extend the knowledge of it, and to contribute to its richness.

The published works of Linnæus amount to more than one hundred and eighty, including the *Amœnitates Academicæ*, for which he provided the material, revising them also for press; corrections in his handwriting may be seen in the Banksian and Linnean Society's libraries. His correspondence was wide and copious. Some of his letters have been published, but the bulk of them remains inedited. Many works remain in MS.; some have lately been published, such as the *Flora Dalecarlica*, and the *Svenska Arbeten*, both edited by Dr. Ewald Ahrling; those which were issued during the author's life are enumerated by Dr. Pulteney in his *General View of the Writings of Linnæus*. (B. D. J.)

LINNELL, JOHN (1792–1882), a richly gifted English painter, was born in London on the 16th of June, 1792. His father being a carver and gilder, Linnell was early brought into contact with artists, and when he was ten years old he was already drawing and selling his portraits in chalk and pencil. His first artistic instruction was received from Benjamin West, and he spent a year in the house of John Varley the water-color painter, where he had William Hunt and Mulready as fellow-pupils, and made the acquaintance of Shelley, Godwin, and other men of mark and individuality. In 1805 he was admitted a student of the Royal Academy, where he obtained medals for drawing, modelling, and sculpture. He was also trained as an engraver, and executed a transcript of the Burial of Saul, one of Varley's most impressive pictures. In after life he frequently occupied himself with the burin, publishing, in 1834, a series of outlines from Michelangelo's frescoes in the Sistine chapel, and, in 1840, superintending the issue of a selection of plates from the pictures in Buckingham Palace, one of them, a Titian landscape, being mezzotinted by himself. At first he supported himself mainly by miniature painting, and by the execution of larger portraits, such as the likenesses of Mulready, Whately, Peel, and Carlyle. Several of his portraits he engraved with his own hand in line and mezzotint. He also painted many subjects like the St. John Preaching, the Covenant of Abraham, and the Journey to Emmaus, in which, while the landscape background is usually prominently insisted upon, the figures are yet of sufficient size and importance to supply the title of the work. But it is mainly in connection with his long series of paintings of pure landscape that his name is known to the public. When he was only seventeen, his Removing Timber carried off the fifty-guinea prize offered by the British Institution for the best landscape, and for many years Linnell was a regular contributor to the exhibitions of that body, and to those of the Royal Academy and the Society of Painters in Oil and Water Colors. His works commonly deal with some scene of typical uneventful English landscape, which is made impressive by a gorgeous effect of sunrise or sunset. They are full of true poetic feeling, and are rich and glowing in color. His art proved exceptionally remunerative; he was able to command very large prices for his pictures, and about 1850 he purchased a property at Redhill, Surrey, where he resided till his death, on the 20th of January, 1882, surrounded by his children—two of them artists like himself—and his children's children, and painting with unabated power till within the last few years of his life. His leisure was greatly occupied with a study of the Scriptures in the original, and he published several pamphlets and larger treatises of Biblical criticism. Among his literary productions are a work on *The Misnaming of the Scripture the Old and New Testament*, 1856; *The Lord's Day the Day of the Lord*, 1859; a pamphlet on *The Ascension Sacrifice of the Old Testament*, 1864; and one on *The Royal Academy a National Institution*, 1869. A word should be said regarding Linnell's connection with William Blake. He was one of the best friends and kindest patrons of the great visionary artist. He gave him the two largest commissions he ever received for single series of designs—£150 for drawings and engravings of *The Inventions to the Book of Job*, and a like sum for those illustrative of Dante.

LINNET, Anglo-Saxon *Linete* and *Linet-wige*, whence seems to have been corrupted the old Scottish "Lintquhit," and the modern northern English "Lintwhite,"—originally a somewhat generalized bird's name, but latterly specialized for the *Fringilla cannabina* of Linnæus, the *Linota cannabina* of recent ornithologists. This is a common and well-known song-bird, frequenting almost the whole of Europe south of lat. 64°, and in Asia extending to Turkestan. In Africa it is known as a winter visitant to Egypt and Abyssinia, and is abundant at all seasons in Barbary, as well as in the Canaries and Madeira. Though the fondness of this species for the seeds of flax (*Linum*) and hemp (*Cannabis*) has given it its common name in so many European languages,[1] it feeds largely, if not chiefly, in Britain on the seeds of plants of the order *Compositæ*, especially those growing on heaths and commons. As these waste places have been gradually brought under the plough, and improved methods of cultivation have been applied to all arable land, in England and Scotland particularly, the haunts and means of subsistence of the Linnet have been slowly but surely curtailed, and hence of late years its numbers have undergone a very visible diminution throughout Great Britain, and its diminution has also been aided by the detestable practice of netting it in spring—for it is a popular cage-bird—so popular indeed as to require no special description. According to its sex, or the season of the year, it is known as the Red, Gray, or Brown Linnet, and by the earlier English writers on birds, as well as in many localities at the present time, these names have been held to distinguish at least two species; but there is now no question among ornithologists on this point, though the conditions under which the bright crimson-red coloring of the breast and crown of the cock's spring and summer plumage is donned and doffed may still be open to discussion. Its intensity seems due, however, in some degree, at least, to the weathering of the brown fringes of the feathers which hide the more brilliant hue, and it is to be remarked that in the Atlantic islands examples are said to retain their gay tints all the year round, while throughout Europe there is scarcely a trace of them visible in autumn and winter; but, beginning to appear in spring, they reach their greatest brilliancy towards midsummer; and it is also to be remarked that they are never assumed by examples in confinement. The Linnet begins to breed in April, the nest being generally placed in a bush at no great distance from the ground. It is nearly always a neat structure composed of fine twigs, roots, or bents, and lined with wool or hair. The eggs, often six in number, are of a very pale blue marked with reddish or purplish brown. Two broods seem to be commonly brought off in the course of the season, and towards the end of summer the birds—the young of course greatly preponderating in number—collect in large flocks and move to the sea-coast, whence a large proportion depart for more south ern latitudes. Of these emigrants some return the following spring, and are invariably recognizable by the more advanced state of their plumage, the effect presumably of having wintered in countries enjoying a brighter and hotter sun.

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[1] *E. g.*, French, *Linotte*; German, *Hänfling*; Swedish, *Hämpling*.

Nearly allied to the foregoing species is the Twite, so named from its ordinary call-note, or Mountain-Linnet, the *Linota flavirostris*, or *L. montium* of ornithologists, which can be at once distinguished by its yellow bill, longer tail, and reddish-tawny throat. This bird never assumes any crimson on the crown or breast, but the male has the rump at all times tinged more or less with that color. In the breeding-season it seems to affect exclusively hilly and moorland districts from Herefordshire northward, in which it partly or wholly replaces the common Linnet, but is very much more local in its distribution, and, except in the British Islands and some parts of Scandinavia, it only appears as an irregular visitant in winter. At that season, it may, however, be found in large flocks in the low-lying countries, and as regards England even on the sea-shore. In Asia it seems to be represented by a kindred form, *L. brevirostris*.

The **Redpolls** (*q. v.*) form a little group placed by many authorities in the genus *Linota*, to which they are unquestionably closely allied, but in this work they may be considered later; and, as before stated (**Finch**, vol x. p. 167), the Linnets seem on the other hand to be related to the birds of the genus *Leucosticte*, the species of which, in number uncertain, inhabit the northern parts of North-West America and of Asia. The most recent list of the birds of the former country by Mr. Ridgway (*Bull. U. S. Nat. Museum*, No. 21, 1881) includes four species and one local race, of which there is need here to mention only *L. tephrocotis*. It is generally of a chocolate color, tinged on some parts with pale crimson or pink, and has the crown of the head silvery-gray. Another species, *L. arctoa*, was formerly said to have occurred in North America, but its proper home is in the Kurile Islands or Kamchatka. This has no red in its plumage. The birds of the genus *Leucosticte* seem to be more terrestrial in their habit than those of *Linota*, perhaps from their having been chiefly observed where trees are scarce; but it is possible that the mutual relationship of the two groups is more apparent than real. Allied to *Leucosticte* is *Montifringilla*, to which belongs the Snow-Finch of the Alps, *M. nivalis*, so often mistaken by travellers for the Snow-Bunting, *Plectrophanes nivalis*. (A. N.)

LINOLEUM is a kind of floor-cloth, invented and introduced by Mr. F. Walton, who in 1860 obtained a patent for its manufacture. It consists of a preparation of linseed oil and ground cork intimately mixed and spread in a uniform layer over a sheet of rough jute canvas. Under the name of kamptulicon, a material similar in appearance and properties, but in which prepared india-rubber took the place of oxidized linseed oil, was in use to a limited extent previous to the introduction of linoleum; the latter material, however, was found to possess several advantages; among others it had the merit of comparative cheapness as against kamptulicon, which it entirely supplanted. Linoleum also became a formidable competitor with the old form of oil floor-cloth, and on the expiry of Mr. Walton's patent the manufacture of the new material was very generally taken up in Kirkcaldy, the principal seat of the floor-cloth trade. In the hands of Messrs. Michael Nairn & Co., who were the first to introduce the floor-cloth industry into Scotland, the machinery used for making linoleum has been improved in important respects, and the ingenuity and resource of Mr. Walton, the original patentee, have discovered several new adaptations and modifications of his original invention.

The making of linoleum involves three distinct preliminary operations—(1) the oxidation of the linseed oil, (2) the grinding of the cork, and (3) the weaving of the jute canvas backing. Of these operations the oxidation of the oil is the most peculiar and distinctive. The linseed oil is first boiled with litharge in the way practised for preparing ordinary boiled oil (see **Linseed**), and it is next oxidized by exposure, in exceedingly thin films, to the influence of air. To secure the exposure of sufficient surfaces of oil to the atmosphere, a large lofty apartment is hung with sheets or continuous webs of calico cloth, which are allowed to depend from near the roof into troughs or tanks on the floor. These webs of calico are kept sufficiently far apart to allow free circulation of air between them. They are daily drenched with boiled oil by allowing it to trickle down from the top over their entire surface, the distribution being effected by a special arrangement of movable tanks and tubs. It will be seen that an enormous surface of oil can thus be exposed within a comparatively limited space. The influence of oxygen on the oil films is facilitated by the blowing of heated air into the chamber so as to keep up a continual circulation; and the activity of the process is unpleasantly manifested by the extremely acrid odor which is evolved by the oil. Day by day the thickness of the coating of oxidized oil increases, and when a deposit of about half an inch has been accumulated, the drenching is stopped. The product, now ready for being withdrawn, forms firm translucent sheets of a caoutchouc-like substance having a straw yellow color, possessed of a certain amount of elasticity, and communicating no oily stain to paper. These sheets are now torn into small pieces and reduced to a uniform plastic mass by means of powerful crushing rollers, after which the material is placed in a close boiler with the addition of certain proportions of kawrie gum, rosin, and ochre, umber, or other pigment, according to the ground-color desired. The boiler is heated by steam, and the entire mass, being thoroughly incorporated by means of stirrers, is run into a shallow trough, from which, after cooling and solidifying, it is taken in large slabs. These are piled up awaiting future use, and when required for manufacturing purposes they are cut into blocks about the size of an ordinary brick.

Ground cork, which is the second essential constituent of linoleum, may be made from cork cuttings and scraps; but, the supply of such material being unequal to the demand, bale cork, of secondary quality as imported, is very largely used. It is first broken to pieces about the size of a nut; the fragments are fed into the hopper of a mill; and the cork passes thence between a pair of ordinary millstones in which it is reduced to a meal-like condition, in exactly the same way as wheat is ground to flour. The product is sifted, and the insufficiently ground portions are returned to be passed again through the mill. In the grinding of the cork great care is necessary to prevent iron, stone, or other hard foreign material from getting into the mill, as such substances, causing sparks between the stones, readily give rise to explosions in air so laden with fine dust as that of the mill necessarily is.

In the making of the jute backing the only notable feature is the great width of the loom, in which webs 12 feet broad are woven by Messrs. Nairn. The maximum width of that produced by other makers, however, has hitherto been 6 feet.

The actual preparation of linoleum floor-cloth in the factory of Messrs. Nairn is conducted in a continuous series of operations by machinery which has been patented by that firm. The bricks of oxidized oil and the requisite proportion of cork are thrown into a hopper, where they are thoroughly mixed in a kind of pug mill, whence the mixture is shot forward in a tube, at the open end of which it is sliced off in thin crumbling masses by a revolving knife. Spread out in thin sheets, it passes from this between a series of steam-heated rollers, from the last of which it is scratched off by a circular drum covered with sharp steel points, and falls in a fine shower into a feeding box the whole width of the linoleum to be made. From this feeding box the mixture is uniformly delivered on the surface of the canvas, which here meets it, and passing immediately between powerful smooth rollers, the semi-plastic mix-

firmly squeezed on the surface of, and rendered
nt to, the rough open canvas which forms its
The distance between the upper and lower com-
g roller determines the thickness of the linoleum,
standard thicknesses being recognized, viz., $\frac{3}{32}$,
d $\frac{5}{32}$ parts of an inch. Linoleum of the thickness
an inch is also made for public libraries and read-
oms on account of its perfect noiselessness. It
mains to coat or waterproof the raw canvas back
il paint, and the floor-cloth is finished as plain
m. The printing of patterns in various colors on
face is done as described under FLOOR-CLOTH,
p. 288. Corticine is a form of linoleum, in
the oil is oxidized by chemical agents.

ntly a method of ornamenting linoleum with pat-
the form of tiles or tesseræ, the color of each tile
ight through to the canvas or sufficiently deep for
t wear, has been devised and patented by Mr. C. F.
The patentee prefers to use canvas first covered
thin linoleum coating. This he brings on a table on
are a series of moulds corresponding with the colored
tern required. Into each mould is put the required
y of properly-colored granulated linoleum material,
is compressed into solid tiles by the descent of
rs. The part covered by the pattern is carried for-
nd powerfully squeezed between hydraulic rams,
being thus made smooth, homogeneous, and firmly
t, while in the meantime the moulds are being
nd a new set of tiles prepared in the first stage of
ration. Mr. Walton, the original patentee of lino-
as adapted a preparation of oxidized oil and cork or
hickening material embossed with patterns for wall
ions under the name of "Lincrusta Walton."

(J. PA.)

SEED is the seed of the common flax or lint,
usitatissimum, from which also the well-known
x is obtained. The plant itself is figured and
ed under FLAX, vol. ix. p. 256. The fruit of
plant consists of a globose capsule which splits
e cocci, each containing two seeds. These seeds,
seed of commerce, are of a lustrous brown color
lly and a compressed and elongated oval form,
slight beak or projection at one extremity. The
testa contains, in the outer of the four coats into
it is microscopically distinguishable, an abundant
n of mucilaginous matter; and it has within
in layer of albumen, enclosing a pair of large
yledons. The seeds when placed in water for
ime become coated with glutinous matter from
dation of the mucilage in the external layer of
dermis; and by boiling in sixteen parts of water
ude sufficient mucilage to form with the water
pasty decoction. The cotyledons contain the
e linseed oil referred to below. Linseed grown
ical countries is much larger and more plump
at obtained in temperate climes, but the seed
he colder countries, on the other hand, yields a
uality of oil. Flückiger and Handbury found
seeds of Sicilian linseed, thirteen of Black Sea,
enteen of Archangel linseed weighed respectively
in. The average composition of linseed may be
represented by the following analysis by Dr.
s Anderson:—albuminous substances, 24·44; oil,
gum sugar and cellulose, 30·73; ash, 3·33;
7·50. Linseed is cultivated and secured as a
all European flax-growing countries, where
d is probably not less valuable than the fibre.
so obtained from Egypt and India, being culti-
in the latter country solely on account of the

rt from its value as a source of oil, and for sow-
seed is not a product of much economic import-
It formed an article of food among the Greeks
mans, and it is said that the Abyssinians at the
day eat it roasted. The oil is to some extent
food in Russia, and in parts of Poland and
ry. Linseed meal, partly on account of its bland
nstitution, is a valuable material for poultices.
time the crushed seeds were the officinally recog-
ataplasmic material, but the readiness with which that preparation became rancid through the oxidation of its abundant oil frequently rendered it a dangerous application for open sores. The *Lini farina* of the pharmacopœia is now the powdered meal of the cake left after expression of the oil, with a proportion of olive oil added when about to be used. An infusion of linseed under the name of "linseed tea" is a popular diluent in bronchial and other inflammatory affections. The abundant mucilage in linseed meal makes it a most useful material for luting stoppers in chemical jars, and other such joints in glass-work. Linseed cake, the marc left after the expression of the oil, is a most valuable feeding substance for cattle. According to a recent analysis by Dr. Voelcker (*Journ. Roy. Agric. Soc.*, 2d ser., vol. xvii. p. 659) it contains in 100 parts—oil, 10·90; albuminous compounds, 24·56; mucilage, sugar, and digestible fibre, 31·97; woody fibre, 11·47; ash, 6·20; moisture, 14·90.

Linseed is subject to extensive and detrimental adulterations, resulting not only from careless harvesting and cleaning, whereby seeds of the flax dodder and other weeds and grasses are mixed with it, but also from the direct admixture of cheaper and inferior oil seeds, such as wild rape, mustard, sesame, poppy, etc., the latter adulterations being known in trade under the generic name of "buffum." In 1864, owing to the serious aspect of the prevalent adulteration, a union of traders was formed under the name of the "Linseed Association," the members of which bind themselves to give compensation for all adulterations in excess of 4 per cent. of foreign matter. Highly adulerated linseed is, however, still very common outside the field of operations of the Linseed Association.

The quantity of linseed imported into the United Kingdom during the year 1881 was 1,829,838 quarters, of a value of £4,395,061. About one-half of this amount, 937,059 quarters, valued at £2,299,877, came from the East Indies, and the imports from Russia, amounting to 728,358 quarters, valued at £1,694,720, account for the greater part of the remainder.

Linseed Oil, the most valuable and characteristic of the series of drying oils, is obtained by expression from the seeds, with or without the aid of heat. Preliminary to the operation of pressing, the seeds are crushed between a pair of revolving rollers, and ground to a fine meal under heavy edge stones on a stone bed. For the extraction of the fine quality of oil known as cold-drawn the meal is, without further preparation, filled into woollen or canvas bags and enclosed in horse-hair envelopes for pressure, either in a Dutch mill worked by means of wedges and falling stampers or in a screw press, or, what is now more prevalent, in a special form of hydraulic press. The oil so obtained is of a clear yellow color, and is comparatively devoid of odor and taste. The cake left by cold pressure is again ground up, heated in a steam kettle to about 212° Fahr., and while hot submitted to further pressure, which results in the exudation of a less pure oil of a brownish-yellow color. In general practice, cold-drawn oil is little prepared; the linseed after grinding is submitted to a high heat, whereby the mucilage in the epidermis is destroyed, and the oil flows more freely; and in many crushing establishments the oil is obtained by a single operation under the press. The yield of oil from different classes of seed varies, but from 23 to 28 per cent. of the weight of the seed operated on should be obtained. A good average quality of seed weighing about 392 ℔ per quarter has been found in practice to give out 109 ℔ of oil.

Commercial linseed oil has a peculiar, rather disagreeable, sharp taste and smell; its specific gravity is given as varying from 0·928 to 0·953, and it does not solidify under the influence of very low temperature. It is soluble in 32 parts of alcohol, sp. gr. 0·82, in 6 parts of boiling alcohol, and in 1·6 of ether. By saponification it yields about 95 per cent. of fatty acids, principally linoleic acid ($C_{16}H_{28}O_2$), a body peculiar to the drying oils, and by treatment with oxide of lead about nine-tenths of the resulting lead salt is found to be linoleate of lead. The oil may be perfectly bleached by treatment with a solution of green sulphate of iron, with repeated shaking and exposure to the light for a period of four to six weeks. Exposed to the air in thin films, linseed oil absorbs oxygen and forms a resinous semi-elastic caoutchouc-like mass, oxylinoleic acid, $C_{16}H_{28}O_5$. The oil, when boiled with small proportions of litharge and minium, undergoes the process of resinification in the air with greatly increased rapidity. Sacc found by boiling 2500 grains of raw oil for ten minutes with 30 grains each of litharge and minium and weighing after twenty-four hours' exposure to the atmosphere, that the oil had lost only 60 grains. A second sample he boiled till there was a loss of 5 per cent. in weight, when the product assumed the consistency of molasses; and a third portion boiled to a loss of 12 per cent. became a caoutchouc-like mass. The first of these products he found dried, on exposure, to a fine transparent varnish; the second did not resinify after fifteen days' exposure; and the atmosphere had no effect on the third portion. The weight of the film of the first after complete resinification was increased 50 per cent. through absorption of oxygen, and the rate at which absorption took place was much influenced by heat.

To these physical properties the varied industrial applications of linseed oil are principally due. Its most important use is certainly found in the preparation of oil paints and varnishes. By painters both raw and boiled oil are used, the latter not only forming the principal medium in oil painting, but also serving separately as the basis of all oil varnishes. Boiled oil is prepared in a variety of ways —that most common being by heating the raw oil in an iron or copper boiler, which, to allow for frothing, must only be about three-fourths filled. The boiler is heated by a furnace, and the oil is brought gradually to the point of ebullition, at which it is maintained for two hours, during which time moisture is driven off, and the scum and froth which accumulate on the surface are ladled out. Then by slow degrees a proportion of "dryers" is added—usually equal weights of litharge and minium being used to the extent of 3 per cent. of the charge of oil; and with these a small proportion of umber is generally thrown in. After the addition of the dryers the boiling is continued two or three hours; the fire is then suddenly withdrawn, and the oil is left covered up in the boiler for ten hours or more. Before sending out, it is usually stored in settling tanks for a few weeks, during which time the uncombined dryers settle at the bottom as "foots." Besides the dryers already mentioned, acetate of lead, borate of manganese, binoxide of manganese, sulphate of zinc, and other bodies are used. The theory of the influence of boiling and of the addition of these bodies on linseed oil is not well understood. By Liebig it was suggested that they simply removed the mucilaginous and other foreign constituents of the oil which by their presence intercepted the action of oxygen; but by Chevreul and others the opinion was held that the chemicals used, by giving up oxygen to the oil, thereby induced a more rapid and energetic absorption from the air. However this may be, it does not appear at least that boiling is essential for the production of that active condition of the oil, as it may also be induced by treatment of cold raw oil with lead acetate and other agencies. Boiled oil is now very largely used in the manufacture of linoleum floor-cloth. See LINOLEUM.

Linseed oil is also the principal ingredient in printing and lithographic inks. The oil for ink-making is prepared by heating it in an iron pot up to the point where it either takes fire spontaneously or can be ignited with any flaming substance. After the oil has been allowed to burn for some time according to the consistence of the varnish desired, the pot is covered over, and the product when cooled forms a viscid tenacious substance which in its most concentrated form may be drawn into threads. By boiling this varnish with dilute nitric acid vapors of acrolein are given off, and the substance gradually becomes a solid non-adhesive mass the same as the ultimate oxidation product of both raw and boiled oil.

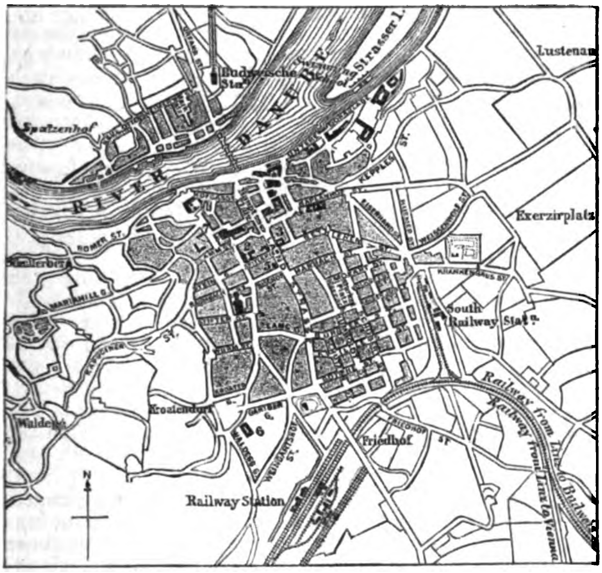
Linseed oil is subject to various falsifications, chiefly through the addition of cotton-seed, niger-seed, and hemp-seed oils; and rosin oil and mineral oils also are not infrequently added. Except by smell, by change of specific gravity, and by deterioration of drying properties, these adulterations are difficult to detect. (J. PA.)

LINUS is one of a numerous class of heroic figures in Greek legend, of which other examples may be found under HYACINTHUS, ADONIS. The connected legend is always of the same character; a beautiful youth, fond of hunting and rural life, the favorite of some god or goddess, suddenly perishes by a terrible death in spite of the heavenly love that would fain protect him. In some cases nothing is known to us with certainty beyond the mythological figure, but in many cases the religious background from which the legend stands out in relief has been preserved to us; in such cases we see that an annual ceremonial, everywhere of the same enthusiastic character, commemorated the legend. At Argos this religious character of the Linus myth was best preserved; the secret child of Psamathe by the god Apollo, Linus is exposed, nursed by sheep, and torn in pieces by the sheep-dogs. Every year in the festival Arnis or Cynophontis, the women of Argos mourned for Linus and propitiated Apollo, who in revenge for his child's death has sent a plague on the Argive children. The grave of Linus, like that of Hyacinthus at Amyclæ, was shown at Argos, at Thebes, at Chalcis, and probably at other places. The enthusiasm and *abandon* which characterized the similar festivals over Greece, Asia Minor, and Syria prove that it was part of the nature worship which spread in various forms by different roads and at different periods from the East into Greece. The songs of lamentation which accompanied the festival strongly impressed the Greeks, and it is most probable that the Phœnician words *ai lenu, ai lenu*, which formed the burden of the Adonis songs, originated the Greek words Linus and Αἴλινος. The Linus song is frequently mentioned in Greek literature, Homer, *Il.*, xviii. 569; Pind., *Fr.* 139 (Bergk), etc.; the tragic poets often use the word Αἴλινος as the refrain in mournful songs, and Euripides calls the custom Phrygian (*Or.*, 1380). In Phrygia the mythic correspondent of Linus is called Lityerses. There can be no doubt that Linus, Adonis, Manerus, Narcissus, etc., are personifications of the life and bloom of nature suddenly slain by the hot sun of summer, while with the religious mourning over the catastrophe of nature were intertwined the ideas of life in relation to death, of good and evil, and so on. The religious side of the Linus myth seems hardly to have existed in Greece outside of Argos; in Thebes, which also was a chief home of the legend, Linus was a hero of song and music. In this form he has passed into literature, *e. g.*, Virgil, *Ecl.*, vi. 67. He is conceived as the inventor of musical methods, especially of the θρῆνος, a kind of lament; this idea was expanded in various ways, particularly by the Alexandrine poets, and finally he was, after the analogy of Musæus, transformed into a composer of prophecies and legends.

See Brugsch, *Die Adonis Klage und das Linos Lied*, etc.

LINUS, one of the saints of the Gregorian canon, was, according to the *Breviarium Romanum*, the immediate successor of Peter in the see of Rome. He was a native of Volterra, who had attained a high degree of sanctity, and by his prevailing faith was able not only to cast out devils but to raise the dead. He wrote an account of the *res gestæ* of Peter, especially of his controversy with Simon Magus. He was beheaded by the orders of the ungrateful consul Saturninus, whose daughter he had freed from demoniac possession, after a pontificate of eleven years two months and twenty-three days. The authorities for the statement that Linus was, leaving Peter out of account, the earliest president of the Roman Church, are very early (Irenæus, *Adv. Hær.*, iii. 3, 3; Euseb, *H. E.*, iii. 2, 13); and that there actually was a presbyter of that name may be gathered from 2 Tim. iv. 21. According to Tertullian, however (*De Præscr.*, 32), Peter appointed Clement to be his successor. The genuineness of the alleged epitaph of Linus found in Rome is now no longer maintained; and the two books on the martyrdom of Peter and Paul which pass under his name must also be regarded as apocryphal and late.

LINZ, capital of Upper Austria, and see of a bishop, in 48° 19′ N. lat., 14° 16′ E. long., lies upon the right bank of the Danube, 98 miles west of Vienna, at the junction of the Kaiserin-Elizabeth Western Railway with a line from Prague and Budweis. The market-town of Urfahr, on the opposite side of the river, is connected with the city by an iron bridge 700 feet in length, constructed in 1872. Linz possesses two cathedrals, one dating from 1670, and another, dedicated to the Immaculate Conception, commenced in 1862, and still unfinished, a Lutheran (1845) and several Roman Catholic churches, the new synagogue opened in 1877, and many religious houses. The old Landeshaus, or House of the Estates (1562), the Bibliotheca Publica (1788), now (1882) containing 34,000 volumes, the Museum Francisco-Carolinum (1834), and a state theatre (1803) may also be noticed, with the episcopal and archducal palaces, and the castle now used as barracks. There are many educational establishments, including the theological diocesan lyceum, a new gymnasium and normal schools, and several hospitals and asylums. The principal manufactories are of tobacco (in 1880 employing 787 hands, and producing 25,286,050 cigars and 1850 tons of tobacco), and boot-varnish and blacking (2500 cwts.), the last chiefly exported to Hungary and Italy. Two breweries in 1881 produced 1,781,828 gallons of beer, and the other industries include iron-boat-building, and the manufacture of locomotives and agricultural implements. Trade and commerce are facilitated by the river. About forty-six thousand passengers embark or disembark at the steamboat landing stage, and the imports and exports there amount together to about 500,000 cwts. annually. There is a considerable traffic in woollen goods, carpets, linen fabrics, thread, prepared leather, iron wares, and salt. Cattle and meat markets are held twice a week. The Volksfest, a popular fair held generally every second September, is much resorted to by strangers. The surrounding country is highly picturesque. On the 31st December, 1880, the population (exclusive of the garrison, 2799) was 36,116, or with the suburbs of Waldegg (1204) and Lustenau (1568) 38,888, chiefly Roman Catholics.



Plan of Linz.

1. New Cathedral.
2. Academy.
3. Post Office.
4. Telegraph Office.
5. Public Library.
6. Military Hospital.
7. Theatre.

Linz is believed to stand on the site of the Roman station *Lentium* or *Lentia*. The authentic history of Linz cannot be traced farther back than 799. In 1140 it was purchased from Gottschalk, count of Kyrnberg, by Leopold IV., margrave of Austria; in 1324 it first received municipal rights, and in 1490 became the capital of the province above the Enns. Of various attacks which Linz from time to time successfully resisted the most notable was that by the insurgent peasants under Stephen Fadinger, 21st and 22d July, 1626, when the suburbs were laid in ashes. At Linz (16th December, 1645) peace was concluded between the emperor Ferdinand III. and the Transylvanian prince Rákóczy (see HUNGARY, vol. xii. p. 384). During the siege of Vienna in 1683 the castle at Linz was the residence of Leopold I. The triple deliverance of Linz from war, fire, and pestilence was commemorated by Charles VI., in 1723, by the erection of a marble monument known as Trinity Column. In 1741, during the war of the Austrian succession, Linz was taken by the troops of the elector of Bavaria, but on the 23d January, 1742, it was recovered by the Austrians. The bishopric was established by Pope Pius VI. in 1784. On the 15th of August, 1800, many of the principal buildings were destroyed by fire. On the 17th May, 1809, an Austrian force was defeated near the city in an engagement with Saxon and Wurtemberg troops. The chain of outlying forts, thirty-two in number, now abandoned, and to a great extent demolished, was constructed between 1828 and 1836 under the direction of Archduke Maximilian d'Este. A general assembly of the Catholic Union for Germany was held here 24th to 26th September, 1850. Tramways were introduced in 1880, and a new line of railway through the Kremsthal was completed as far as Kremsmünster in 1881.

See the anonymous *Führer auf der Kremsthalbahn, mit Beschreibung von Linz*, Linz, 1881; the *Statisticher Bericht Oberösterreichs 1876–1880*, Linz, 1881, vol. ii. pp. 243–283; the official *Ergebnisse über die Volkszählung in Linz*, Linz, 1881; F. Krackowizer, *Die Landeshauptstadt Linz*, Linz, 1875; and G. H. Heinse, *Linz und seine Umgebungen*, 2d ed., Linz, 1888.

LION. From the earliest historic times few animals have been better known to man than the lion. Its geographical habitat made it familiar to all the races among whom human civilization took its origin, and its strongly marked physical and moral characteristics have rendered it proverbial, perhaps to an exaggerated degree, and have in all ages afforded favorite types for poetry, art, and heraldry.

The literature of the ancient Hebrews abounds in allusions to the lion; and the almost incredible numbers that are stated to have been provided for exhibition and destruction in the Roman amphitheatres (as many as six hundred on a single occasion by Pompey, for example) show how abundant these animals must have been within accessible distance of the capital of the world.

The geographical range of the lion was once far more extensive than at present, even within the historic period covering the whole of Africa, the south of Asia, including Syria, Arabia, Asia Minor, Persia, and the greater part of northern and central Hindustan, and also the south-eastern portion of Europe, as shown by the well-known story told by Herodotus of the attacks by lions on the camels which carried the baggage of the army of Xerxes on his march through the country of the Pæonians in Macedonia. The very circumstantial account of Herodotus shows that the animal at that time ranged through the country south of the Balkans, through Roumania to the west of the river Carasu, and through Thessaly as far south as the Gulf of Lepanto and the Isthmus of Corinth, having as its western boundary the river Potamo and the Pindus mountains. The whole of the evidence relating to the existence of lions in Europe, and to their retreat from that continent shortly before the commencement of the Christian era, has been collected in the article on "Felis spelæa" in Boyd Dawkins and Sanford's *British Pleistocene Mammalia*, 1868. Fossil remains attest a still wider range, as it is shown in the same work that there is absolutely no osteological or dental character by which the well-known cave lion (*Felis spelæa* of Goldfuss), so abundantly found in cave deposits of the Pleistocene age, can be distinguished from the existing *Felis leo*. There are also remains found in North America of an animal named *Felis atrox* by Leidy, which the palæontologists just quoted attribute to the common lion; but, as they are very fragmentary, and as the specific characters by which most of the *Felidæ* are distinguished are more dependent on external than on anatomical conformation, this determination cannot be so absolutely relied upon.

At the present day the lion is found in localities suitable to its habits, and where not exterminated (as it probably was in Europe) by the encroachments of man, throughout Africa from Algeria to the Cape Colony, and in Mesopotamia, Persia, and some parts of the north-west of India. According to Blanford,[1] lions are still very numerous in the reedy swamps bordering the Tigris and Euphrates, and also occur on the west flanks of the Zagros mountains and the oak-clad ranges near Shiraz, to which they are attracted by the immense herds of swine which feed on the acorns. The lion nowhere exists in the table-land of Persia, nor is it found in Balúchistán. In India it appears now to be confined to the province of Kathiawar in Gujerat, though within the present century its range extended through the north-west parts of Hindustan, from Baháwalpur and Sind to at least the Jumna (about Delhi), southward as as far Khándesh, and in Central India through the Sagar and Nerbudda territories, Bundelkund, and as far east as Palamau. It was extirpated in Hariána about 1824. One was killed at Rhyli, in the Dumaoh district, Sagur and Nerbudda territories, so late as in the cold season of 1847–48; and about the same time a few still remained in the valley of the Sind river in Kotah, Central India (Blyth).

The great variations in external characters which different lions present, especially in the color and amount of mane, has given rise to the idea that there are several species, or, at all events, distinct varieties peculiar to different localities. It was at one time supposed, on the authority of Captain Walter Smee,[2] that the lion of Gujerat differed essentially from that of Africa in the absence of mane, but subsequent evidence has not supported this view, which was probably founded upon young specimens having been mistaken for adults. Lions from that district as well as from Babylonia, which have lived in the gardens of the London Zoological Society, have had as fully developed manes as any other of the species. Mr. F. C. Selous[3] has shown that in South Africa the so-called black-maned lion and others with yellow scanty manes are found, not only in the same locality, but even among individuals of the same parentage.

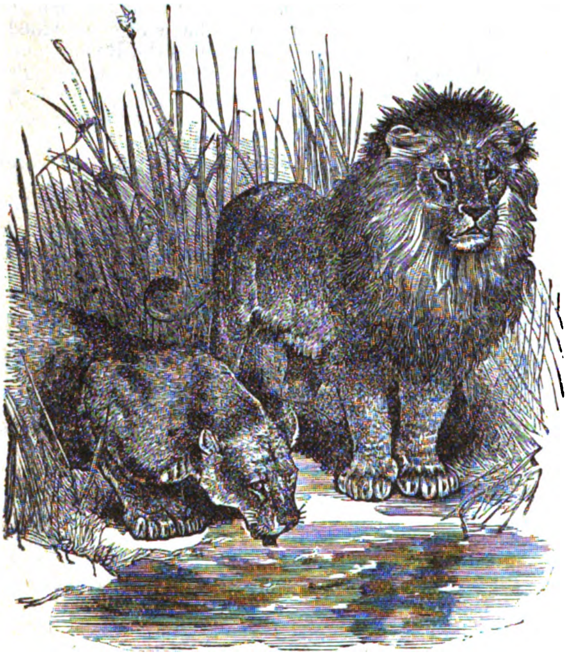


Fig. 1.—Lion and Lioness, after a Drawing by Wolf in Elliot's Monograph of the *Felidæ*.

The lion belongs to the very natural and distinctly defined group constituting the genus *Felis* of Linnæus (for the characters and position of which see article MAMMALIA), a genus held by Pallas and other philosophical naturalists as a model of what a genus ought to be, although recent writers have divided and subdivided it into as many as thirteen sections, on each of which a new generic term has been imposed. Among these sections is one containing the largest members of the group, and differing from the others in the well-marked anatomical character that the anterior cornu of the hyoid arch is but little ossified, and by the less important one that the pupil of the eye when contracted is a circular hole, instead of a vertical slit as in the cat. The lion agrees with the tiger and the leopard in these respects, but differs from them in its uniform style of coloring, and from all the other *Felidæ* in the arrangement of its hairy covering, the hair of the top of the head, chin, and neck, as far back as the shoulder, being not only very much longer, but also differently disposed from the hair elsewhere, being erect or directed forwards, and so constituting the characteristic ornament called the mane. There is also a tuft of elongated hairs at the end of the tail, one upon each elbow, and in most lions a copious fringe along the middle line of the under surface of the body, wanting, however, in some examples.[4] It must, however, be observed that these characters are peculiar to the adults of the male sex only, and that, even as regards their coloration, young lions show indications of the darker stripes and mottlings so characteristic of the greater number of the members of the genus; just as the young of nearly all the plain-colored species of deer show for a time the light colored spots which are met with in the adults of only some of the species. The usual color of the adult lion is yellowish-brown, but it may vary from a deep red or chestnut brown to an almost silvery gray. The mane, as well as the long hair of the other parts of the body, sometimes scarcely differs from the general color, but it is usually darker and not unfrequently nearly black. The mane begins to grow when the animal is about three years old, and is fully developed at five or six.

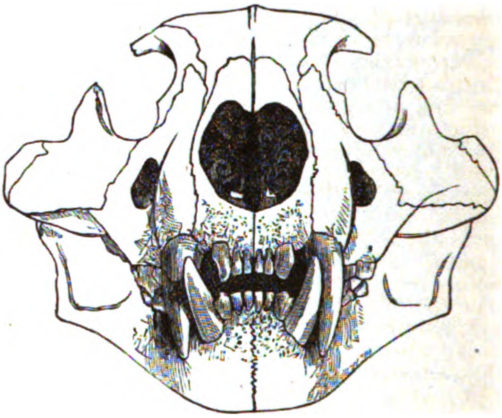


Fig. 2.—Front View of Skull of Lion.

In size the lion is only equalled or exceeded by the tiger among the existing *Felidæ;* though both species present great variations, the largest specimens of the latter appear to surpass the largest lions. A full-sized South African lion, according to Selous, measures

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[1] *Zoology and Geology of Eastern Persia*, 1876.

[2] *Transactions of the Zoological Society*, vol. i. p. 165, 1835.

[3] *A Hunter's Wanderings in Africa*, 1881, p. 258.

[4] Mr. Selous, whose opportunities for obtaining evidence upon this subject were very large, says that in the region of South Africa, between the Zambesi and the Limpopo rivers, he never saw a lion with any long hair under the body, and that the manes of the wild lions of that district are far inferior in development to those commonly seen in menageries in Europe.

' less than 10 feet from nose to tip of tail, follow- ı curves of the body. Harris gives 10 feet 6 of which the tail occupies 3 feet. The lioness t a foot less.

internal structure of the lion, except in slight resembles that of the other *Felidæ*, the whole ɪation being that of an animal modified to fulfil, most perfect degree yet attained, an active, eous mode of existence. The teeth especially lify the carnivorous type in its highest condition elopment. The most important function they o perform, that of seizing and holding firmly s of considerable size and strength, violently ing for life, is provided for by the great, sharp- l, and sharp-edged canines, placed wide apart at gles of the mouth, the incisors between them be- atly reduced in size and kept back nearly to the evel, so as not to interfere with their action. The e short and strong, and the width of the zygo- rches, and great development of the bony ridges skull, give ample space for the attachment of the ul muscles by which they are closed. In the series of teeth the sectorial or scissor-like cutting n is developed at the expense of the tubercular ding, there being only one rudimentary tooth of ter form in the upper jaw, and none in the lower. re, however, sufficiently strong to break bones e size. The dental formula is expressed as fol- —incisors $\frac{3}{3}$, canines $\frac{1}{1}$, premolars $\frac{3}{2}$, molars $\frac{1}{1}$ = l, 30. The tongue is long and flat, and remark- r the development of the papillæ of the anterior f the dorsal surface, which (except near the re modified so as to resemble long, compressed, ed, horny spines or claws, which, near the middle tain the length of one-fifth of an inch. They give rt of the tongue on which they occur the appear- nd feel of a coarse rasp, and serve the purpose of n instrument in cleaning the flesh from the bones animals on which the lion feeds. The vertebral ı is composed of seven cervical, thirteen dorsal, lumbar, three sacral, and about twenty-six caudal ræ. The clavicles are about three inches in , embedded loosely in the muscles, and not y connected either with the sternum or the a. The limbs are digitigrade, the animal resting round soft pads or cushions covered with thick, skin, one on the under surface of each of the pal toes, and one larger one of trilobed form, be- hese, under the lower ends of the metacarpal and rsal bones, which are placed nearly vertically in ry progression. The fore feet have five toes, of the third and fourth are nearly equal and longest, econd being slightly and the fifth considerably r. The first or pollex (corresponding to the n thumb) is much shorter than the others, and ot reach to the ground in walking. The hind ave only four toes, the third and fourth being ngest, the second and fifth somewhat shorter and ' equal. The first or hallux (or great toe) is rep- ed only by a rudimentary metatarsal bone. The are all very large, strongly compressed, very , and exhibit the retractile condition in the highest e, being drawn backwards and upwards into a eous sheath by the action of an elastic ligament g as the foot is in a state of repose, but exserted uscular action when the animal strikes its prey. is remarkable piece of animal mechanism their and points are always kept sharp and unworn.

e habits of the lion in a state of nature are fairly nown from the united observations of numerous llers and sportsmen who have explored those dis- of the African continent in which it is still com-

It lives chiefly in sandy plains and rocky places spersed with dense thorn thickets, or frequents the bushes and tall rank grass and reeds that grow ; the sides of streams and near the springs where s in wait for the larger herbivorous animals on h it feeds. Although it is occasionally seen abroad during the day, especially in wild and desolate regions, where it is subject to but little molestation, the night is, as in the case of so many other predaceous animals, the period of its greatest activity. It is then that its characteristic roar is chiefly heard, as thus graphically described by Gordon Cumming:—

> "One of the most striking things connected with the lion is his voice, which is extremely grand and peculiarly striking. It consists at times of a low deep moaning, repeated five or six times, ending in faintly audible sighs; at other times he startles the forest with loud, deep-toned, solemn roars, repeated in quick succession, each increasing in loudness to the third or fourth, when his voice dies away in five or six low muffled sounds very much resembling distant thunder. At times, and not unfrequently, a troop may be heard, roaring in concert, one assuming the lead, and two, three, or four more regularly taking up their parts, like persons singing a catch. Like our Scottish stags at the rutting season, they roar loudest in cold frosty nights; but on no occasions are their voices to be heard in such perfection, or so intensely powerful, as when two or three troops of strange lions approach a fountain to drink at the same time. When this occurs, every member of each troop sounds a bold roar of defiance at the opposite parties; and when one roars, all roar together, and each seems to vie with his comrades in the intensity and power of his voice. The power and grandeur of these nocturnal concerts is inconceivably striking and pleasing to the hunter's ear."

"The usual pace of a lion," C. J. Andersson[1] says, "is a walk, and, though apparently rather slow, yet, from the great length of his body, he is able to get over a good deal of ground in a short time. Occasionally he trots, when his speed is not inconsiderable. His gallop—or rather succession of bounds—is, for a short distance, very fast,—nearly or quite equal to that of a horse. Indeed, unless the steed has somewhat the start when the beast charges, it will be puzzled to escape. Many instances are on record of horsemen who have incautiously approached too near to the lion, prior to firing, who have been pulled down by him before they could get out of harm's way. Happily, however, the beast soon tires of the exertion of galloping, and unless his first rush succeeds, he for the most part soon halts and beats a retreat." "The lion, as with other members of the feline family," the same writer tells us, "seldom attacks his prey openly, unless compelled by extreme hunger. For the most part he steals upon it in the manner of a cat, or ambushes himself near to the water, or a pathway frequented by game. At such times he lies crouched upon his belly in a thicket until the animal approaches sufficiently near, when, with one prodigious bound, he pounces upon it. In most cases he is successful, but should his intended victim escape, as at times happens from his having miscalculated the distance, he may make a second or even a third bound, which, however, usually prove fruitless, or he returns disconcerted to his hiding-place, there to wait for another opportunity." His food consists of all the larger herbivorous animals of the country in which he resides, —buffaloes, various kinds of antelopes, zebras, giraffes, or even young elephants or rhinoceroses, though the adults of these latter he dare not attack. In cultivated districts the cattle, sheep and even human inhabitants are never safe from his nocturnal ravages. He appears, however, as a general rule, only to kill when hungry or attacked, and not for the mere pleasure of killing, as with some other carnivorous animals. He, moreover, by no means limits himself to animals of his own killing, but, according to Selous, often prefers eating game that has been killed by man, even when not very fresh, to taking the trouble to catch an animal himself. All books of African travel and sport abound with stories, many of which are apparently well authenticated, of the lion's prodigious strength, as exemplified by his being able to drag off a whole ox in his mouth to a long distance, even leaping fences and dykes with it.

The lion appears to be monogamous, a single male and female continuing attached to each other irrespectively of the pairing season. At all events the lion remains with the lioness while the cubs are young and helpless, and assists in providing her and them with food, and in educating them in the art of providing for themselves. The number of cubs at a birth is from two to four, usually three. They are said to remain with their parents till they are about three years old. The following account by an eyewitness gives a good idea of lion family life:[1]—

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[1] *The Lion and the Elephant*, 1873, p. 19.

[Carl Johan Andersson (1827-67), an Anglo-Swede and explorer in South Africa; wrote *Lake Ngami* and *Okavango River*. on the bank of the Cunene.—AM. ED.]

> "I once had the pleasure of, unobserved myself, watching a lion family feeding. I was encamped on the Black Umfolosi in Zululand, and towards evening, walking out, about half a mile from camp, I saw a herd of zebra galloping across me, and when they were nearly 200 yards off, I saw a yellow body flash towards the leader, and saw him fall beneath the lion's weight. There was a tall tree about 60 yards from the place, and anxious to see what went on, I stalked up to it, while the lion was still too much occupied to look about him, and climbed up. He had by this time quite killed the beautifully striped animal, but instead of proceeding to eat it he got up and roared vigorously, until there was an answer, and in a few minutes a lioness accompanied by four whelps, came trotting up from the same direction as the zebra, which no doubt she had been to drive towards her husband. They formed a fine picture, as they all stood round the carcase, the whelps tearing it and biting it, but unable to get through the tough skin. Then the lion lay down, and the lioness driving her offspring before her did the same 4 or 5 yards off, upon which he got up, and commencing to eat, had soon finished a hind-leg, retiring a few yards on one side as soon as he had done so. The lioness came up next and tore the carcase to shreds, bolting huge mouthfuls, but not objecting to the whelps eating as much as they could find. There was a good deal of snarling and quarrelling among these young lions, and occasionally a stand-up fight for a minute, but their mother did not take any notice of them, except to give them a smart blow with her paw if they got in her way. . . . There was now little left of the zebra but a few bones, which hundreds of vultures were circling round waiting to pick, while almost an equal number hopped awkwardly about on the ground within 50 or 60 yards of it, and the whole lion family walked quietly away, the lioness leading, and the lion, often turning his head to see that they were not followed, bringing up the rear."

Though not strictly gregarious, lions appear to be sociable towards their own species, and often are found in small troops, sometimes consisting of a pair of old lions, with their nearly full-grown cubs, but occasionally of adults of the same sex; and there seems to be good evidence that several lions will associate together for the purpose of hunting upon a preconcerted plan. As might be supposed, their natural ferocity and powerful armature are sometimes turned upon one another; combats, often mortal, occur among male lions under the influence of jealousy; and Andersson relates an instance of a quarrel between a hungry lion and lioness over the carcase of an antelope which they had just killed, and which did not seem sufficient for the appetite of both, ending in the lion not only killing, but even devouring his mate. Old lions, whose teeth have become injured with constant wear, often become "man-eaters," finding their easiest means of obtaining a subsistence in lurking in the neighborhood of villages, and dashing into the tents at night and carrying off one of the sleeping inmates. Lions differ from most of the smaller *Felidæ* in never climbing trees; indeed, as mentioned before, they are rarely found in forests.

With regard to the character of the lion, those who have had opportunities of observing it in its native haunts differ greatly. The exaggerated accounts of early writers as to its courage, nobility, and magnanimity have led to a reaction, which causes some modern authors to speak of it in language quite the reverse, and to accuse it of positive cowardice and all kinds of meanness. Livingstone goes so far as to say, "nothing that I ever learned of the lion could lead me to attribute to it either the ferocious or noble character ascribed to it elsewhere," and he adds that its roar is not distinguishable from that of the ostrich. Of course these different estimates depend to a great extent upon the particular standard of the writer, and also upon the circumstance that lions, like other animals, undoubtedly show considerable individual differences in character, and behave differently under varying circumstances. They are certainly not so reckless as to be entirely devoid of the instinct of self-preservation, and if one, perhaps satiated with a good meal the night before, unexpectedly disturbed in the day time, will occasionally retreat when confronted, even by an unarmed man, that is scarcely a reason for assigning cowardice as one of the characteristics of the species. The latest authority, Selous, while never denying the daring courage of the lion when hungry or provoked, and vindicating the awe-inspiring character of the roar of several lions in unison, when heard at close quarters, as the grandest sound in nature, says with regard to its outward aspect:—

> "It has always appeared to me that the word 'majestic' is singularly inapplicable to the lion in its wild state, as when seen by daylight he always has a stealthy, furtive look that entirely does away with the idea of majesty. To look majestic a lion should hold his head high. This he seldom does. When walking he holds it low, lower than the line of his back, and it is only when he first becomes aware of the presence of man that he sometimes raises his head and takes a look at the intruder, usually lowering it immediately, and trotting away with a growl. When at bay, standing with open mouth and glaring eyes, holding his head low between his shoulders, and keeping up a continuous low growling, twitching his tail the while from side to side, no animal can look more unpleasant than a lion; but there is then nothing majestic or noble in his appearance."

Notwithstanding this evidently truthful description of the animal when seen under what may be called unfavorable circumstances, no one with an eye for beauty can contemplate the form of a fine specimen of a lion, at all events in a state of repose, even though in the confinement of a menagerie, without being impressed with the feeling that it is a grand and noble-looking animal. (W. H. F.)

LIPARI ISLANDS. These islands, which take their name from the largest and most populous member of the group, are situated to the north of the eastern half of Sicily, between 38° 20′ and 38° 55′ N. lat., and 14° 15′ and 15° 15′ E. long. The seven principal islands are Lipari, Salina, Vulcano, Stromboli, Panaria, Filicudi, and Alicudi; besides which there are ten islets, some of them mere rocks, the remains of a great central volcano now submerged. The total population of the islands in 1871 was 18,400, and the area is less than 50 square miles. They were known to the ancients as the *Hephæstiades* or *Vulcaniæ insulæ*, from their supposed connection with Vulcan; the *Liparenses*, from their mythical king Lipara; and the *Æoliæ insulæ*, from Æolus, who was said to have married the daughter of Lipara, and to have succeeded to the kingdom. Lipara, the chief island, was colonized in the 6th century B. C. by Cnidians and Rhodians, who rapidly spread to the adjacent islands of Hiera and Didyme. The new settlers maintained their independence in spite of the attacks of the Tyrrhenian pirates, but they later became subject successively to the Athenians, Carthaginians, and Romans. In the Middle Ages the Saracens took possession of the islands, but they were expelled by the Normans in the 11th century. Finally Ferdinand the Catholic annexed them to Sicily.

Lipari has an area of about 11 square miles, with a population of 12,000. It is mountainous in character, and consists of tuffs and lavas, and of highly siliceous volcanic products such as quartz-trachyte, pumice, and obsidian. The great central cone, Monte Sant' Angelo (1952 feet), is the ruin of an extinct volcano, as is also Monte Chirica (1978 feet); while Campo Bianco or Monte Pelato (1500 feet) is a mountain of white pumice, breached by an outflow of vitreous lava. Hot springs exist in various parts of the island, the most ant being those of San Calogero, mentioned by rus Siculus, and situated about 6 miles from the The water, which possesses a temperature of ahr., contains free carbonic acid and sulphuretted gen, together with carbonates of calcium and sium, and chlorides of calcium and sodium. The town, which stands on the eastern point of the is quite modern, and contains no objects of in-

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[1] Hon. W. H. Drummond, *The Large Game and Natural History of South and South-East Africa*, 1875, p. 278.

The cathedral and several other churches are the precincts of the castle, and they are presided y a bishop and thirty-two canons. The castle is s a prison for some four hundred malefactors, rom various parts of Italy. The island is gov- by a delegate, subject to the prefect of Messina. oil is fertile; and a considerable trade is carried a number of merchants who export currants, figs, e stone, and malmsey wine. Water is scarce to the great porosity of the soil.

miles to the south of Lipari is the island of Vul- anciently known as *Hiera*, *Vulcania*, and *The-* In early times it was a very active volcano; and escribed by Thucydides, Aristotle, and Callias as frequently in a state of violent eruption. In the ntury B. C. the smaller island of Vulcanello was ved from the sea. The present crater was prob- ormed during the eruption of 1786, from which the volcano remained in a quiescent state till the n of 1873, when it commenced to discharge of vapor, showers of sand, and large stones. nd green flames were also seen to issue from rifts floor of the crater. When visited by the writer 9, the volcano had again relapsed into the solfa- tage, and it had recently been purchased by a firm for £8000, for the purpose of extracting boracic acid, and sulphur from the numerous ots which line the sides and cover the floor of the . A number of volcanic minerals have been ob- from Vulcano; the most remarkable perhaps hat lately analyzed by Professor Cossa of Turin, was found to contain seven non-metallic elements ight metals, among them the rare bodies thal- cæsium, and rubidium. The highest point of no—a portion of the old crater ring—has an alti- of 1601 feet.

ittle more than 20 miles to the north-north-east pari, the cone of Stromboli rises from the sea to a t of 3022 feet. It is of special interest to the vul- gist from the fact that it is the only example in e of a volcano in a state of constant activity, and ecause, from an elevated point above the crater h is at the side of the cone below the summit), it sible, when the wind blows away from the observer, for hours and watch the operations going on within rater. Such observations, carried out in 1788 by nzani, made him the father of modern vulcanol- nd furnished some of the most important data which the science is founded. The mountain is ioned as early as the 4th century B. C.

ween Stromboli and Lipari there is a group of islets enting portions of the crater ring of a great volcano, rgest of which, Panaria (*Hicesia*), is 7 miles in cir- and contains about 200 inhabitants. It produces , oil, and wine. Salina (*Didyme*), 3 miles to the -west of Lipari, has an area of 10 square miles, and ts of two volcanic cones rising respectively to the t of 3156 and 2821 feet. The island contains nearly nhabitants, who are mainly employed in cultivating ines, which produce a fine malmsey wine. The cone licudi rises to a height of 2598 feet, some 10 miles to est of Salina, while at an equal distance further west cudi, the most westerly member of the Lipari group. partly cultivated, and is inhabited by about 500 fisher- nd shepherds.

d maps of the Lipari Islands have been published by talian Government. The best general account of the s is still that of Admiral Smyth (*Sicily and its Islands*, , while Professor J. W. Judd has exhaustively dis- d their geology in the pages of the *Geological Magazine* 75. (G. F. R.)

PETSK, a district town of Russia, in the govern- ment of Tamboff, 95 miles west of the chief town of the government, and 23 miles north-west of Gryazi railway junction, at the confluence of Lyesnoy Voronesh and Lipovka rivers. The town is built of wood, and the streets are unpaved, but it is a commercial centre of some importance. There are several beetroot-sugar and leather works, tallow-melting houses, and distilleries. There is a brisk business at the weekly fairs, and the merchants carry on active trade in horses, cattle, tallow, skins, and honey, sent by rail to the northern provinces, and in timber, shipped down to the province of the Don Cossacks. The Lipetsk mineral springs came into repute in the time of Peter I., who caused them to be surrounded by galleries, and laid down three gardens; they continue to attract visitors during the summer. Lipetsk received municipal institutions in 1779. Population 14,500.

LIPPE is the name of a territory in north-western Germany, now divided into two small sovereign principalities, but formerly united under the same ruler. The name is derived from the river Lippe, which rises in the Teutoburgian Forest, and flows into the Rhine at Wesel.

I. Lippe proper, also called Lippe-Detmold, is bounded on three sides by the Prussian province of Westphalia, and on the E. and N. E. by Hanover, Pyrmont, and Hesse-Cassel. It also possesses three small enclaves in Westphalia. Its area is about 450 square miles. The greater part of the surface is mountainous, especially towards the south, where it is intersected by the Teutoburgian Forest. The chief rivers are the Weser, which crosses the north extremity of the principality, and its affluents the Werre, Exter, Kalle, and Emmer. The forests of Lippe are among the finest in Germany, and produce abundance of excellent timber. The valleys contain a considerable amount of good arable land, the tillage of which occupies the greater part of the inhabitants. The principal crops are corn, flax, and rape. Cattle, sheep, and swine are also reared, and the "Senner" breed of horses is celebrated. The industries of Lippe are almost confined to a little yarn-spinning and linen-weaving. Its trade is also inconsiderable; but, besides agricultural products, timber, meerschaum pipes, and starch are exported. The brine springs of Salzuflen produce about 1500 tons of salt annually. In 1880 the population amounted to 120,216 souls, upwards of 95 per cent. of whom were Calvinists (Reformed Church), the remainder being Lutherans, Roman Catholics, and Jews. Education is provided for by two gymnasia and numerous other efficient schools. The principality contains seven small towns, the chief of which are Detmold, the seat of government, and Lemgo. The present constitution was granted in 1836, and is modified by a new election law of 1876. It provides for a representative chamber of twenty-one members, whose functions are mainly consultative. For electoral purposes the population is divided into three classes, rated according to taxation, each of which returns seven members. The estimated revenue in 1881 was £49,200, and the expenditure £50,850. The public debt amounts to nearly £60,000. Lippe has one vote in the German Reichstag, and also one vote in the Federal Council. Its military forces form a battalion of the 6th Westphalian infantry.

II. Schaumburg-Lippe, or Lippe-Bückeburg, to the north of Lippe-Detmold, consists of the western half of the old countship of Schaumburg, and is surrounded by Westphalia, Hanover, and the Prussian part of Schaumburg. The northern extremity of the principality, which is 175 square miles in extent, is occupied by a lake named the Steinhuder Meer. The southern part is mountainous, but the remainder consists of a fertile plain, producing abundant crops of cereals and flax. Besides husbandry, the inhabitants practise yarn-spinning and linen-weaving, and the coal-mines of the Bückeburg, on the south-eastern border, are very productive. The great bulk of the population, which in 1880 amounted to 35,374, are Lutherans. The capital is Bückeburg, and Stadthagen is the only other town. Under the constitution of 1868 there is a legislative diet of fifteen members, ten of whom are elected by the towns and rural districts and three by the nobility, clergy, and educated classes, while the remaining two are nominated by the prince. Schaumburg-Lippe sends one deputy to the Federal Council, and has one vote in the Reichstag. It contributes a battalion of riflemen to the imperial army. The budget of 1881–82 showed an estimated revenue of £25,750, which was balanced by the expenditure. The public debt is about £18,000.

History.—The district now named Lippe was inhabited in the earliest times of which we have any record by the Cherusci, whose leader Arminius annihilated the legions of Varus in the Teutoburgian Forest (9 A.D.). It was afterwards occupied by the Saxons, and was subdued by Charlemagne. The founder of the present reigning family, one of the most ancient in Germany, was Bernard I. (1128–58), who received a grant of the territory, till then called the countship of Haholt, from the emperor Lothair, and assumed the title of lord of Lippe. Bernard VIII., who with his people embraced the tenets of the Reformation in 1556, was the first to style himself count of Lippe. In 1613 Lippe was divided among the three sons of Simon VI., the lines founded by two of whom still exist, while the third (Brake) became extinct in 1709.

Lippe-Detmold was the patrimony of the eldest son, whose descendants became princes of the empire in 1789. In 1809 it joined the Confederation of the Rhine, and in 1813 the German Confederation. Under the prudent government of the Princess Pauline (1807–20) the little country enjoyed great prosperity. Her son, Paul Alexander Leopold, ruled in the same spirit, and in 1836 granted the charter of rights on which the government is now based. In 1842 Lippe entered the German Customs Union (Zollverein), and in 1866 it threw in its lot with Prussia and joined the North German Confederation.

Philip, the youngest son of Simon VI. (see above), received but a scanty share of his father's possessions, but in 1640 he inherited a large part of the countship of Schaumburg, including Bückeburg, and adopted the title of count of Schaumburg-Lippe. The ruler of this territory became a sovereign prince in 1807. In 1866 the prince at first sided with Austria, but afterwards entered the German Confederation.

For further information consult Falkmann, *Beiträge zur Geschichte des Fürstenthums Lippe*, 1869; Schikedanz, *Das Fürstenthum Lippe-Detmold in geographischer, statitischer, und geschichtlicher Beziehung*, 1830; "Erinnerungen aus dem Leben der Fürstin Pauline," in Sybel's *Historische Zeitschrift*, 1861.

LIPPI, the name of three celebrated Italian painters.

I. **Fra Filippo Lippi** (1412–1469), commonly called Lippo Lippi, one of the most celebrated painters of the Italian quatrocento, was born in Florence,—his father, Tommaso, being a butcher. His mother died in his earliest infancy, and his father two years later. His aunt, a poor woman named Monna Lapaccia, then took charge of him; and in 1420, when only eight years of age, he was registered in the community of the Carmelite friars of the Carmine in Florence. Here he remained till 1432, and his early faculty for fine art was probably developed by studying from the works of Masaccio in the neighboring chapel of the Brancacci. Between 1430 and 1432 he executed some works in the monastery, which were destroyed by a fire in 1771; they are specified by Vasari, and one of them was particularly marked by its resemblance to Masaccio's style. Eventually Fra Filippo quitted his convent, but it appears that he was not relieved from some sort of religious vow; there is a letter of his, dated in 1439, in which he speaks of himself as the poorest friar of Florence, and says he is charged with the maintenance of six marriageable nieces. In 1452 he was appointed chaplain to the convent of S. Giovannino in Florence, and in 1457 rector (*Rettore Commendatario*) of S. Quirico at Legnaia, and his gains were considerable, and even uncommonly large from time to time; but his poverty seems to have been chronic none the less, the money being spent, according to one account, in frequently recurring amours.

Vasari relates some curious and romantic adventures of Fra Filippo, which modern biographers are not inclined to believe. Except through Vasari, nothing whatever is known of his visits to Ancona and Naples, and his intermediate capture by Barbary pirates and enslavement in Barbary, whence his skill in portrait-sketching availed to release him. The doubts thrown upon his semi-marital relations with a Florentine lady appear, however, to be somewhat arbitrary; Vasari's account is circumstantial, and in itself not greatly improbable, and to say that he is the sole authority for the facts goes but a small way towards invalidating them. Towards June, 1456, Fra Filippo was settled in Prato (near Florence) for the purpose of fulfilling an important commission which had been given him to paint frescoes in the choir of the cathedral. Before actually undertaking this work he set about painting, in 1458, a picture for the convent chapel of St. Margaret of Prato, and there saw Lucrezia Buti, the beautiful daughter of a Florentine, Francesco Buti: she was either a novice or a young lady placed under the nuns' guardianship. Lippi asked that she might be permitted to sit to him for the figure of the Madonna; he made passionate love to her, abducted her to his own house, and kept her there spite of the utmost efforts the nuns could make to reclaim her. The fruit of their loves was a boy, who became the painter, not less celebrated than his father, Filippino Lippi (noticed below). Such is substantially Vasari's narrative, published less than a century after the alleged events; it is not refuted by saying, more than three centuries later, that perhaps Lippo had nothing to do with any such Lucrezia, and perhaps Lippino was his adopted son, or only an ordinary relative and scholar. The argument that two reputed portraits of Lucrezia in paintings by Lippo, one as a Madonna in a very fine picture in the Pitti gallery, and the other in the same character in a Nativity in the Louvre, are not alike comes to very little; and it is reduced to nothing when the disputant adds that the Louvre painting is probably not done by Lippi at all. This painting comes, however, from St. Margaret's at Prato, and is generally considered to be the very one on which Vasari's story hinges.

The frescoes in the choir of Prato cathedral, being the stories of the Baptist and of St. Stephen, represented on the two opposite wall spaces, are the most important and monumental works which Fra Filippo has left, more especially the last of the series, showing the ceremonial mourning over Stephen's corpse. This contains a portrait of the painter, but which is the proper figure is a question that has raised some diversity of opinion. Some of the subjects are legendary, as, for instance, the attempt of the devil to substitute a changeling for the infant protomartyr. At the end wall of the choir are S. Giovanni Gualberto and S. Albert, and on the ceiling the four evangelists.

The close of Lippi's life was spent at Spoleto, where he had been commissioned to paint, for the apse of the cathedral, some scenes from the life of the Virgin. In the semidome of the apse is Christ crowning the Madonna, with angels, sibyls, and prophets. This series, which is not wholly equal to the one at Prato, was completed by Fra Diamante after Lippi's death.

That Lippi died in Spoleto, on or about 8th October, 1469, is an undoubted fact; the mode of his death is again a matter of dispute. It has been said that the pope granted Lippi a dispensation for marrying Lucrezia, but that, before the permission arrived, he had been poisoned by the indignant relatives either of Lucrezia herself, or of some lady who had replaced her in the inconstant painter's affections. This is now generally regarded as a fable; and it may very well be such, although the incident does not present any intrinsic improbability in relation to the Italy of the 15th century. Fra Filippo lies buried in Spoleto, with a monument erected to him by Lorenzo the Magnificent; he had always been zealously patronized by the Medici family, beginning with Cosmo Pater Patriæ. Francesco di Pesello (called Pesellino) and Sandro Botticelli were among his most distinguished pupils.

Some leading pictures by Lippi not already mentioned are the following. In 1441 he painted an altarpiece for the nuns of S. Ambrogio which is now a prominent attraction in the Accademia of Florence, and has been celebrated in Browning's well-known poem. It represents the Coronation of the Virgin among angels and saints, of whom many are Bernardine monks. One of these, placed to the right, is a half-length portrait of Lippo, pointed out by an inscription upon an angel's scroll "Is perfecit opus." The price paid for this work in 1447 was 1200 Florentine lire, which seems surprisingly or even unaccountably large. For Geminiano Inghirami of Prato he painted the death of St. Bernard, a fine specimen still extant. His principal altarpiece in this city is a Nativity in the refectory of S. Domenico,—the Infant on the ground adored by the Virgin and Joseph, between Sts. George and Dominic, in a rocky landscape, with the shepherds playing and six angels in the sky. In the Uffizi is a fine Virgin adoring the infant Christ, who is held by two angels; in the London National Gallery, a Vision of St. Bernard. The picture of the Virgin and Infant with an Angel, in this same gallery, also ascribed to Lippi, is disputable.

Few pictures are so thoroughly enjoyable as those of Lippo Lippi; they show the naiveté of a strong rich nature, redundant in lively and somewhat whimsical observation. He approaches religious art from its human side, and is not pietistic though true to a phase of Catholic devotion. He was perhaps the greatest colorist and technical adept of his time, with good draughtsmanship,—a naturalist, with less vulgar realism than some of his contemporaries, and with much genuine episodical animation, including semi-humorous incidents and low characters. He made little effort after perspective and none for foreshortenings, was fond of ornamenting pilasters, and other architectural features. Vasari says that Lippi was wont to hide the extremities in drapery, to evade difficulties. His career was one of continual development, without fundamental variation in style or in coloring. In his great works the proportions are larger than life.

II. Filippino or Lippino Lippi (1460–1505) was the natural son of Fra Lippo Lippi and Lucrezia Buti, born in Florence and educated at Prato. Losing his father before he had completed his tenth year, the boy took up his avocation as a painter, studying under Sandro Botticelli, and probably under Fra Diamante. The style which he formed was to a great extent original, but it bears clear traces of the manner both of Lippo and of Botticelli,—more ornamental than the first, more realistic and less poetical than the second. His powers developed early; for we find him an accomplished artist by 1480, when he painted an altarpiece, the Vision of St. Bernard, now in the Badia of Florence; it is in tempera, with almost the same force as oil painting. Soon afterwards, probably from 1482 to 1490, he began to work upon the frescoes which completed the decoration of the famous Brancacci chapel in the Carmine, commenced by Masolino and Masaccio many years before. He finished Masaccio's subject of the Resurrection of the King's Son, and was the sole author of Paul's Interview with Peter in Prison, the Liberation of Peter, the Two Saints before the Proconsul, and the Crucifixion of Peter. These works, were none others extant from his hand, are sufficient to prove that Lippino stood in the front rank of the artists of his time. The dignified and expressive figure of St. Paul in the second-named subject has always been particularly admired, and appears to have furnished a suggestion to Raphael for his Paul at Athens. Portraits of Luigi Pulci, Antonio Pollaiuolo, Lippino himself, and various others are to be found in this series. In 1485 he executed the great altarpiece of the Virgin and Saints, with several other figures, now in the Uffizi Gallery. Another of his leading works is the altarpiece for the Nerli Chapel in S. Spirito—the Virgin Enthroned, with splendidly living portraits of Nerli and his wife, and a thronged distance. In 1489 Lippino was in Rome, painting in the church of the Minerva, having first passed through Spoleto to design the monument for his father in the cathedral of that city. Some of his principal frescoes in the Minerva are still extant, the subjects being in celebration of St. Thomas Aquinas. In one picture the saint is miraculously commended by a crucifix; in another, triumphing over heretics. In 1496 Lippino painted the Adoration of the Magi now in the Uffizi, a very striking picture, with numerous figures. This was succeeded by his last important undertaking, the frescoes in the Strozzi Chapel, in the church of S. Maria Novella in Florence—Drusiana Restored to Life by St. John the Evangelist, St. John in the Cauldron of Boiling Oil, and two subjects from the legend of St. Philip. These are conspicuous and attractive works, yet somewhat grotesque and exaggerated,—full of ornate architecture, showy color, and the distinctive peculiarities of the master. Filippino, who had married in 1497, died in 1505 of an attack of throat disease and fever, aged only forty-five. His character for amiability and courtesy is described in very laudatory terms by Vasari. The best-reputed of his scholars was Raffaellino del Garbo.

Like his father, Filippino had a most marked original genius for painting, and he was hardly less a chief among the artists of his time than Fra Filippo had been in his; it may be said that in all the annals of the art a rival instance is not to be found of a father and son each of whom had such pre-eminent natural gifts and leadership. The father displayed more of sentiment and candid sweetness of motive; the son more of richness, variety, and lively pictorial combination. He was admirable in all matters of decorative adjunct and presentment, such as draperies, landscapes, backgrounds, and accessories; and he was the first Florentine to introduce a taste for antique details of costume, etc. He formed a large collection of objects of this kind, and left his designs of them to his son. In his later works there is a tendency to a mannered development of the extremities, and generally to facile overdoing. The London National Gallery possesses a good and characteristic though not exactly a first-rate specimen of Lippino, the Virgin and Child between Sts. Jerome and Dominic.

III. Lorenzo Lippi (1606–1664), a painter and poet, was born in Florence. He studied painting under Matteo Rosselli, the influence of whose style, and more especially of that of Santi di Tito, is to be traced in Lippi's works, which are marked by taste, delicacy, and a strong turn for portrait-like naturalism. His maxim was "to poetize as he spoke, and to paint as he saw." After exercising his art for some time in Florence, and having married at the age of forty the daughter of a rich sculptor named Susini, Lippi went as court painter to Innsbruck, where he has left many excellent portraits. There he wrote his humorous poem named *Malmantile Racquistato*, which was published under the anagrammatic pseudonym of "Perlone Zipoli." Lippi was a friend of Salvator Rosa, and was a man of pleasant and generous temper, and very polite. He was, however, somewhat self-sufficient, and, when visiting Parma, would not look at the famous Correggios there, saying that they could teach him nothing. He died of pleurisy in 1664.

The most esteemed works of Lippi as a painter are a Crucifixion in the gallery at Florence, and a Triumph of David which he executed for the saloon of Angiolo Galli, introducing into it portraits of the seventeen children of the owner. His poem the *Malmantile Racquistato* is a burlesque romance, mostly compounded out of a variety of popular tales; its principal subject-matter is an expedition for the recovery of a fortress and territory whose queen had been expelled by a female usurper. It is full of graceful or racy Florentine idioms, and is counted by Italians as a "testo di lingua." Lippi is more generally or more advantageously remembered by this poem than by anything which he has left in the art of painting. It was not published until 1688, several years after his death.

(W. M. R.)

LIPSIUS, Justus (1547–1606), the Latinized form of Joest Lips, an eminent humanist of the 16th century, born 18th October, 1547, at Overyssche, a small village in Brabant, about half way between Brussels and Ottignies. Sent early to the Jesuit college in Cologne, he was removed at seventeen to the university of Louvain by his parents, who had some reason for fearing that he might be induced to become a professed member of the Society of Jesus. But he had received at Cologne two mental tendencies from which he never emancipated himself. One of these, which was suppressed or suspended in middle life, asserted itself later in his return to the bosom of the Catholic Church before his death. The other, derived from his Jesuit training, showed itself in his merely rhetorical or verbal view of classical literature, of which the one interest lay in its style.

Lipsius rushed into print at twenty with one of those volumes of miscellaneous remarks then in vogue (*Variarum Lectionum Libri Tres*, 1567), the dedication of which to Cardinal Granvella procured him an appointment as Latin secretary, and a visit to Rome in the retinue of the cardinal. Here Lipsius remained two years, using his spare time in study of the Latin classics, in viewing the monuments, collecting inscriptions, and handling MSS. in the Vatican. A comparison of a second volume of miscellaneous criticism (*Antiquarum Lectionum Libri Quinque*, 1575), published after his return from Rome, with the *Variæ Lectiones* of eight years earlier shows that he had advanced from the notion of purely conjectural emendation to that of emending by collation, and that he had learnt to distinguish between a "good" and a "bad" MS. In Rome he also made the acquaintance of Muretus, Paullus Manutius, and the other humanists of the catholic reaction who were then in credit there. He was also noticed by Cardinal Sirleto and Fulvio Orsini; but he can hardly have even seen in the street Sigonio and Vettorio, and the introduction of these celebrated names is perhaps only a stylistic flourish of the biographer Le Mire, to whom we owe the only original account of Lipsius's life. In 1570 he wandered over Burgundy, Germany, Austria, Bohemia, in search of learning and learned acquaintances, and was engaged for more than a year as teacher in the university of Jena, a position which implied an outward conformity to the Lutheran Church. On his way back to Louvain, he stopped some time at Cologne, where he must again have comported himself as a Catholic. Here he married, but the union was without issue, and in other respects did not conduce to happiness, as we gather from various allusions scattered through Lipsius's letters. He returned to Louvain, but was soon driven by the civil war to take refuge in Antwerp, where he received, in 1579, a call to the newly founded university of Leyden, as professor of history.

At Leyden, where he must have outwardly conformed to the Calvinistic creed and worship, Lipsius remained eleven years,—years about which his Catholic biographer Le Mire has nothing to tell, but speaks of the period as an enforced temporary sojourn among the infidels,—till the restoration of peace allowed him to return to his home in Brabant. In truth, this period of Lipsius's life was the period of his greatest productivity. It was now that he prepared his *Seneca*, and that he perfected, in successive editions, his *Tacitus*. To edit and comment on two authors of the first class, such as Tacitus and Seneca, in addition to the daily drudgery of teaching, might seem work enough for eleven years. But Lipsius's industry enabled him, over and above, to bring out, from the press of Plantin at Antwerp, a series of works of varied character and contents, some of pure scholarship, others collections from classical authors, and others again of more general interest. Of this latter class was a treatise on politics (*Politicorum Libri Sex*, 1589), in which he let it be seen that, though a public teacher in a country which professed toleration, he had not departed from the state maxims of Alva and Philip II. He lays it down that a Government should only suffer one religion to exist in its territory, and that dissent should be extirpated by fire and sword. This frank avowal of what were known to be his real sentiments might have easily had disagreeable consequences for the author, if he had not been sheltered from the attacks to which it exposed him by the prudence of the authorities of Leyden. Lipsius was prevailed upon to publish a declaration that his expression "*Ure, seca*," was not intended of material fire and sword, but was only a metaphor for "vigorous treatment."

The time at last arrived when Lipsius, who had always been somewhat ill at ease in his Calvinistic disguise, was to throw it off and return into the bosom of the church. In the spring of 1591 he left Leyden under pretext of taking the waters at Spa for the relief of a liver complaint. He went to Mainz, where he was reconciled to the church by the instrumentality of the Jesuit fathers. The event was one which deeply interested the Catholic world, and invitations poured in on Lipsius from the courts and universities of Italy, Austria, and Spain. But he preferred to remain in his own country, and after two years of unsettled residence at Liége, Spa, etc., settled at Louvain, as professor of Latin in the Collegium Buslidianum. He was not expected to teach, and his trifling stipend was eked out by the appointments of privy councillor and historiographer to the king of Spain.

From this time till his death Lipsius continued to publish antiquarian collections and dissertations as before. But he was, in fact, lost to learning. His name and fame, and his sententious and amusing style, were placed at the disposal of the Jesuits, and used by them to restore the credit of two local images of the Virgin, whose authentic miracles were retailed by Lipsius in two tracts, *Diva Virgo Hallensis*, and *Diva Virgo Sichemensis*. Joseph Hall, afterwards bishop of Norwich, was at Spa in the suite of Sir E. Bacon at the time of the appearance of Lipsius's brochures, and was like to have got into trouble by disputing against them (Hall's *Epistles*, cent. i. ep. 5). Lipsius died at Louvain on the 23d of March, 1606, at the age of fifty-eight. His Greek books and MSS. he left to the Jesuit college at Louvain; the rest of his library, choice rather than extensive, to a nephew. His furred doctor's robe he ordered to be offered at the shrine of the Virgin at Hall.

If, according to the fancy of some biographers, Scaliger, Casaubon, and Lipsius be erected into a literary triumvirate, Lipsius represents Lepidus. His knowledge of classical antiquity was extremely limited. He had but slight acquaintance with Greek; "pour sa provision" only, said Scaliger. He is fond of adorning his letters with Greek phrases, his quotations betraying that he is a stranger in that country. In Latin literature the poets and Cicero lay outside his range; he had no ear for metre, and no taste for poetical expression. Where he was strong was in the Latin historians and in Roman antiquities. His greatest work was his edition of Tacitus. This author he had so completely made his own that he could repeat the whole, and offered to be tested in any part of the text, with a poniard held to his breast, to be used against him if he should fail. His *Tacitus* first appeared in 1575, and was five times revised and corrected by the editor—the last time in 1606, shortly before his death. His *Seneca* is dated Antwerp, 1605. His *Opera Omnia* were collected in 4 vols., Antwerp, 1637, of which the Wesel edition, 1675, is a verbal reprint in the same number of volumes, but in a smaller form. The first volume contains also Le Mire's *Life of Lipsius*, which had appeared separately in 1607. Both editions contain ten centuries of his epistles, to which additions have been made in *Epistolarum quæ in Centuriis non exstant Decades XII.*, etc., Harderwijk, 1621; Burmann's *Sylloge*, tom. i.; *Lettres inédites*, ed. Delprat, Amst., 1858. On Lipsius's relations with Scaliger, see Bernay's *J. J. Scaliger*, note 40. A bibliographical list of his separate publications, forty-eight in number, may be found in Niceron, *Mémoires*, xxiv. p. 118. (M. P.)

LIQUEURS are perfumed and sweetened spirits prepared for drinking and for use as a flavoring material in confectionery and cookery. The term liqueur is also applied to certain wines and spirits remarkable for their amount of bouquet, such as tokay and liqueur brandy, etc. Ordinary liqueurs consist of certain mixtures of pure spirit with essential oils and vegetable extracts, and with syrup of refined sugar. A certain number of such preparations have an established reputation; but the methods by which these are compounded, and the precise proportions of the various ingredients they contain, are valuable trade secrets, scrupulously kept from public knowledge.

The raw materials employed in the preparation of liqueurs are—(1) a pure flavorless spirit, which must be free from fusel oil; (2) various essential oils, on the purity and constant quality of which much of the success of the manufacture depends, or, in place of the oils, the aromatic substances from which they may be distilled; (3) bitter aromatic vegetable substances, fruits, rinds, etc., or their alcoholic extracts called tinctures; (4) fresh juicy fruits possessed of special flavor; (5) refined sugar prepared in the form of a perfectly smooth colorless syrup; (6) soft or distilled water; and (7) tinctorial substances for those liqueurs in which a particular color is demanded by fashion. The French, who excel in the preparation of liqueurs, grade their products according to their sweetness and alcoholic strength into *crêmes*, *huiles*, or *baumes*, which have a thick oily consistency, and *eaux*, *extraits*, or *elixirs*, which, being less sweetened, are perfectly limpid. Liqueurs of British fabrication, generally of inferior quality, are frequently dealt in under the name of *cordials*. *Bitters* form a class of liqueurs by themselves, claiming to possess certain tonic properties and a medicinal value. Certain liqueurs, containing only a single flavoring ingredient, or having a prevailing flavor of a particular substance, are named after that body, as for example—crême de rose, vanille, thé, cacao, anisette, and kümmel, etc. On the other hand, the liqueurs which in general are most highly prized are compounded of very numerous aromatic principles, and they are not considered fit for use till they have matured and mellowed for several years.

The simplest method of preparing liqueurs is by adding the requisite proportion of essential oil to spirit of known strength, and then mixing this with the necessary amount of clear syrup. In this way, indeed, the greater number of the commoner and cheaper kinds are manufactured. Thus for making (say) 20 gallons inferior quality of kümmel, there are added to 7 gallons of spirit of wine ¼ ℔ of essential oil of caraway seed, 7½ drachms of fennel-seed oil, and 15 drops of bitter almond oil. With this preparation is mixed a syrup containing 40 ℔ of refined sugar dissolved in about 12 gallons of water, and when fined with gelatine or with alum and soda solution the liqueur is ready for use. To prepare, on the other hand, 20 gallons of fine kümmel liqueur, there would be placed in a simple still, with 10 gallons of spirit and 8 of water, 4 ℔ of caraway seeds, ¾ ℔ of fennel, and 2 oz. of Florentine iris root. This mixture after maceration is distilled, the first portion of the distillate being put aside on account of its rough aroma, after which about 8 gallons of fine kümmel spirit is obtainable. There still may be procured, by forcing the heat, from 3 to 4 gallons of inferior spirit. To the 8 gallons of fine spirit is added a syrup consisting of 60 ℔ of refined sugar dissolved in 10 gallons of water, the two compounds being thoroughly incorporated with heat in an open vessel. On cooling, the amount of water necessary to make up 20 gallons is added; the liqueur is fined with isinglass, and stored to mature and mellow. All varieties of liqueurs may be made or imitated by both these methods; but as a rule it is only the simple-flavored and commoner varieties which are compounded by the addition of essential oils and alcoholic tinctures. Fine liqueurs are made by macerating aromatic bodies and subsequent distillation; bitters by maceration and straining.

Of trade liqueurs the most highly esteemed in the United Kingdom are Chartreuse, Curaçoa, Maraschino, and Doppel-Kümmel or Allasch. Of all kinds the most famous is *Chartreuse*, so called from being made at the famous Carthusian monastery near Grenoble. Three qualities are made—green, yellow, and white, the green being the richest and most delicate in flavor. Chartreuse is said to be a most complex product, resulting from the maceration and distillation of balm leaves and tops as a principal ingredient, with orange peel, dried hyssop tops, peppermint, wormwood, angelica seed and root, cinnamon, mace, cloves, Tonquin beans, *Calamus aromaticus*, and cardamoms. *Curaçoa*, which is a simple liqueur, is chiefly made in Amsterdam from the dried peel of the Curaçoa orange. The peel is first softened by maceration in water; then three-fourths of the quantity in preparation is distilled with mixed spirit and water, and the remaining fourth is macerated in a proportion of this distillate for two or three days; the tincture is strained off and expressed and added to the original distilled Curaçoa spirit. The flavor of Curaçoa is improved by the addition of about one per cent. of Jamaica rum. The centre of the *Maraschino* trade is at Zara in Dalmatia. Genuine Maraschino is prepared from a variety of cherry—the Marasca—peculiar to the Dalmatian mountain regions. The juice of the cherry fermented and distilled yields the spirit, which is flavored with the broken cherry kernels themselves. Imitations of Maraschino are easily prepared,—a praiseworthy liqueur resulting from raspberry juice, bitter almonds, and orange-flower water. In the preparation of *Allasch*—which is a rich *Kümmel*—bitter almonds, star-anise, angelica root, Florentine iris root, and orange peel are used in addition to caraway seeds. Gold-water and silver-water are liqueurs to which small quantities of powdered gold-leaf and silver-leaf have been added, on account of their lustre. They are now little used.

Gentian root is the fundamental "bitter" in most of the preparations known as *Bitters*. These compounds, prepared by maceration, are very various in their constitution, but the following is a fair typical sample of the composition of a kind largely used. To prepare 20 gallons of bitters there are taken 6 ℔ of gentian, 5 ℔ each of cinnamon and caraway seeds, 1 ℔ of juniper berries, and ½ ℔ of cloves. These are macerated in 7 gallons of spirit, 60° over proof, strained and filtered, and to the product is added 10 ℔ of sugar dissolved in 13 gallons of water, and the resulting liquor is colored with cochineal.

The following list includes the names of the principal commercial liqueurs not already named:—Noyeau (white and pink), trappistine (yellow and green) (from the Abbey de la Grâce Dieu), bénédictine (from Fécamp), peppermint liqueur, French cherry brandy or kirsebaer (from Copenhagen), mandarine, parfait amour, crême de vanille, crême de rose, thé, café, menthe, cacao, vanille, pomeranzen, ratafia (from Dantzic), anisette (from Amsterdam and Bordeaux), kirschenwasser (from Switzerland and the Black Forest), absinthe, and vermouth. (J. PA.)

LIQUIDAMBAR, Liquid Amber, or Sweet Gum, is a product of *Liquidambar styraciflua*, L., order *Hamamelideæ*, a deciduous tree of from 30 to 50 feet high and attaining 15 feet in circumference in Mexico, of which country it is a native, as well as of the greater portion of the United States. It bears palmately-lobed leaves, somewhat resembling those of the maple, but larger. The male and female inflorescences are on different branches of the same tree, the globular heads of fruit resembling those of the plane. This species is nearly allied to *L. orientalis*, Miller, a native of a very restricted portion of the south-west coast of Asia Minor, where it forms forests. It is from the bark of this latter tree that the storax of the ancients (Herod., iii. 107; Diosc., i. 79), the medicinal styrax of to-day, is prepared (Bentley and Trimen, *Med. Plants*, No. 107). The earliest record of the tree appears to be in a Spanish work by F. Hernandez, published in 1651, in which he describes it as a large tree producing a fragrant gum resembling liquid amber, whence the name (*Nov. Plant.*, etc., p. 56). In Ray's *Historia Plantarum* (1686) it is called *Styrax liquida*. It was introduced into Europe in 1681 by Banister, the missionary collector sent out by Bishop Compton, who planted it in the palace gardens at Fulham.

The wood is very compact and fine-grained,—the heart-wood being reddish, and, when cut into planks, marked transversely with blackish belts. It is employed for veneering in New York. Being readily dyed black, it is sometimes used instead of ebony for picture frames, balusters, etc.; but it is too liable to decay for out-door work. The principal product of the tree, however, is the resinous gum which issues from between the bark and wood. It is sometimes called white balsam of Peru, or liquid storax, though it is said by Michaux (*Les Végétaux résineux*, ii. p. 337) to differ materially from the latter. It is considered to be styptic and to possess healing and balsamic properties, being stimulant and aromatic. It possesses nearly the same properties as the balsam of Peru and of Tolu, for which it is often substituted, as well as for storax. Mixed with tobacco, the gum was used for smoking at the court of the Mexican emperors (Humb., iv. 10). It has been long used in France as a perfume for gloves, etc. It is mainly produced in Mexico, little being obtained from trees growing in higher latitudes of North America, or in England. For localities where it has been observed, see Pickering's *Chron. Hist. of Plants*, p. 741.

LIQUORICE. The hard and semi-vitreous sticks of paste, black in color and possessed of a sweet, somewhat astringent taste, known as liquorice paste or black sugar, are the inspissated juice of the roots of a leguminous plant, *Glycyrrhiza glabra*, the *radix glycyrrhizæ* of the pharmacopœia. The plant is cultivated throughout the warmer parts of Europe, especially on the Mediterranean shores, and its geographical limits travel eastward throughout Central Asia to China, where its cultivation is also prosecuted. In the United Kingdom it is grown in Surrey and in Yorkshire. The roots for use are obtained in lengths of 3 or 4 feet, and varying in diameter from ¼ to 1 inch, soft, flexible, and fibrous, and internally of a bright yellow color with a characteristic sweet pleasant taste. To this sweet taste of its root the plant owes its generic name *Glycyrrhiza* (the sweet root), of which liquorice is a corruption. According to the analysis of Sestini (*Gaz. Chim. Ital.*, vol. viii. p. 131), the root dried at 110° C. has the following composition:—resin, fat, and coloring matters, 3·220; glycyrrhizin, 6·378; starch, 57·720; cellulose, 19·790; albuminoid substances, 6·373; ammonia (combined), 0·043; asparagine, 2·416; ash, 4·060. It is to the sugar-like body glycyrrhizin in combination with ammonia that the peculiar taste and properties of liquorice root are due. Glycyrrhizin in itself is a tasteless nearly insoluble substance having the composition of $C_{16}H_{24}O_6$; but in combination with ammonia, potash, or soda it develops its sweet taste. It is easily precipitated from its combination by the influence of mineral acids. Liquorice has been known and its virtues appreciated from the most remote periods, and the root is an article of some commercial importance on the Continent.

Stick liquorice is made by crushing and grinding the roots to a pulp, which is boiled in water over an open fire, and the decoction separated from the solid residue of the root is evaporated in copper pans till a sufficient degree of concentration is attained, after which, on cooling, it is rolled into the form of sticks or other shapes for the market. The preparation of the juice is a widely extended industry along the Mediterranean coasts; but the quality best appreciated in the United Kingdom is made in Calabria, and sold under the names of Solazzi and Corigliano juice. The liquorice grown in Yorkshire is made into a confection called Pontefract cakes. Liquorice in various forms is a popular remedy for coughs; and it is largely used by children as a sweetmeat. It enters into the composition of many cough lozenges and other demulcent preparations; and in the form of aromatic syrups and elixirs it has a remarkable effect in masking the taste of nauseous medicines, a property peculiar to glycyrrhizin. A considerable quantity of liquorice is used in the preparation of tobacco for chewing. Commercial liquorice paste is frequently much adulterated, and often contains distinct traces of copper, apparently derived from the vessels in which the juice is inspissated.

LIQUOR LAWS may be divided into the three great systems of free trade, restriction, and prohibition. The system of free trade may mean either that no special license is required by law for carrying on a traffic in intoxicating liquors, or that such a license is required, but that the licensing authority is bound to grant it in every case in which certain conditions are complied with. Wherever the determination of these conditions involves an appeal to the discretion of the licensing authority, the system of free trade tends to pass into the system of restriction. For practical purposes it does not matter much whether the law says, "every man of good character is entitled to a license for a properly constructed house in a suitable locality," or "the magistrate must consider the character of the applicant and of the premises, but is not bound to give reasons for his decision." But wherever the applicant can submit to a court capable of dealing with evidence the question of fact whether he has fulfilled certain conditions defined by law, the system of free trade may be said in theory to exist. Wherever, on the other hand, the law distinctly affirms an absolute discretion in the magistrate, or lays down a positive principle, such as the "normal number" or the fixed proportion between public-houses and population, the system is properly described as restriction, or monopoly. This system, again, in its extreme form, tends to pass into one of prohibition. Under one of the alternative plans permitted by the Swedish licensing law of 1855, generally known as the Gothenburg plan, the municipality begins by the partial, and advances to the total, prohibition of liquor traffic, except by servants of the municipality; and this plan is sometimes advocated merely as a step towards the suppression of all trade in liquor. In nearly all countries the nature of the trade carried on in public-houses has subjected them to a much more rigorous police supervision than ordinary trades. All trades, however, must be carried on under the conditions required by the public comfort and safety; and to give unlimited license in such matters to publicans would be to violate social rights not inferior to freedom of industry and trade.

Of recent years there has been a considerable increase in the amount of drunkenness in Europe generally. There are no means of determining the law of the increase by reliable statistics, but it seems probable that the increase is confined to the large towns and to the lowest classes. There has also been of late, both in the United Kingdom and on the Continent, a very earnest and animated discussion on the policy and results of the various systems of liquor law. It cannot be said that so far any decisive experience has been adduced on the subject. In fact the legislation of Europe is in a very uneasy and changeful state. Thus, prior to the federal constitution of 1874, the cantons of Switzerland were in the habit of directing the municipal authorities to observe a certain proportion between the number of licenses and the population. The new constitution, however, laid down the general principle of free trade, and the federal council intimated to the various cantons that it was no longer lawful to refuse a license on the ground that there was no public need of it. In the previous year precisely the opposite change took place in Denmark. The license system rested on the law of 29th December, 1857, but this was modified by the law of 23d May, 1873, which increased the conditions to be fulfilled by those applying for a license, and conferred upon the communal authorities the power of fixing the maximum number of licenses to be granted. Similarly, in France, the liquor law rests upon the decree of 1851, but public opinion is turning against the absolute discretion reposed in the administrative authority, and the law proposed by M. de Gasté and approved of by the chamber of deputies on 22d March, 1878, will probably lead to a system of greater freedom. In the German empire the various states are still permitted by a law of the confederation, dated 21st June, 1869, to restrict the issue of licenses to what the public seem to require, but except in Würtemberg this permission seems not to have been used. In Austria the rapid growth of drunkenness in Galicia made necessary the severe police law of 19th July, 1877, but in other parts of the empire the exceptionally lenient law of 20th December, 1859, seems to be considered sufficient. In the midst of so many fluctuations of opinion, the practical questions of legislation must be decided on general principles and not by experimental evidence. Those who speak and write on the reform of the liquor laws are divided into two great classes—(1) the nephalists, who consider alcohol, in every form, whether in distilled or in fermented liquors, to be poison, and therefore wish the sale of it to be entirely suppressed; (2) those who see no objec-

ıoderate drinking, especially of the less alcoholic
ːs, or at least regard the idea of suppression as
acticable chimera. In the United Kingdom
ıalists are at present agitating for Sir Wilfrid
s Permissive Bill, which has latterly taken the
a local option resolution. This means that in
gh or parish two-thirds of the ratepayers may
hat no licenses shall be given, a vote to be taken
subject every three years. On 17th March,
e select committee of the House of Lords on
rance reported emphatically against the scheme
'ermissive Bill. The committee did not exam-
esses from the United States with respect to
eriments in prohibition which have been made
a large scale; but it is generally admitted that
ine Liquor Law has succeeded only in villages
l districts; in towns it has failed. So also the
n Law, prohibiting the sale of liquor except for
al or mechanical purposes, was condemned after
years' experience; and in 1875 a license tax was
l on dealers in liquor.

esult is the same under those celebrated "local
aws" which are in force in some of the United
These laws proceed from the legislatures of the
States. They sometimes take the form of a gen-
ibition of the sale of intoxicants, subject to a vote
nhabitants in each township or county, but more
ly they merely provide in general terms for the
licenses in the usual way, unless the local con-
y shall otherwise determine. Such laws are in
Massachusetts, New Jersey (which had the Chat-
cal Option Law of 1871), New Hampshire, Connec-
d Vermont. But whether they are constitutional
s a matter of serious controversy in the courts of
ted States. On the one hand, it is said that such a
unts to a delegation by the State of its legislative
-that it leaves the hands of the senate and general
y in an unfinished state, commanding nothing,
ing nothing. On the other hand, it is said this is
regulation, which is properly entrusted to county
ioners or boards of selectmen for the protection of
lth and morals of the localities over which they
; and it is quite competent for a State to make a
gating the power to determine some fact or state
s, upon which the law makes, or intends to make,
action depend. In the case of the States already
ed the constitutional character of the local option
been upheld by decision, but in the cases of Dela-
'exas, Indiana, California (Wall's Case), Iowa, and
lvania, it has been denied. The question has also
ised in the American courts whether in the case of
nts being imported from one State to another a
tion law, which prohibits the sale of the imported
loes not violate the freedom of commerce which is
eed to all the States by the American Constitu-

ng those who are not nephalists a variety of
s has been suggested. A small minority are in
f free trade subject to certain conditions. An
nent of this kind was tried by the Liverpool mag-
in 1853. "The premises were to be of high
value; the excise duty was to be greatly in-
l; the licensee was invariably to reside on the
es; and a special police for the inspection of
g houses was to be provided." These conditions
omplied with, no license was refused. This ex-
nt was made the subject of inquiry by Mr. Vil-
elect committee of 1854. That committee, which
d Sir George Grey and Lord Sherbrooke (Mr.
reported unanimously in its favor. A similar
ment was made in Liverpool during the years
6 without evil results, and also since 1862 in the
t division of the county of Lancashire. On the
ent the only countries where free trade prevails
are Belgium, Holland, Greece, Spain, and Roumania. In certain parts of Bavaria communes possess breweries, the produce of which they are by custom entitled to sell without any license; and the Rhenish Palatinate has never been subject to the restrictions mentioned below which apply to the rest of the empire. In Belgium licenses are unknown. The only tax which the publican pays is the "patent" which is paid by every trade. So strong is the general law in Belgium that in 1866, when the municipal authorities of Antwerp issued a regulation prohibiting the sale of alcoholic drinks in the streets, this was held to be illegal by the court of cassation. The Dutch law is the same as in Belgium. It must not be supposed, however, that the Dutch are satisfied with the present law. The Dutch "society for total abstinence from strong drink" is very active; and in 1880 the Government presented to the lower chamber a bill, introducing a license and also the principle of the normal number, the proportion of licenses to population varying according to the total population of towns. In Belgium the *Association contre l'abus des boissons alcooliques* is endeavoring to secure amendments of the law, chiefly of a fiscal and police character, but the introduction of the license is not suggested. In Germany, with the exception of Würtemberg and those places where the license is unknown, the liquor trade is practically free. The law of 1869 declares that a license can be refused for two reasons only—if the police condemn the structure or situation of the premises, or if the applicant is likely to encourage drunkenness, gaming, reset of theft, or improper meetings. This system may be contrasted with those of Italy and Russia. In Italy, under the law of 20th March, 1865, a license is obtained from the sub-prefect or *autorita politica del circondario* on the demand of the syndic (*sindaco*) of the commune and after consulting with the municipal *giunta*. In Russia, under the decree of 1861 and the communal law of 28th June, 1870, the license is got from the municipal or communal council, or, in certain cases, from the owners of land, especially church land. In both countries the licensing authorities have unlimited discretion, which they have exercised so as to multiply public-houses enormously. Assuming that sufficient guarantees can be got for the respectability of the applicant and the good sanitary condition of his premises, the system of free trade, or of unrestricted licensing on defined conditions, is the only one which can be defended on principle. It is impossible for the magistrates to exercise a just discretion in deciding what public-houses are required for a locality. The fact that an applicant has invested capital in the business and is ready to begin is the best evidence that there is a demand to be supplied. There is, however, no prospect of free trade being established in the United Kingdom. The select committee of 1879 reported against it.

A large number of licensing reformers support the scheme for introducing the "normal number" to the United Kingdom. This was embodied in the bills of Sir Robert Anstruther and Sir Harcourt Johnstone (1876). No new licenses were to be granted till the number had been reduced to 1 in 500 of the population in towns, and 1 in 300 in country districts. At present the proportion is 1 to 173 of the population in towns in England and Wales. It seems impossible to determine any such proportion *ab ante*. Even were it possible, the rough classification of towns by population, and the failure to discriminate between various rural districts, would result in great injustice. In Mr. Cowen's bill of 1877 and Lord Colin Campbell's bill of 1882 it was proposed to have in each locality a separate licensing board elected annually by the ratepayers. This proposal sins against the recognized principle in the reform of local government that authorities must be consolidated, not multiplied. The select committee of 1879 suggested that the function of licensing might be entrusted to the proposed representative county boards.

Another scheme, which has the advantage of appealing to modern experience in Europe, was contained in

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Cooley, *On Constitutional Limitations*, and *On Taxation*, p.
llon, *On Municipal Corporations*, i. p. 892; and the recent
Boyd *v.* Bryant, 37 Amer. Rep. 6. In some States it has
tempted to prohibit indirectly by raising enormously the
fee. The subject is frequently before the courts, and it
led that where the licensing power is given for revenue
s there is no limit to the discretion of the licensing
ty, but where it is given for purposes of regulation the
ld not exceed the expense of issuing the license and in-
g and regulating the licensed trade.

Sir Robert Anstruther's bills of 1872 and 1874 and Mr. Chamberlain's bill of 1877. These were all modifications of the Gothenburg system, which Mr. Carnegie, a Scotch brewer in Gothenburg, has done much to make known in the United Kingdom. In Sweden, prior to 1855, there was absolute free trade in liquor. The General Licensing Act, passed in that year, gave power to local authorities, subject to confirmation by the provincial governor, to fix annually the number of licenses, and to sell them for three years on certain conditions. If a company, or "bolag," were formed for the purpose of taking all the licenses, the local authority might contract with the company for three years. The Act did not apply to beer. The result of this Act has been twofold. In rural districts almost no licenses have been issued. In towns, on the other hand, drinking has increased of late, and has led to the severe police laws of 18th September, 1874, and 15th October, 1875. In 1866 Gothenburg set the example of transferring the whole public-house traffic to a bolag, which undertakes to appropriate no profit from the business, but to conduct its establishments in the interest of temperance and morality, and to pay over to the municipality the profits made beyond a fair interest on capital. This experiment has been a great financial success, and if developed will relieve the town from the greater part of its local taxation. The example has been followed by every town in Sweden having a population above 5000; and in 1877, after long discussion, it was adopted in Stockholm, the capital, where the number of life licenses presented unusual difficulties. Mr. Chamberlain proposed that the work done by the Swedish bolag should be attempted by town councils in the United Kingdom. For this purpose he asked power to acquire the freehold of all licensed premises and the interests of the license holders. The business would then be carried on by the town council, the profits being carried to the credit of the education and poor rates. The powers of the licensing justices would cease on the adoption of the scheme by the town council The select committee of 1879 recommended that legislative facilities should be given for the adoption of this scheme. It is doubtful, however, if the burden would be generally submitted to, except on the understanding that the local rates would be *pro tanto* diminished; and, were this realized, the tendency would be to support the municipality on the liquor trade by extending its operations.

The great mass of opinion in the United Kingdom, however, seeks some modification of the present licensing system. That system is extremely complicated. The wholesale licenses are granted by the excise without a magistrate's certificate, but for nearly all retail licenses such a certificate is required. Generally, the magistrates have absolute discretion as regards licenses to sell *on* the premises, but in England a license to sell *off* the premises can be refused only for one or more of the following reasons—no satisfactory evidence of good character, disorderly house, previous forfeiture of license by misconduct, want of legal qualification. The English law is contained in the Wine and Beerhouse Act 1869, and the Licensing Act 1872 and 1874.[1] The great features of the legislation of 1872 were (1) the introduction of a confirming authority (viz., the licensing committee in counties and the whole magistrates in burghs) for the purpose of restricting the issue of new licenses; (2) the qualification of annual value in public-house premises for the purpose of raising the character of those engaged in the trade; (3) the new regulations for closing; (4) the new regulations of police penalties, especially with reference to the endorsement of convictions on the license and the forfeiture of the license. The Act of 1874 abolished the necessity of confirmation in the case of "off" licenses, gave the magistrates absolute discretion as regards the endorsement of convictions, and removed from magistrates all discretion as regards closing hours. There are not many peculiarities in the licensing law of Ireland. Public-house licenses are generally held by shopkeepers, and no qualification of value is required except in the case of beerhouses. Mr. Meldon's Act of 1877 (37 & 38 Vict. c. 69) closed public-houses on Sunday. In Scotland prior to 1853 licenses were regulated by the Home-Drummond Act (9 Geo. IV. c. 58), which authorized only one form of certificate for "common inns."[2] In 1846 a select committee reported that the combination of the grocer trade with the sale of spirits to be consumed on the premises was productive of evil to the working classes. This led to the Forbes Mackenzie Act of 1853, which was amended in 1862, upon the report of a royal commission in 1860 (16 & 17 Vict. c. 67; 25 & 26 Vict. c. 35). It created three licenses—(1) for hotels, (2) for public-houses, (3) grocers' licenses. Under the hotel license intoxicating liquors may be sold to lodgers and travellers. On Sundays the public-houses are closed, and on week days the sale is practically limited to the period between 8 A. M. and 11 P. M. Cameron's Act of 1876 (39 & 40 Vict. c, 26) makes the refusal of a certificate by the magistrate final, and in the case of a new license requires the confirmation of a county licensing committee or in burghs of a joint committee of magistrates and justices.

Information on this subject is to be found chiefly in the *Reports* of royal commissions and select committees. It has been much discussed at the meetings of the Social Science Association, and there is a large literature of pamphlets and magazine articles, to which, among many others, Lord Sherbrooke, Mr. Chamberlain, and Mr. Arthur Arnold have contributed. The reports of the various international congresses "pour l'étude des questions relatives à l'alcoolisme," may be studied with advantage. See also Metman's *Études sur les Legislations Européennes relatives aux débits de boissons alcooliques*, Paris, 1879. (W. C. S.)

LISBON (Portuguese, *Lisboa*), the capital of the kingdom of Portugal, is situated in 38° 42′ N. lat. and 9° 5′ W. long., on the northern bank of the Tagus (*Tejo*) at the spot where the river broadens to a width of 9 miles, some 8 or 9 miles from the point where it enters the Atlantic. Standing on a range of low hills, backed by the lofty granite range of Cintra, and extending along the margin of the wide Tagus, Lisbon wears a very noble aspect to those who approach it from the sea. In regard to beauty of position it may rightly claim to be the third of European cities, Constantinople and Naples alone ranking before it. The river affords secure anchorage for a very large number of vessels, and the bar at the mouth is easily crossed even in rough weather. Like London, Paris, and Vienna, Lisbon stands in a geological basin of Tertiary formation. The upper portion consists of loose sand and gravel destitute of organic remains, below which is a series of beds termed by Mr. Daniel Sharpe the Almada beds, composed of yellow sand, calcareous sandstone, and blue clay, rich in marine remains. The greater part of Lisbon stands on those beds which belong to the older Miocene epoch, and are nearly of the same age as those of Bordeaux. Next comes a conglomerate without fossils. These Tertiary deposits, which cover altogether an area of more than 2000 square miles, are separated, near Lisbon, from rocks of the Secondary epoch by a great sheet of basalt which covered the Secondary rocks before any of the Tertiary strata were in existence. The uppermost of the secondary deposits is the Hippurite Limestone, which corresponds to a part of the Upper Chalk of northern Europe. The narrow valley of Alcantara, in the immediate neighborhood of Lisbon, has been excavated in this deposit; and here there are extensive quarries, where abundance of its peculiar shells may be collected.[3]

Lisbon stretches along the margin of the river for 4 or 5 miles, and extends northward over the hills for nearly 3 miles, but much of it is scattered amongst gardens and fields. In the older parts the streets are very irregular, but that portion which was rebuilt after the great earthquake of 1755 consists of lofty houses arranged in long straight streets. Here are the four principal squares, the handsomest of which, the Praça do Commercio, is open on one side to the river, and on the other three is surrounded by the custom-house and nent offices, with a spacious arcade beneath. In dle is a bronze equestrian statue of Joseph I., reign the earthquake and restoration of the k place. At the middle of the north side is triumphal arch, under which is a street lead- nother handsome square, the Rocio or Praça . Pedro (built on the site of the Inquisition ind prisons), where stands the theatre of D. I. The houses are for the most part well built, divided into flats for the accommodation of families. The streets had formerly a bad repu- n regard to cleanliness, but of late years great ment has taken place in this respect, although ral system of drainage has yet been adopted. e lighted with gas made from British coal. blic gardens, five in number, are small, but are requented in the evenings. The city contains seven theatres and a bull ring. The hotels of Lisbon offer but indifferent accommodation to strangers; the shops present little display, and are ill furnished with wares. The markets are tolerably well supplied with meat, fish, and country produce. A large quantity of excellent fruit is brought in for sale during the season.

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[1] 32 & 33 Vict. c. 27; 35 & 36 Vict. c. 94; 37 & 38 Vict. c. 49.

[2] So also the first English Act, 5 & 6 Edw. VI., provided one form of license for "alehouses."

[3] After careful investigation, Mr. Sharpe discovered that the greatest force of the earthquake of 1755 was expended upon the area of the above-mentioned Almada blue clay, and that not one of the buildings standing upon it escaped destruction. Those upon the slopes of the hills immediately above the clay suffered very severely, and all on the Tertiary strata were more or less injured, whilst none of the buildings on the hippurite limestone or the basalt suffered any damage whatever,—the line at which the earthquake ceased to be destructive corresponding exactly with the boundary of the Tertiary beds.

The king usually resides at the palace of Ajuda, situate on a hill above the suburb of Belem. It is in the Italian style, and was intended to be one of the largest palaces in Europe, but it has been left incomplete. It contains a large library, a collection of pictures, and a numismatic cabinet. There is another royal palace at Lisbon (that of the Necessidades), where former monarchs were wont to reside; and in the neighborhood of the city are numerous others. Several of the nobility have good and spacious houses in the city, which are dignified with the name of palaces. The houses of the residents are mostly to be found in the elevated t called Buenos Ayres.

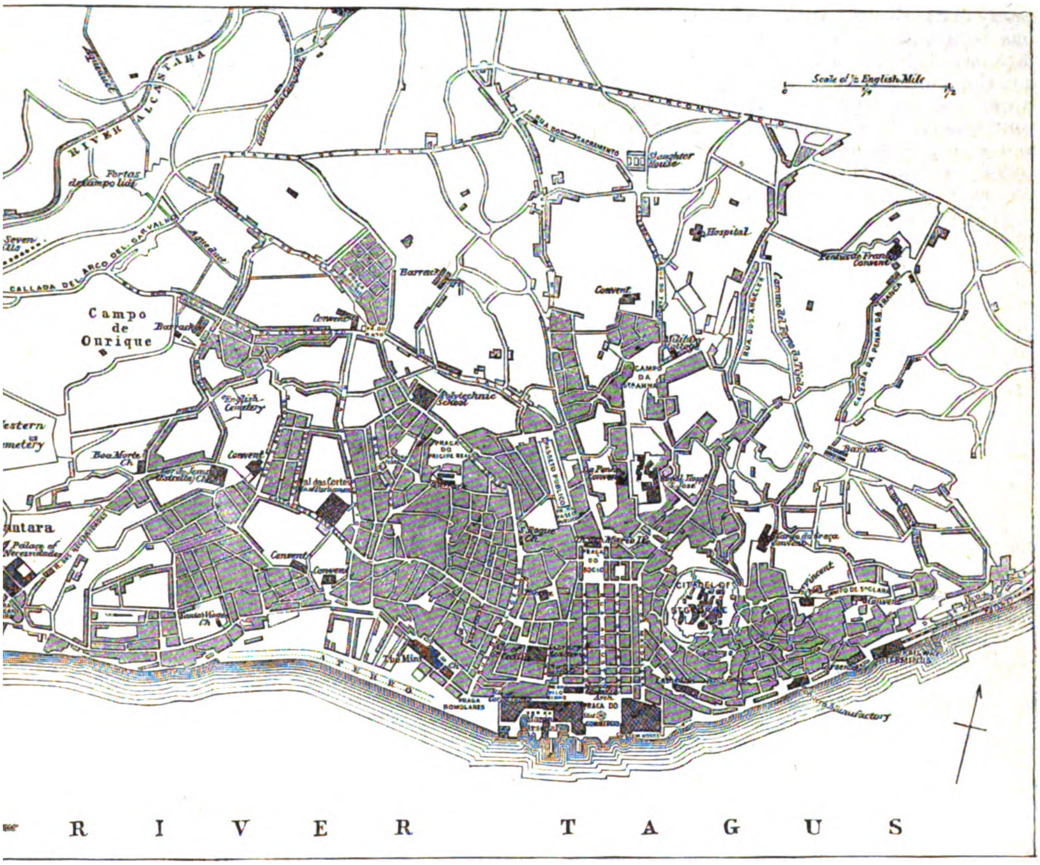

Fig. 1.—Plan of Lisbon.

or three small forts, one on a rock at the mouth Tagus, afford a very inadequate defence against tacks of a hostile fleet. In ascending the river cturesque Tower of Belem, built about the end 15th century, is seen on the north bank close to ater's edge. On a rocky hill stands the citadel of eorge, surrounded by the most ancient part of Lis- omposed of narrow tortuous streets, still retain- s old Moorish name, Alfama. The chief naval nilitary arsenals of the kingdom are at Lisbon. hed to the former are a naval school and a hydro- ical office. Here also is a museum of colonial cts. In various parts of the city are barracks for ccommodation of the troops and for the municipal . The churches are numerous, but are nearly all same tasteless Italian style; the interiors, over- y heavy ornament, contain pictures utterly devoid of merit. The cathedral is gloomy without being grand, but the oldest part behind the high altar may deserve inspection. The largest church in the city is St. Vincent's, 222 feet by 82. The large adjacent convent is now the residence of the cardinal patriarch. In a modern chapel attached to the church the coffined corpses of the monarchs of the house of Braganza are deposited, and the public are admitted to see them on certain days in the year. Perhaps the most striking church in Lisbon itself is that of the Estrella, with a dome commanding an extensive view, and two towers, the whole design reminding the visitor of St. Paul's, London. At St. Roque is the famous chapel of St. John the Baptist, designed by Vanvitelli, and made at Rome for King John V., who had been enriched by the discovery of the gold and diamond mines of Brazil. Before being sent to Portugal it was set up in St. Peter's, and Benedict XIV. celebrated the first mass in it. It is composed of precious marbles with mosaics and ornaments in silver and bronze, and is said to have cost upwards of £120,000. By far the most interesting architectural object at Lisbon is, however, the unfinished Hieronymite church and monastery at Belem. The church was begun in 1500 near the spot where Vasco da Gama had embarked three years before on his famous voyage to India. The style is a curious mixture of Moorish Gothic and Renaissance, with beautiful details. The English college was founded in 1628 for the education of British Roman Catholics; and the Irish Dominicans have a church and convent originally established for the education of youths intended for the priesthood. Ecclesiastically Lisbon is a patriarchate, the holder of the dignity being at the head of the clergy of the kingdom, and president of the chamber of peers. He is usually made a cardinal.

The two chambers of parliament hold their sittings in a huge building, formerly the monastery of St. Bento, to which a handsome façade has been added. New and ornamental buildings have been erected for the courts of justice and the municipal chamber. The mint is fitted up with steam machinery on a small scale for coining gold, silver, and copper. Postage stamps and inland revenue stamps are printed at this establishment. The national astronomical observatory is near the Ajuda palace, and the meteorological observatory is at the Polytechnic school, which also contains the national museum of natural history. Here is a good collection of the birds of Portugal, with collections in other branches of the zoology of Portugal and the Portuguese possessions in Africa—minerals, fossils, etc. The fossils collected by the Geological Commission to illustrate the geology of the kingdom are preserved in the sequestrated Convento do Jesus.

Lisbon is singularly destitute of works of high art. The gallery of the Academy of Fine Arts contains only a few pictures worth notice. In the custody of the academy is an interesting assemblage of gold and silver plate taken from suppressed monasteries. There is also a collection of pictures at the Ajuda palace. At the Carmo church is an archæological museum. The great national library consists for the most part of old theological works and ecclesiastical histories swept out of various suppressed monasteries, and has a collection of 24,000 coins with some Roman bronzes. The Portuguese take little interest in literature, art, or science, and almost everything connected with them is in a neglected state. Literary and scientific societies are few in number and badly supported, the principal one being the Royal Academy of Sciences, founded in 1779. The national printing office, a Government establishment, turns out creditable work, but the booksellers' shops are few and ill-stocked. Eight or ten daily journals are published in Lisbon, and there are a few weekly newspapers, besides periodicals appearing at longer intervals, and chiefly devoted to special interests.

Several cemeteries have been constructed of late years near Lisbon, the practice of interring in churches having been abandoned. In the English cemetery lies the English novelist Fielding, who died here in 1754; a marble sarcophagus with a long Latin inscription covers his remains. The British residents maintain a chaplain, who performs service regularly in an adjacent chapel, and the Scottish Presbyterians have also a place of meeting. The great hospital of S. José contains beds for nine hundred patients, and the large lunatic asylum has accommodations for four hundred patients. The Foundling Hospital takes in more than two thousand children annually. At Belem is an excellent establishment where a large number of male orphans and foundlings are fed, clothed, educated, and taught various trades. The Lazaretto is a vast building on the south side of the Tagus, where one thousand inmates can be received at one time.

Lisbon is connected by railway with Madrid, and there is also a line northward to Coimbra and Oporto, as well as lines southward to Setubal, Evora, and Beja. Submarine cables connect it with England and with Brasil. There is communication by regular lines of steamers with the Portuguese islands in the Atlantic and the colonies in Africa, and with a great number of ports in Britain, continental Europe, and other parts of the world. Lisbon is the largest port in the kingdom, and its custom-house is a spacious and very substantial fireproof building worthy of any capital in Europe, in which merchants are allowed to deposit their goods free of duty for a year, or for two years in the case of Brazilian produce. The duties annually collected here exceed £1,150,000, tobacco alone producing £400,000. Upwards of 1400 foreign vessels, and about 1100 Portuguese ships, including coasters, enter the port annually. The annual imports amount to about £5,600,000, and the exports to £4,500,000. A considerable number of foreign merchants reside in Lisbon, and there are about fifty British firms. The most active commerce is carried on with Brazil and Great Britain, tropical produce being imported from the one, and manufactured goods from the other, while wine and oil are sent to both in return. The wine for exportation is all made and stored outside the city bounds, so as not to be subject to the octroi duty. There are several joint-stock banks, one of them being British (the New London and Brazilian Bank), as well as private bankers. Manufactures are carried on only to a limited extent. The largest establishment by far is the tobacco manufactory, where 1600 persons are employed, and three millions of pounds are annually manufactured.

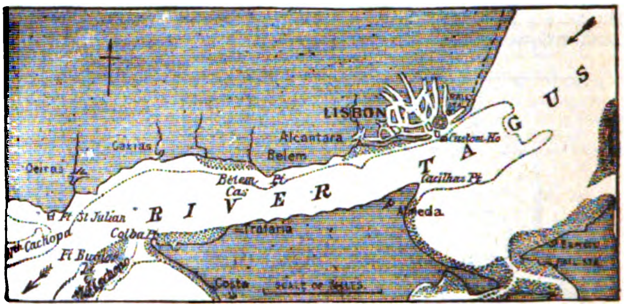

FIG. 2.—Port of Lisbon.

The chief supply of water for the use of the city is brought by an aqueduct 9 miles in length, from springs situated on the north-west. This work, one of the boasts of Lisbon, was completed in 1738, and was so well executed that the great earthquake did it no injury. It crosses the Alcantara valley on thirty-five arches, the principal one being 263 feet above its base, with a span of 110 feet. On reaching the city the water is conducted into a covered massive stone reservoir, which an inscription styles "urbis ornamentum orbis miraculum," and thence it flows to the fountains, thirty-one in number, distributed throughout the city. From these fountains it is removed in barrels to the houses by "Gallegos," men from Galicia, who do the principal part of the hard work in Lisbon. Although there are two other reservoirs near the city, the supply of water is insufficient for the requirements of the place during the warm season.

For municipal purposes the city is divided into four districts (*barros*), the whole under one municipal chamber, and two suburban districts under separate chambers. The city chamber consists of twelve members elected by the burgesses every two years. Its revenue is about £75,000. The octroi duties, levied on provisions and fuel entering the city, are collected on account of the Government, and exceed £270,000 a year. The police force is paid by the Government, and consists of the municipal guard, a military force of cavalry and infantry under the orders of the home secretary, and a body of ordinary policemen at the orders of the civil governor, an official appointed by Government. According to the census of 1878 the population in the thirty-nine parishes of the city and suburbs was 253,000.

Climate.—Notwithstanding the mildness of the climate, Lisbon is not considered a healthy place of residence, owing chiefly to the defective sanitary arrangements. The annual death-rate is 36 per thousand. The deaths are said to exceed the births, and the population would therefore decrease were the city not continually recruited from the country. To chest invalids it is not by any means to be recommended as a winter resort, on account of the frequent and rapid changes of temperature to which it is subject. These changes, and the great difference between the temperature of sun and shade during the winter and spring, are dangerous to the delicate. In summer the heat is great, and all who have the means betake themselves during the season to Cintra or to the seaside. The following data, deduced from twenty years' observations (1856 to 1875) taken at the Meteorological Observatory, a well-managed institution which stands 335 feet above the level of the sea, will afford the means of judging the climate in its principal features. Mean annual temperature of shade, 60°·37 Fahr.; mean annual range, 60°·2; mean daily range, 12°·6; highest and lowest registered during the whole period, 98°·8 and 30°·3. Mean annual quantity of rain, 28·84 inches; greatest and least annual quantity during the period, 38·8 inches (1865) and 17·22 inches (1874). The rainfall of 1876, however, amounted to 45 inches, more than one-third of which fell in the month of December. The mean annual number of days on which rain fell was one hundred and twelve, whilst snow fell only three times during the twenty years. The mean atmospheric moisture (100 = saturation) was 70·89. The mean annual height of the barometer was 29·8 inches, and its mean annual range 1·3 inches. The prevailing winds of the winter and autumn are from the north, of the spring and summer from the north-north-west.

History.—The name Lisbon (Portuguese, *Lisboa*) is a modification of the ancient name Olisipo, also written Ulyssippo under the influence of a mythical story of a city founded by Ulysses in Iberia, which, however, according to Strabo, was placed by ancient tradition rather in the mountains of Turdetania. Under the Romans Olisipo became a municipium with the epithet of Felicitas Julia, but was inferior in importance to the less ancient Emerita Augusta (Merida). After the Romans the Goths and the Moslems successively became masters of the town and district. Under the latter the town bore in Arabic the name of Lashbûna or Oshbûna. It was the first point of Moslem Spain attacked by the Normans in the invasion of 844. When Alphonso I. of Portugal took advantage of the decline and fall of the Almoravid dynasty to incorporate the provinces of Estremadura and Alemtejo in his new kingdom, Lisbon was the last city of Portugal to fall into his hands, and yielded only after a siege of several months (21st October, 1147), with the aid of English and Flemish crusaders who were on their way to Syria. In 1184 the city was again attacked by the Moslems under the powerful caliph Abu Ya'kub, but the enterprise failed. In the reign of Ferdinand I., the greater part of the town was burned by the Castilian army under Henry II. (1373), and in 1384 the Castilians again besieged Lisbon, but without success. Lisbon became the seat of an archbishop in 1390, the seat of government in 1422. It gained much in wealth and splendor from the maritime enterprises that began with the voyage of Vasco da Gama (1497). The patriarchate dates from 1716. From 1586 to 1640 Lisbon was a provincial town under Spain, and it was from this port that the Spanish Armada sailed in 1588. In 1640 the town was captured by the duke of Braganza, and the independence of the kingdom restored. For many centuries the city had suffered from earthquakes, of more or less violence, but these had been almost forgotten when, on the 1st of November, 1755, it was reduced almost in an instant to a heap of ruins. A fire broke out to complete the work of destruction, and between 30,000 and 40,000 persons lost their lives. Pombal, an unscrupulous minister, but a man of great talent, applied himself with unremitting energy both to the protection of the rights of property (for the place was infested by bands of robbers) and to the reconstruction of the buildings. The handsomest part of the present city was erected under his direction, but even to this day there are edifices which speak forcibly of the great earthquake. In 1807 Napoleon proclaimed that the house of Braganza had ceased to reign in Europe, whereupon the regent Don John (his mother the reigning queen Maria I. having become insane) thought it prudent to quit the country for Brazil, and next day a French army under Junot entered the city, possession of which he retained for ten months. He then quietly embarked his army under the protection of the inexplicable convention of Cintra so disgraceful to the English generals. In 1859 Lisbon was stricken by yellow fever, and many thousands were carried off before the plague was stayed. Lisbon boasts of having been the birthplace of St. Anthony, surnamed of Padua, of Camoens, the national epic poet (to whose honor a bronze statue has been placed in one of the squares), and of Pope John XII. (J. Y. J.)

LISBURN, a market-town, cathedral city, and municipal and parliamentary borough of Ulster, Ireland, partly in Antrim and partly in Down, is situated in a beautiful and fertile district on the Lagan, and on the Ulster Railway, 8 miles south-south-west of Belfast. It is substantially built, and consists principally of one long and irregular street, in the centre of which there is a large open space for the market. The parish church, which possesses a fine octagonal tower, is the cathedral church of the united dioceses of Down, Connor, and Dromore, and contains a monument to Jeremy Taylor, who was bishop of the see. Among other buildings are the court-house, the market-house, the linen-hall, and the county infirmary. There are a number of charitable foundations. The staple manufacture of the town is linen, specially damasks and muslins. There are also bleaching and dyeing works. The population in 1871 was 9326, and in 1881 it was 10,834.

In the reign of James I. Lisburn, which was then known as Lisnegarvy, was only an inconsiderable village, but in 1627 it was granted by Charles I. to Viscount Conway, who erected the castle for his residence, and laid the foundation of the prosperity of the town by the introduction of English and Welsh settlers. In November, 1641, the town was taken by the insurgents, who on the approach of superior numbers set fire to it. The troops of Cromwell gained a victory near the town in 1648, and the castle surrendered to them in 1650. The church was constituted a cathedral by Charles II., from whom the town received the privilege of returning two members to parliament, but since the Union it has returned only one.

LISIEUX, capital of an arrondissement in the department of Calvados, France, 113 miles by rail west-north-west from Paris, and 24 miles as the crow flies east from Caen, is prettily situated on the Touques, at the point where it is joined by the Orbiquet, 24 miles above Trouville. The Paris and Caen Railway has a branch from Lisieux to Honfleur and Trouville, and another to Orbec. The cathedral church, dedicated to St. Peter, founded about 1045, and finished in 1233, which has recently been restored, is the most interesting specimen to be found in Normandy of the transition from the Roman to the Ogival style. It is 360 feet in length, 90 in breadth, and 65 in height; the south tower rises to 230 feet. The nave is remarkable for harmony of proportion, purity of design, and unity of style. The church of St. Jacques, built at the end of the 15th century, contains some beautiful glass of the Renaissance, some remarkable woodwork and old frescoes, and a curious picture on wood, restored in 1681. The old episcopal palace (Lisieux ceased to be a bishopric in 1801) near the cathedral is now used as a court-house and prison. In the court-house is a beautiful hall called the Salle Dorée. The town still retains quaint examples of the wooden houses of the 14th, 15th, and 16th centuries; and there are some elegant modern villas. It also possesses a charming public garden and a small museum. The confluence of the two rivers renders it subject to disastrous inundations; but its commerce and industry cause it, notwithstanding, to rank among the richest towns of Normandy. There is a large cattle trade, and the arrondissement has nearly three hundred factories, employing about ten thousand workmen in the manufacture of cloth and cretonnes. Connected with this industry are numerous spinning-mills, bleach-fields, and dye-works; and there are besides wool-mills, chemical works, tanneries, saw-mills, and the like, which bring up the trade of Lisieux to an annual aggregate of upwards of 50 million francs. The population in 1876 was 18,400.

In the time of Cæsar, Lisieux, by the name of *Noviomagus*, was the capital of the Lexovii. Though destroyed by the barbarians, by the 6th century it had become one of the most important towns of Neustria. Its bishopric is said to date from the 3d or 4th century. In 877 it was pillaged by the Normans; and in 911 we find it included in the duchy by the treaty of St. Clair-sur-Epte. Civil authority was exercised by the bishop as count of the town. In 1136 Geoffrey Plantagenet laid siege to Lisieux, which had taken the side of Stephen of Blois. The war lasted five years, and reduced Lisieux and its neighborhood to the direst extremities of famine. In 1152 the marriage of Henry II. of England to Eleanor of Guienne, which added so largely to his dominions, was celebrated in the cathedral. Thomas a Becket took refuge here, and some vestments used by him are still shown in the hospital chapel. Taken by Philip Augustus and reunited to France in 1203, the town was a frequent subject of dispute between the contending parties during the Hundred Years' War, the religious wars, and those of the League. Among the bishops of Lisieux may be mentioned Nicholas Oresme, who died in 1382, and Pierre Cauchon, the judge of Joan of Arc, who occupied this see after he had been driven from that of Beauvais.

LISKEARD, anciently LISCARRET, a market-town and municipal and parliamentary borough in the county of Cornwall, England, is picturesquely situated, partly in a hollow and partly on a rocky eminence, 12 miles east of Bodmin, and 265 west-south-west of London by rail. The church of St. Martin, in the Perpendicular style, with a tower of earlier date which possesses a Norman arch, is the largest ecclesiastical building in the county, except the church of Bodmin. A town-hall in the Italian style was erected in 1859. A grammar school was founded at a very early period, and there are several other schools and charities. There are manufactures of leather, but the prosperity of the town is dependent chiefly on agriculture, and the neighboring tin, lead, and copper mines. Liskeard returns one member to parliament. It received its first charter in 1240, from Richard, earl of Cornwall, brother of Henry III., but its principal charter in 1586, from Queen Elizabeth. The population of the municipal borough (area 810 acres) in 1871 was 4700, and in 1881 it was 4479, that of the parliamentary borough (area 8387 acres) in the same years being 6576 and 5591.

LISLE, JOSEPH NICOLAS DE (1688–1768), astronomer, was born at Paris on April 4, 1688, and was educated at the Collége Mazarin. His devotion to astronomy dates from 1706, in which year he carefully observed an eclipse of the sun. In 1714 he was admitted to the Academy of Sciences, and in 1720 he made the proposals for determining the figure of the earth, which were carried out under the auspices of that body some years afterwards. In 1724 De Lisle visited England, where, through Newton and Halley, he was received into the Royal Society, and in 1726 he accepted an invitation from Catherine I. to the chair of astronomy in the Imperial Academy of Sciences at St. Petersburg. In 1747 he returned to Paris, and was allowed a very imperfect observatory in the Hôtel Cluny, where Messier and Lalande were among his pupils. In 1753, previous to the transit of Mercury, he published a map of the world representing the effect of that planet's parallaxes in different countries, and in 1754 he was made geographical astronomer to the naval department. In 1762 he resigned in favor of Lalande, and withdrew to the abbey of Sainte Geneviève, where he died of apoplexy on September 11, 1768.

Besides numerous papers contributed to the *Transactions* of the Academies of Paris, Berlin, and St. Petersburg, he wrote *Mémoires pour servir à l'histoire et aux progrés de l'Astronomie, de la Géographie, et de la Physique* (St. Petersburg, 1738), *Eclipses circumjovialium, ad annos 1734, 1738, et menses priores 1739* (Berlin, 1734), and *Mémoire sur les nouvelles découvertes au nord de la mer du Sud* (Paris, 1752–53). See ASTRONOMY, vol. ii. p. 662.

LISMORE, an island of 9600 acres, about 10 miles long and averaging 1½ miles broad, with a population in 1881 of 630, lying south-west and north-east at the entrance of the Linnhe Loch in Argyllshire, Scotland. The name means the great enclosure (whether "garden," as the Scotch, or "fort," as the Irish authorities suppose, is uncertain), and occurs in Ireland in the Waterford, Lismore and ten other places. "Lis" is one of the most frequent words in compound Irish names, there being one thousand four hundred townlands or villages which begin with it. A Columban monastery was founded there by St. Moluag about 592 (Reeves, *Adamnan*, p. 34), whose bell is perhaps that found in 1814 at Kilmichael Glassary,[1] and whose crozier or staff is in the possession of the duke of Argyll.[2] About 1200 the see of Argyll was separated from Dunkeld by Bishop John "the Englishman," and Lismore soon after became the seat of the bishop of Argyll, sometimes called "Episcopus Lismoriensis" (Skene, *Celtic Scotland*, ii. p. 408 *sq.*), quite distinct from the bishop of the Isles (Sudreys and Isle of Man), called "Episcopus Sodoriensis" or "Insularum," whose see was divided into the English bishopric of Sodor and Man and the Scottish bishopric of the Isles in the 14th century (Keith's *Catalogue*, p. 173). The monastic establishment of Lismore, at one time consisting of Culdees (Reeves, *Culdees*, p. 49), was converted into a chapter of canons regular and a dean, whose right to elect the bishop was recognized as early as 1249 (Baluze, *Miscel.*, vii. p. 442; *Orig. Paroch. Scot.*, ii. pt. 1, p. 161).

Lismore has an accidental celebrity from the *Book of the Dean of Lismore*, a MS. collection of poems, Gaelic and English, made by James M'Gregor, vicar of Fortingall and dean of Lismore (1514–51). A selection of the Gaelic poems, with translations by Rev. T. M'Lauchlan, and introduction by Mr. W. F. Skene, published 1862, is of value both for the language and the contents. The language is the Gaelic of the West Highlands, spelt phonetically, as spoken in the beginning of the 16th century, and its variations from ancient Irish on the one hand and modern Gaelic on the other are of much interest to Celtic scholars. Its contents are Ossianic fragments, some of Irish, others of Scotch origin, and a few more recent Gaelic verses. The publication of this work, and J. F. Campbell of Islay's collection from oral sources of the existing traditional Gaelic poetry, have for the first time given a genuine historical solution of the Ossianic problem (see OSSIAN). There are remains of three castles on Lismore:—at Tireforr a fort of two concentric circles of dry stones, supposed to be Norse or Danish; at Achindown a square keep with walls 40 feet high, believed to be the palace of the bishop; and on the west side of the island Castle Corffin, mentioned in a grant to Campbell of Glenurqhay in 1470 (*Orig. Par. Sc.*, ii. p. 109.)

LISMORE, a market-town and seat of a diocese, partly in Cork but chiefly in Waterford, Ireland, is beautifully situated on a steep eminence rising abruptly from the Blackwater, 40 miles west-south-west of Waterford. At the verge of the rock on the western side is the old baronial castle, erected by King John in 1185, which was the residence of the bishops till the 16th century. It was besieged in 1641 and 1643, and in 1645 it was partly destroyed by fire. To the east, on the summit of the height, is the cathedral of St. Carthagh, erected in 1663 by the earl of Cork, in the Later English style, with a square tower surmounted by a tapering spire. There are a grammar school, a free school, and a number of charities. Some trade is carried on by means of the river, and there is a salmon fishery. The population of the town in 1871 was 1946.

The original name of Lismore was Maghsciath. Its present name was derived from a monastery, founded by St. Carthagh in 633, which became so celebrated as a seat of learning that it is said no less than twenty churches were erected in the vicinity. In the 9th and beginning of the 10th centuries the town was repeatedly plundered by the Danes, and in 978 the town and abbey were burned by the Ossorians. Henry II., after landing at Waterford, received in Lismore castle the allegiance of the archbishops and bishops of Ireland. In 1518 the manor was granted to Sir Walter Raleigh, from whom it passed to Sir Richard Boyle, afterwards earl of Cork. From the earls of Cork it descended by marriage to the dukes of Devonshire. It was incorporated as a municipal borough in the time of

[1] Anderson, *Scotland in Early Christian Times*, 1st ser., p. 206, where it is figured.

[2] See *Orig. Paroch. Scot.*, where it is figured.

arles I., when it also received the privilege of returning mbers to parliament, but at the Union it was disfran- ised, and also ceased to exercise its municipal functions. more is the birthplace of Robert Boyle, but its claim to the birthplace of Congreve does not rest on a sufficient ndation.

LISSA (in Polish, *Leszna*), a manufacturing town the circle of Fraustadt, district of Posen, Prussia, is uated on the Breslau and Posen Railway, near the ntier of Silesia. The most prominent buildings are e handsome château, the mediæval town-house, the ree churches, and the synagogue. Its manufactures nsist chiefly of cloth, liqueurs, tobacco, and wax; it o possesses several tanneries and a large steam flour- ill, and carries on a brisk trade in grain, cattle, spirits, ne, and furs. The population in 1880 was 11,758, cluding 3810 Roman Catholics and 1833 Jews.

Lissa owes its origin to a number of Moravian Brothers om Bohemia, who were banished by the emperor Ferdi- nd I. in the 16th century, and found a refuge on the tate of the Polish family of Leczynski. Their settle- ent received municipal rights in 1548. During the hirty Years' War the population was reinforced by other fugees, and Lissa became an important commercial town, d the chief seat of the Moravian Brothers in Poland. OMENIUS (*q. v.*) was long rector of the celebrated Mora- an school there. Lissa was twice burned down (in 1656 d 1707) during the Swedish and Polish wars.

LISSA (Lat., *Issa;* Slav., *Vis*), an Austrian island the Adriatic, 9 miles long, with a greatest breadth of miles, is situated 41 miles from the coast of southern almatia, almost due west of the mouth of the Narenta, 43° 1′ N. lat. and 16° 6′ E. long. "The shape is a ng parallelogram with two breaks, the Porto di S. iorgio (one of the finest harbors of refuge in the driatic) on the eastern short side, and the Vallone di omisa contained between two long prongs stretching ue west and south-west. The outer walls are stony dges rising from 470 to 610 feet above sea-level, and eclining quaquaversally to the fertile plateau which, veraging 400 feet high, forms the body of the island. he apex is Monte Hum, a bald and flattened cone 1868 feet) on the south-west" (Burton). Wine- rowing (for which Issa was famous of old) still forms he principal means of subsistence, an average season ielding from 70,000 to 80,000 barrels; but the sardine shery (15,000 to 25,000 barrels per annum) is of grow- g importance, and the peasants distil about 24,000 ℔ f rosemary oil annually. The island is divided into wo communes, Lissa and Comisa. In the former is he chief town, Lissa, with the palace of the old Vene- ian counts Gariboldi, the former residence of the Eng- sh governor, the monastery of the Minorites, and at little distance to the west the ruins of the ancient city f Issa. The population, 6485 in 1869, was 7871 in 880.

Issa is said to have been settled by people from Lesbos, he Issa of the Ægean. The Parians, assisted by Dionysius he Elder of Syracuse, introduced a colony in the 4th century . C. During the First Punic War the Issæans with their eaked ships helped the Roman Duilius; and the great re- ublic, having defended their island against the attacks f Agron of Illyria and his queen Teuta, again found them aithful and serviceable allies in the war with Philip of acedon. As early as 996 we find the Venetians in posses- ion of the island, and, though they retired for a time be- ore the Ragusans, their power was effectually established n 1278. Velo Selo, which by that time had become the hief settlement, was destroyed by Ferdinand of Naples in 483, and by the Turks in 1571. The present city arose hortly afterwards. During the Napoleonic wars Lissa was ccupied by the French, but the English defeated their quadron in 1810, and kept possession of the island till July, 815, erecting fortifications (dismantled in 1870) and mak- ng it a centre of operations. In 1866 the Italians under ersano made an attack on Lissa, but were defeated by the ustrians under Tegethoff—the battle being fought about 0 miles north of the harbor.

See Wilkinson (1848); Neal (1861); Brackenbury, in the *Times*, ugust 14, 1866; *Revue marit. et col.*, 1867; and Burton in *Journ. oy. Geog. Soc.*, 1879.

LISTON, JOHN (1776–1846), comedian, was the son of a watchmaker in Soho, London, where he was born in 1776. While the teacher of a day school near Leicester Square, he began to take part in private theatricals, and soon conceived a passion for the stage. He made his début at a small theatre in the Strand, and shortly afterwards obtained an engagement at Dublin theatre, where, although he adopted tragedy as his role, his natural talent for acting attracted the attention of Stephen Kemble, who engaged him for his theatre at Newcastle-on-Tyne. Discovering accidentally that his forte was not tragedy but comedy, Liston displayed in his personation of old men and country boys a fund of drollery and humor which proved irresistible. An introduction to Charles Kemble led to his appearance at the Haymarket in 1805 as Zekiel Homespun, and from this time he occupied an unrivalled position in his own line of performance, his broad humor being tempered by true artistic finish, while he possessed an original power of creation which, with his boundless faculty in the elaboration of absurdities, filled up meagre and commonplace outlines with the characteristics of vivid individuality. Paul Pry, first represented in 1825, and always his most popular part, soon became to many a real personage. Liston played successively at Covent Garden, Drury Lane, and the Olympic, and remained on the stage till almost the close of his life. He died March 22, 1846.

LISTON, ROBERT (1794–1847), an eminent Scottish surgeon, was born on the 28th of October, 1794, at Ecclefechan, where his father was parish minister. He commenced the study of anatomy under Dr. Barclay in Edinburgh University in 1810, and soon became a skilful anatomist. After eight years' study, he began his career as a lecturer on anatomy and surgery in the Edinburgh School of Medicine; and in 1827 he was elected one of the surgeons to the Royal Infirmary. In 1835 he was invited to fill the chair of clinical surgery in University College, London. He held the appointment until his death, on the 7th of December, 1847. Liston was a teacher more by what he did than by what he said. He taught simplicity in all operative procedures; fertile in expedients, of great nerve, and of powerful frame, his name is remembered at the present day as a bold and rapid operator. He inspired all around with confidence, and every one present at his operations felt that the knife in his hands, however rapidly he worked, was guided with skill founded upon knowledge. He was the author of *The Elements of Surgery* and *Practical Surgery*, and made several improvements in methods of amputation, and in the dressing of wounds.

LITANY. This word (λιτανεία), like λιτή (both from λίτομαι), is used by Eusebius and Chrysostom, most commonly in the plural, in a quite general sense, to denote a prayer, or prayers, of any sort whatever, whether public or private; it is similarly employed in the law of Arcadius (*Cod. Theod.*, xvi. tit. 5, leg. 30), which forbids heretics to hold assemblies in the city "ad litaniam faciendam." But some trace of a more technical meaning is found in the epistle (*Ep.* 63) of Basil to the church of Neocæsarea, in which he argues, against those who were objecting to certain innovations, that neither were "litanies" used in the time of Gregory Thaumaturgus. The nature of the recently introduced litanies, which must be assumed to have been practised at Neocæsarea in Basil's day, can only be vaguely conjectured; probably they had many points in common with the "rogationes," which, according to Sidonius Apollinaris, had been gradually coming into occasional use in France about the beginning of the 5th century, especially when rain or fine weather was desired, and which, so far as the three fast days before Ascension were concerned, were first definitely fixed, for one particular district at least, by Mamertus or Mamercus of Vienne (*c.* 450 A. D.). We gather that they were penitential and intercessory prayers offered by the community while going about in procession, fasting, and clothed in sackloth. Sidonius alludes to the incongruity of men going "castorinati ad litanias." In the following century the manner of making litanies (litanias facere) was to some extent regulated for the entire Eastern empire by one of the *Novels* of Justinian, which forbade their celebration without the presence of the bishops and clergy, and ordered that the crosses (which were carried about in procession) should not be deposited elsewhere than in churches, nor be carried by any but such persons as were duly appointed to do so. The first synod of Orleans (511 A. D.) in its twenty-seventh canon enjoins for all Gaul that the "litanies" before Ascension be celebrated for three days; on these days all menials are to be exempt from work, so that every one may be free to attend divine service. The diet is to be the same as in Quadragesima; clerks not observing these rogations are to be punished by the bishop. In 517 A. D. the synod of Gerunda provided for two sets of "litanies;" the first were to be observed for three days (from Thursday to Saturday) in the week after Pentecost with fasting, the second for three days from November 1. A synod of Paris (573) in its tenth canon ordered litanies to be held for three days at the beginning of Lent, and the fifth synod of Toledo (636) appointed litanies to be observed throughout the kingdom for three whole days from December 14. The first mention of the word litany in connection with the Roman Church goes back to the pontificate of Pelagius I. (555), but implies that the thing was at that time already old. In 590 Gregory I., moved by the pestilence which had followed an inundation, ordered a "litania septiformis," that is to say, a sevenfold procession of clergy, laity, monks, virgins, matrons, widows, poor, and children. He is said also to have appointed the processions or litanies of April 25 (St. Mark's day), which seem to have come in the place of the ceremonies of the old Robigalia. In 747 the synod of Cloveshoe (can. 16 and 17) ordered the litanies or rogations to be gone about by all the clergy and people with great reverence,—on April 25 "after the manner of the Roman Church," and on the three days before Ascension "after the manner of our ancestors." The latter are still known in the English Church as Rogation Days. Games, horse racing, junketings were forbidden; and in the litanies the name of Augustine was to be inserted after that of Gregory. The reforming synod of Mainz in 813 ordered the major litany to be observed by all for three days, not with horses or in magnificent attire, but in sackcloth and ashes, and barefoot. The sick only were exempted from this command.

As regards the form of words prescribed for use in these "litanies" or "supplications," documentary evidence is somewhat defective. Sometimes it would appear that the "procession" or "litany" did nothing else but chant "Kyrie eleison" without variation. There is no reason to doubt that from an early period the special written litanies of the various churches all showed the common features which are now regarded as essential to a litany, in as far as they consisted of (1) invocations, (2) deprecations, (3) intercessions, (4) supplications. But in details they must have varied immensely. The offices of the Roman Catholic Church at present recognize two litanies, the "Litaniæ majores" and the "Litaniæ breves," which differ from one another chiefly in respect of the fulness with which details are entered upon under each of the four heads mentioned above. It is said that in the time of Charlemagne the angels Orihel, Raguhel, Tobihel were invoked, but the names were removed by Pope Zacharias as really belonging to demons. In some mediæval litanies there were special invocations of S. Sapientia, S. Fides, S. Spes, S. Charitas. The major litanies, as given in the Breviary, are at present appointed to be recited on bended knee, along with the penitential psalms, in all the six week days of Lent when ordinary service is held. Without the psalms they are said on the feast of Saint Mark and on the three rogation days. They are also chanted in procession before Mass on Holy Saturday. The "litany" or "general supplication" of the Church of England, which is appointed "to be sung or said after morning prayer upon Sundays, Wednesdays, and Fridays, and at other times when it shall be commanded by the ordinary," closely follows the "Litaniæ majores" of the Breviary, the invocations of saints being of course omitted. A very similar German litany will be found in the works of Luther. In the Roman Church there are a number of special litanies peculiar to particular localities or orders, such as the "Litanies of Mary" or the "Litanies of the Sacred Name of Jesus."

LITHGOW, William (c. 1583–c. 1660), a noted Scottish traveller, was born in Lanark, where his father was a burgess, possessed of considerable heritable property. The date generally assigned to his birth is 1583; and he was educated at the grammar school of his native town, then celebrated as a seminary of learning. His natural disposition was probably active and restless, as even in his boyhood he tells us that he made voyages to both the Orkneys and the Shetlands, and somewhat later travelled through the Low Countries, Germany, Bohemia, and Switzerland. The final impelling cause of his leaving Scotland, however, appears to have been some savage outrage committed either upon himself or on one nearly connected with him, arising, it is thought, from some love affair, which gave him an intolerable disgust to home. He left his native country about 1608 or 1609, and proceeded to Paris, where he remained ten months, and then crossed the Alps to Rome and Naples; after which he wandered through Istria, Dalmatia, Albania, Greece, Asia Minor, Syria, Mesopotamia, Palestine, and Egypt, most of his journey having been performed on foot. In the course of his travels he escaped innumerable dangers from robbers, and hardships from exposure to inclement weather. He returned to England by Sicily and Paris. Another tour which he made lay through Morocco, Algiers, Tunis, Tripoli, Hungary, Germany, and Poland. On his arrival in London he became an object of interest to King James, who, on the spirit of travel again returning upon him, furnished him with commendatory letters to all kings, princes, dukes, etc., whose territories he might desire to visit. In 1619, accordingly, he went over to France, and thence passed through Portugal and Spain as far as Malaga. There he was apprehended as a spy, and after suffering the most excruciating tortures, first in prison, and afterwards in the Inquisition, he was at length released on the interference of the English consul, and allowed to return to England in 1621. The minute description which he gives of the terrible torture to which he was subjected is almost unequalled for horror, and, when he arrived in London, he had the appearance of a man more dead than alive. He was carried on a feather bed to Theobald's in order that King James might be an eyewitness of what he called his "martyred anatomy." The whole court crowded to see him. The king commanded that the greatest care should be taken of him, and he was twice sent to Bath at his Majesty's expense. On recovering his health, he was desired by James to apply to Gondomar, the Spanish ambassador, for recovery of the money and other valuables of which he had been plundered by the governor of Malaga, and for a thousand pounds in reparation of his injuries. Gondomar gave fair promises that all his demands should be granted, but nothing was done. Whereupon, having met the ambassador at the royal levee, and reproached him with his perfidy, after high words on both sides, Lithgow furiously assailed him with his fists, in the presence of the king, the imperial ambassador, and the knights and gentlemen of the court. This, of course, was an offence which could not be passed over, and, though his boldness was generally commended, he had to suffer an imprisonment of nine weeks in the Marshalsea. His latter years are understood to have been spent in his native town, and he is said to have died somewhere about 1660.

A portion of his travels appeared in a small volume in London in 1614, but the complete work was not published till 1632. It has been repeatedly reprinted. It was also translated into Dutch and published at Amsterdam in his lifetime. His other works are—*An Account of the Siege of Breda* (1637) at which he had been present; *A Survey of London and England's State*, 1643; *Relation of the Siege of Newcastle*, 1645. His poetical remains, collected by James Maidment, were published at Edinburgh in 1863.

LITHIUM, one of the rarer metallic elements, intermediate in its character between sodium and barium. It was discovered in 1817 by Arfvedson in the course of an analysis of petalite in Berzelius's laboratory. He recognized the presence in this mineral of a new kind of alkali, which his master subsequently named "lithia," to denote its mineral origin. Lithia, though widely disseminated throughout the mineral world—traces of it being found in almost all alkaliferous silicates, in the soils derived from these, and in many mineral waters—nowhere occurs in any abundance except in the immense masses of lithia-mica (lepidolite) known to exist in Bohemia. Of other lithia-minerals (all rare) we may name petalite and spodumene (both silicates of alumina and alkalies) and triphylline, a mixed phosphate of ferrous, manganous, and lithium oxides. Only lepidolite comes into consideration as a raw material for the preparation of lithia and its salts. But the extraction from it of pure lithia in any form is difficult. The first step is the disintegration of the finely powdered mineral, which may be effected by means of vitriol and hydrofluoric acid (or vitriol and fluorspar); the silicon goes off as gaseous fluoride, the bases remain as sulphates. Or else we may mix the mineral intimately with quicklime, and by very intense heating of the mixture produce a more highly basic silicate, which is readily disintegrable by acids. In either case it is easy to unite all the bases (Al_2O_3, Fe_2O_3, CaO, MgO, Li_2O, K_2O, Na_2O) into a solution of chlorides or sulphates. From it we precipitate successively and remove by filtration (1) the bases not alkalies or Li_2O by means of excess of milk of lime, and (2) the lime introduced by operation (1) by means of carbonate of ammonia. There results a mixed solution of potash, soda, lithia, and ammonia salt, from which the last-named component is easily removed by evaporation to dryness and ignition. For these very tedious operations Troost has substituted an elegant process which, though admittedly imperfect in the analytic sense, lends itself admirably to manufacturing purposes. He mixes ten parts of the finely powdered mineral with ten parts of carbonate of baryta, five parts of sulphate of baryta, and three parts of sulphate of potash, and melts down the mixture in a powerful wind-furnace. There results a mass which separates spontaneously into a lower layer forming a transparent glass, and an upper one consisting of the sulphates of barium, potassium (sodium), and lithium, the latter representing about three-fourths of the lithia contained in the mineral. By treatment with water the sulphate of baryta is easily removed as an insoluble residue; the mixed alkaline sulphates are converted into chlorides by decomposition with chloride of barium, and from the dry mixed chlorides approximately pure chloride of lithium is obtained by lixiviation with ether-alcohol, which solvent dissolves only very small proportions of the other chlorides. To purify the crude chloride it is dissolved in water and, by double decomposition with carbonate of soda, converted into a precipitate of carbonate of lithia, Li_2CO_3, which must be washed with small instalments of water, as it is very appreciably soluble in water. This carbonate of lithia is still contaminated with soda. To purify it fully dissolve it in water with the help of carbonic acid, filter, and evaporate slowly on a water-bath; the added carbonic acid goes off, and pure carbonate of lithia separates out in crystalline crusts (Troost). One litre of pure water dissolves 12 grammes; 1 litre of water kept saturated with carbonic acid dissolves 52·5 grammes of the carbonate. The dry salt fuses at a red heat, but before doing so loses part of its carbonic acid, which, after cooling, it shows no tendency to take up again from the atmosphere. Perfectly acid-free lithia, Li_2O, can be obtained by heating a mixture of the carbonate and pure charcoal in a platinum crucible, or by heating the nitrate for a long time in a silver one. If the preparation, ultimately, of the hydrate $Li_2OH_2O = 2LiOH$ is contemplated, the latter operation may be very materially shortened by addition of metallic copper, which reduces the nitric acid. The anhydrous oxide, when treated with water, dissolves without much evolution of heat as hydrate, LiOH, which, by evaporation (in silver) is easily obtained in the solid form. It melts at a dull red heat, but at even higher temperatures loses no water. It dissolves in water (far less abundantly than soda), with formation of a strongly alkaline solution, which neutralizes all acids, with formation of salts. Like baryta, it refuses to form acid sulphates or carbonates (the bodies $HLiSO_4$ and $HLiCO_3$ exist only in solution), and forms insoluble or almost insoluble salts with carbonic and phosphoric acids (formulæ Li_2CO_3 and Li_3PO_4); and last, not least, it is not reducible to metal by charcoal at any temperature. Add to this that the highly deliquescent chloride LiCl, when dehydrated by heating, always loses part of its chlorine as HCl, and we feel tempted to conclude that in the case of lithium, as in that of barium or magnesium, two equivalents are united into one atom $\text{\L i} = Li_2 = 14$. But the specific heat of the metal demands the lesser number.[1]

Metallic Lithium, although long before known to exist, was successfully prepared for the first time in 1855, by Bunsen. He obtained it by fusing the pure chloride in a porcelain crucible, and decomposing the fused salt by a battery of four or six "Bunsens," using a rod of retort charcoal as a positive and a knitting wire as a negative pole. The metal separates out in about pea-sized globules, which stick to the wire, and, thanks to the protecting action of the fused chloride, can be lifted out and collected without reoxidation, under rock-oil. Lithium is a silver-white metal, of only ·58 specific gravity (it floats on rock-oil), somewhat softer than lead, and like it susceptible of being pressed into wire. It tarnishes in air, though far less readily than sodium. When thrown upon water it gradually dissolves as hydrate, with evolution of hydrogen, but without fusing. The metal melts at 180° C., and at a somewhat higher temperature takes fire and burns into oxide with a brilliant white flame. Hence the characteristic intensely red color which a colorless gas flame assumes when a lithium salt is volatilized in it must be a property of something else than the metal itself; perhaps it is the hydroxide LiOH that emits it. The red lithium flame forms a spectrum consisting chiefly of one brilliant red and a somewhat faint orange line.

Lithia-salt solutions behave to general reagents pretty much like those of potash or soda, from which, however, they differ in the following points:—(1) concentrated solutions are precipitated by carbonate of potash or soda; (2) even dilute solutions when mixed with phosphate of soda and caustic soda, in the heat more readily, give precipitates of the phosphate PO_4Li_3, soluble in 2530 parts of plain and 3900 parts of ammonia water, more largely in solutions of ammonia salts; (3) unlike potassium salts, they give no precipitate with chloride of platinum. (W. D.)

LITHOGRAPHY. The principle upon which the art of lithography is based is very simple—the antagonistic qualities of grease and water. An unctuous composition is made to adhere to a peculiar kind of limestone; the parts thus covered acquire the power of receiving printing ink; the other parts are prevented from receiving it by the interposition of a film of water; and then by pressing paper strongly upon the stone impressions are obtained. There are two distinct branches in lithography—drawing and printing. Those practising the first are known as lithographic *draughtsmen* or *writers*, the second as lithographic *printers*.

The art of lithography was discovered by Alois Senefelder, a native of Prague, born 6th November, 1771. His father, Peter Senefelder, was one of the performers of the Theatre Royal at Munich. The son Alois wished to follow the same profession, but, his father being opposed to this, he went to the university of Ingolstadt, and devoted himself to the study of jurisprudence. Owing to the death of his father shortly afterwards, he was unable to continue his studies at the university, and, yielding to his old inclination, he tried to support himself as a performer and author, but without success. In order to accelerate the publication of one of his works, he frequently spent whole days in the printing office, and thus became acquainted with all the particulars of the process of printing. It appeared so simple that he conceived the idea of purchasing a small printing press, thus enabling himself to print and publish his own compositions; but his means were inadequate, and to this circumstance we probably owe the invention of lithography. Unable to pay for the engraving of his compositions, he attempted to engrave them himself. He tried numerous experiments with little success; tools and skill were alike wanting. Copper-plates were expensive, and the want of a sufficient number entailed the tedious process of grinding and polishing afresh those he had used. About this period his attention was accidentally directed to a fine piece of Kellheim stone which he had purchased for the purpose of grinding his ink. His first idea was to use it merely for practice in his exercises in writing backwards, the ease with which the stone could be ground and polished afresh being the chief inducement. The idea of being able to take impressions from the stone had not yet occurred to him. While he was engaged one day in polishing a stone slab on which to continue his exercises, his mother entered the room and desired him to write her a bill for the washerwoman, who was waiting for the linen. Neither paper nor ink being at hand, the bill was written on the stone he had just polished. The ink used was composed of wax, soap, and lampblack. Some time afterwards, when about to wipe the writing from the stone, the idea all at once struck him to try the effect of biting the stone with aqua fortis. If the parts written on resisted its action, impressions might then be taken in the same way as from wood engravings. Surrounding the stone with a border of wax, he covered its surface with a mixture of one part of aqua fortis and ten parts of water. The result of the experiment was that at the end of five minutes he found the writing elevated about the tenth part of a line ($\frac{1}{120}$ inch). He then proceeded to apply the printing ink to the stone, using at first a common printer's ball, but soon found that a thin piece of board covered with a fine cloth answered better, communicating the ink more equally. He was able to take satisfactory impressions, and, the method of printing being new, he hoped to obtain a patent for it, or even some assistance from the Government. For years Senefelder continued his experiments, until the art not only became simplified, but reached a high degree of excellence in his hands. In later years the king of Bavaria settled a handsome pension on Senefelder. He died at Munich in 1834, having lived to see his invention brought to comparative perfection.

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[1] Lithia oxide and carbonate were long supposed to exert a characteristically powerful corrosive action on platinum vessels used for their fusion. This, according to Troost, holds only for such preparations as are contaminated with rubidia or cæsia. The pure lithia compounds, even the oxide (and hydrate?) do not attack platinum.

Materials Employed by the Lithographic Artist.—Lithographic stones are very compact homogeneous limestones, imported chiefly from Germany. The traffic has its centre in the village of Solenhofen, in the district of Monheim. The Solenhofen stone, in its chemical decomposition, consists of lime and carbonic acid. It is generally cut in slabs from 2 to 3 inches in thickness, and is sold by weight. Stones yielding impressions in the lithographic press have been found in England, France, Italy, Canada, and the West Indies; but all are much inferior to the best German stones. Lithographic stones vary in color from a dull gray or yellow to a light creamy shade, the dark gray stones being the hardest. They are sometimes uneven in color, having light and dark patches. These are suitable for ordinary transfer work; but, in cases where the artist requires to see the effect he is producing during progress (as in chalk drawing), stones of an even gray or drab color should be selected.

Lithographic ink is composed of tallow (4 oz.), wax (5 oz.), soap (4 oz.), shellac (3 oz.), and *quant. suff.* of fine Paris black. The inks of Lemercier and Vanhymbeeck are generally considered as among the best. Lithographic chalk is made in the same manner as the ink, but requires to be burnt sufficiently hard for use in drawing. Excellent lithographic crayons are manufactured by Lemercier of Paris. They are made of several degrees of hardness, copal chalk, used for outlining, being the hardest.

Transfer paper for writing and drawing is prepared by coating the surface of the paper with a composition of size, made from parchment cuttings and flake white. Sometimes the coating is composed of starch and glue. Coloring matter, generally gamboge, is added, the object being to show more readily which is the coated side of the paper. The coating is applied with a full brush. For writing, the paper used is thin, for drawing it is thicker; for large subjects ordinary drawing paper is used. It is afterwards glazed by being pulled through the lithographic press, face down, on a smooth stone, or hot pressed. There are several other varieties of transfer papers—a transparent or tracing paper, and a transfer paper for chalk drawing, having a finely granulated surface. Mr. Nelson of Edinburgh patented a method of graining transfer paper by means of stippled plates. The older method was to press the coated surface of the paper on an ordinary sand-grained stone or plate.

Instruments and Appliances used in Lithographic Drawing and Writing.—For the finer purposes of lithography ordinary steel pens are useless; "Perry's lithographic pen" may be found serviceable when the work is not very delicate. Transfer writers prefer pens of their own making. These are either made from quills scraped down, before cutting, with a piece of broken glass, until the barrel yields to pressure of the nail, or cut with a pair of sharp scissors from thin sheets of steel prepared for the purpose. This operation is difficult, and requires much skill and practice. Pens are also made of watch springs, reduced to the necessary tenuity by nitric acid and water.

Lithographic brushes are made from red sable crow-quill pencils; a portion of the hair is cut away all round, and only the central part of the brush is used.

Scrapers are employed in correcting the work upon stone, but a penknife or ordinary erasing knife answers the purpose equally well.

Crayon holders of the ordinary kind may be used for lithographic chalk. When cut in two and fitted with a wooden handle, they will be found lighter and pleasanter to work with.

The hand-board is a piece of wood about 6 inches wide, three-eighths of an inch thick, and somewhat longer than the stone on which the draughtsman works. It rests upon thick strips of millboard fixed round the edges of the stone, to keep it from touching the part to be drawn on.

Ruling and circle pens, parallel rulers, tracing paper, a tracing point, and red tracing paper, for transferring tracings to paper or stone, are also requisites.

Drawing on Stone.—The Chalk Method.—For artistic purposes this is perhaps the most important and interesting department of lithography. In preparing the stone for chalk drawing, the surface, instead of being polished, is broken up into minute points or "grained." The coarseness or fineness of the grain is varied according to the work to be done. A hard stone, free from veins, marks, and chalk spots, and of a clear gray color, is selected. It is first ground and pumiced to free it from scratches. A small quantity of the finest gravel sand, or "graining-sand," is sprinkled over the surface, and a few drops of water added; a smaller stone of the same size and hardness is placed above, face downwards, and moved about with a circular motion; water is added from time to time, and fresh sand when needed. Care must be taken that no scratches are caused by grains of coarser sand finding their way to the stone the stone is afterwards washed in clean water and dried, and the grain tested with a crayon. If it prove too coarse or too fine, or if scratches are discovered, the graining is done over again.

The drawing is then traced upon the stone. As it has to be reversed, the tracing is fastened face downwards; red tracing paper is introduced between, and the outline carefully gone over with a steel tracing point or hard pencil. The tracing papers are then removed, and the surface of the stone protected with a sheet of plain paper. The hand-board is placed across to keep the warmth of the hand from causing the condensation of moisture resulting from its coming in contact with the paper covering the stone. The paper covering the part of the drawing to be first commenced is then removed. The crayons are pointed with the knife, cutting from the point upwards.

Great care and cleanliness are necessary to prevent injury to the work. If the artist wishes to talk he ought first to cover up the surface of the stone, as a drop of saliva falling upon it prevents the penetration of the chemical chalk, and a white spot will be the result when the drawing is "brought up" by the printer. If the stone is touched by greasy hands, the form of the fingers and of the skin will appear in black.

The drawing is commenced by outlining. For this purpose the hardest chalk (copal) may be used, but No. 1, when it will answer the purpose, is better. The "tinting" or shading follows; lights may be picked out with the scraper or penknife, and ink used when sharp, dark touches are desirable. It is difficult to rectify mistakes;—prevention is better than cure. In reversing the drawing a small hand looking-glass will be found useful.

When completed the drawing is "etched." There are two different ways of applying the acid—one by flooding the stone with nitric acid diluted with water, the other with acid diluted with gum-water, applied with a flat, soft brush about 4 or 5 inches in width. Although this operation appears simple, it is not without risks; much of the success of the impressions depends upon it. If the stone is too strongly etched, the delicate tints and lines disappear; if not etched strong enough, the drawing is apt to lose clearness, and run smutty in printing. When the etching is completed, the water is drained off and the stone gummed and allowed to dry. It may then be put into the hands of the printer for proving.

Pen and Brush Method.—The surface of the stone is ground and afterwards polished with Water-of-Ayr stone or snake-stone. The drawing or writing is traced upon the surface in the manner already described. The principal drawback in this method is the necessity of reversing writing and lettering, which cannot be done without considerable practice. Its advantages over the transfer method scarcely compensate for the additional difficulties. The stone is etched as in chalk drawing before passing into the printer's hands.

Engraving on stone is chiefly useful in the reproduction of drawings by architects, civil engineers, etc. Its advantages are accuracy and sharpness in drawing and printing. A thin film of gum is spread on the surface of the stone, and when dry washed off; a dark ground is then laid on by rubbing in Paris black. Red grounds also are sometimes used. The tracing, if on a black ground, is made with paper prepared with chrome yellow, if on a red ground with Paris black. The method of engraving is simple. The tools are strong needles, firmly fixed in cane handles, and good spring dividers; the incised lines show white upon the black or red ground. When the work is finished they are filled up with fatty ink, and the stone cleared with water and a piece of coarse flannel.

In printing, the stone is damped in the usual way, but the ink is applied with a dabber instead of a roller.

Lithographing on Paper, or Transfer Lithography.—By this method the work is done on paper, and afterwards transferred to the stone. The paper has been already described, as also the instruments used in writing and drawing. The ink is prepared by rubbing a small quantity into a saucer of white delft or china, the saucer being first heated to make the ink adhere; water is then added, and the ink rubbed with the finger till it dissolves. Care has to be taken to make it of the proper consistency. If pale and thin, it will not transfer properly; if too thick, it will not flow freely from the pen or brush, and will spread in transferring.

The paper should not be handled or touched, except at the edges. Finger marks from a moist or greasy hand will roll-up black. A piece of clean white paper is kept under the hand when working. The same line must not be gone over twice while wet, as the composition on the surface of the paper is apt to get mixed with the ink and destroy its qualities. In drawing on chalk transfer paper the crayon is used instead of the brush or pen. Dark touches may be put in with ink, and the lights picked out with the knife.

The stone for the reception of transfers is polished free from perceptible scratches, and is generally warmed to make it more susceptible of receiving the ink. The transfer is placed face downwards on the stone, pulled repeatedly through the press, and afterwards removed to the trough, where hot water is poured over it. It is then peeled off, leaving the ink and the composition on the stone; the latter is washed off, and the stone gummed and allowed to dry. The work is afterwards "proved" by rolling-up, cleaning, etching, and taking the first impressions

The transfer method is also applied successfully to the reproduction by lithography of engraved plates, wood engravings, and type.

Photo-Lithography.—By this method copies of prints or drawings executed in clear lines or dots can be produced. They may be either of the same or of altered dimensions. The copying is done by photography upon glass; but, as it is necessary that the negatives should have straight marginal lines, ordinary photographic lenses are not adapted for the purpose—"rectilinear," "aplanatic," "symmetrical," and other varieties being used instead. The negative is put into a photographic printing frame, and a piece of sensitive transfer paper placed face downwards upon it, the glass side being exposed to the light. The time of exposure varies according to the intensity of the light and the quality of the negative. When sufficiently exposed it is carried into a dark room, the photographic print taken out of the frame, laid face downwards on a stone coated over with transfer ink, and pulled through the press. It is then soaked for a few minutes in water warmed to the temperature of 100°, and the inked side of the paper carefully sponged with gum-water to remove the transferring ink from the parts upon which the light could not act. After being washed in warm water it is allowed to dry, and is then transferred to the stone and printed from in the usual manner.

Zincography so nearly resembles lithography in its principles that a very few words of explanation will be sufficient. Zinc plates possess the advantage of costing less and being much more portable than lithographic stones, and are easily cut into convenient sizes. They are grained in the same manner as lithographic stones, a muller of zinc being used instead of one of stone. Drawings on zinc, whether in chalk or ink, are executed on a grained surface. Zinc plates are subject to oxidation, and care must be taken to dry them off quickly after graining. The drawing is done precisely in the same way as on stone; the etching solution is applied with a flat camel-hair brush. It consists of a decoction of nut-galls; a solution of gum and phosphoric acid is sometimes added. During printing the plate is screwed for support to a block of beech or other hard wood. As neither crayon nor ink penetrates the zinc as they do the stone, the adhesion of the ink forming the drawing is less thorough than in lithography, and greater precautions have to be taken to prevent accidents in printing.

Chromo-Lithography.—Great advances have been made in recent years in this branch of the art, notably in the reproduction of works of an artistic character. Its simplest form is the tint, in several gradations of one color, printed over drawings in chalk or line; in its more elaborate forms it includes imitations of water-color drawings, decorative and ornamental designs, etc. The term "chromo-lithography" is usually applied only to the more elaborate kinds of color printing.

All lithographs in two or more colors are printed from two or more stones. It is therefore necessary to employ some method to get a correct repetition of the subject on the first stone made upon the others, and to be able in printing to place the sheet so correctly in position that the second and each succeeding printing shall fall exactly into its place upon the first. Much of the success of the work depends upon this, and various modes of "registering," by "lay," by needles, by fixed points, etc., are employed. The first drawing is generally in outline. It is called the keystone, and provision is made in it for "registering," according to the particular method adopted by the artist. It is used only to take as many impressions on other stones as are required for the several colors, and as a means of getting each color in its exact place. In work of an artistic character it is omitted in printing.

For ordinary color printing the stone is polished; when gradation of color is required the stone is grained, but in a somewhat coarser way than for chalk drawing. It will be sufficient here to describe the production of drawings with two tints. The principal drawing is done upon a grained stone in chalk, and should be very bold, more like a sketch on tinted paper, the middle and finer tints being left out. The stone is then etched, and two impressions are taken, so that when each of these is put upon a roughly-grained stone, and passed through the press, counter impressions will be found upon the stones, revealing the drawing quite distinctly. After having cut in the outlines with a sharp-pointed graver, or steel needle, the artist covers those parts on the two stones which are not to appear in the one or the other color, as well as the margin of the two stones, with a brush containing acid and gum. The stones are then warmed, and a composition containing the same ingredients, as soft chalk, with double the quantity of soap, and three times the quantity of tallow, is rubbed over it with a bit of coarse flannel, until it is of a dark grayish-brown color. From having been previously cut in, the outline comes out very distinctly. The artist can now produce an effect similar to crayon sketches which have been washed in with two separate colors. Those portions which have been rubbed in, and which appear dark grayish-brown, form the middle tint, and the scraper may be used to reduce the color of the tint where the gradation of color is desired,—the darkest portions being laid in with lithographic ink, and the blending together done with chalk, brush, pen, and scraper, so as to produce in many places the effect of shadings of one color over another. When the work is of a very elaborate or complicated nature, the order in which the colors should succeed each other in printing is of much importance, and requires to be very carefully considered. In highly-finished chromo-lithographs, fifteen or more printings are frequently necessary. Difficulties sometimes arise from the paper stretching, either from the moisture on the surface of the stone or from the action of the press.

Oleography differs from chromo-lithography only in name, and is a mere vulgar attempt to imitate oil painting. The finished print is mounted on canvas, sized, and varnished. The loaded colors and rough textures, if there happen to be such in the original, are suggested by embossing, with what result it is hardly needful to say.

Instruments, Tools, and Apparatus used in Printing.—Lithographic presses are of a great variety of construction, and we can only glance at the chief points in their mechanism. The scraper is a wedge-formed plate of boxwood, fixed to the bottom of the platten; its edge is covered with a piece of leather, and properly adjusted. The table on which the stone with the paper for receiving the impression is placed, and on which the tympan is brought down, is, by means of a handle or wheel, brought upon the metallic moving roller and under the scraper; the pressure is applied with a lever, and continued from one end of the stone to the other; when it has passed through the press, the lever is lifted, the moving table brought to its original place, and the printed sheet removed. The lithographic steam-press began to be generally used about 1867, and has quite revolutionized the lithographic trade.

The rollers for printing may be made of different lengths, from 6 to 24 inches long, and 3½ to 5 inches in diameter. They are made of wood of the alder and lime tree, with wooden handles to project and hold by; the roller is then covered with several complete turns of flannel, well stretched and fastened by sewing at the extremities near the handles; the whole is then covered with calf-skin, sewed with great care, so as to fit tightly, and laced near the handles. For printing chalk, tints, and colors, skins of different preparations are required. Hollow metallic rollers, covered with flannel and calf-skin, are in use on some parts of the Continent, where they are preferred to rollers made of wood.

The best varnishes for making the printing-ink are boiled from old linseed oil, of different degrees of strength—thin, middle, strong, and very strong varnish; for printing with gold-leaf, bronze, and dusting colors, the very strong varnish is required. For writings, maps, and music, common calcined lamp-black is ground with the varnish; some hard blue is added to improve the color, and to make the ink dry in a short time; for chalk ink, Paris black is used instead of the common lamp-black. For tinting and color-printing, colorless or bleached varnish must be used, as otherwise the purity of the colors will suffer.

Printing.—After the stones containing the writings or drawings in chalk and those used for tinting or color-printing are etched, and the preparation has become dry, the stones may be put into the press and properly fixed. To prevent a stone containing drawings of any value from breaking, it should, if thin, be backed to another stone, or, what is better, to a slab of Aberdeen granite. This is done by a mixture of plaster of Paris and cold water, of the consistency of syrup, a pretty thick coating of which should be spread evenly and quickly on the slab; the stone containing the drawing is placed into this layer, and moved in all directions until the plaster of Paris becomes quite hard, which will take place in a very short time. After the printing is accomplished, the stone can be quite easily removed from the slab, by using a chisel, and by giving some side strokes with a wooden hammer. The old dry plaster of Paris is now removed, and the slab is again fit for use.

Everything being ready, the gum is entirely washed away with a soft Turkey sponge and water; the writing or drawing is then obliterated by taking a clean sponge and oil of turpentine, to which may be added, at pleasure, a few drops of sweet oil, after which the stone must be cleaned with water. An entirely clean sponge (or for writings, a bit of soft canvas manufactured for the purpose) is now required for the printing. The stone is slightly wetted with this sponge; the printing roller, charged already with the proper ink, is passed repeatedly over the whole stone, and the writing or drawing will begin to reappear; the roller is again worked on the ink-slab, the stone wetted anew with the sponge, and again rolled over, until the writing or drawing appears in full strength. A sheet of damped paper (dry paper may be used for writings and drawings in line) is put on the stone, the tympan is let down, the scraper brought to its proper place, the pressure effected, and, by means of the handle, cross, or wheel, according to the style of press, the table with the stone is slowly and equally drawn through to nearly the end of the stone, for which purpose the press requires to be set properly beforehand. The printer now relaxes the pressure, the table with the stone runs to its original place, the tympan is put back, and the impression is carefully taken up from the stone. The stone is then again wetted as before, inked in anew, the paper placed upon the stone, and further impressions are effected. When the stone is to be kept after the required number of impressions has been struck off, it should always be inked up with preserving-ink, which is made by melting lard, tallow, and wax, in equal proportions, with a quantity of printing-ink. When about to be used, this preserving-ink may be thinned with some oil of turpentine, thinly spread on a roller kept for this purpose; it must then be properly turned on the slab; the writing or drawing is washed out with oil of

tine, the whole removed with a clean sponge, and
ɔne wetted and inked in with this preserving-ink.
minutes afterwards, when the turpentine has evapo-
a thin solution of gum-arabic is spread over the
ɔontaining a little sugar-candy to prevent the crack-
the gum by change of atmosphere. The stone will
ıny length of time; but the preserving-ink should
ɜwed at least every twelve months.

printing of tint and color stones is treated in the
ray, only the rollers, varnishes, and colors are differ-
m those used for ordinary black and chalk printing.
inting of this class of work requires great skill and
Many of the lithographic printers of London, Paris,
ls, Munich, Berlin, Vienna, and Dresden are justly
for their beautiful productions.

ɜngraved stone is printed by using a small wooden
or tampon, either round at the sides, flat below,
ıandle at top, or square, with the corners rounded
his tampon is covered several times with a very
blanket, or coarse thick firm cloth, fastened at the
the ink is then spread very thinly on the slab, the
is properly tapped into it, the gum is removed from
ne, and the drawing is removed with oil of turpen-
the stone is wetted, the tampon is tapped over the
drawing, the stone cleaned with a bit of wet canvas,
ıally a printing roller is passed once or twice over
ɔne, which removes all impurities; a damped sheet
er is then placed on the stone, and the impression
as formerly explained.

e printers print engraved outlines or drawings done
hin lines entirely with the roller, which is a great
of time; other printers again ink an engraving
large shoe brush with long, stiff bristles—which is
l on the ink-slab to give it the ink required—by
ng over the drawing in all directions.

r.—The proper selection of paper for lithographic
ıg when beauty of impression is a chief considera-
s of great importance. Hand-made and hand-sized
are objectionable, the materials used in sizing being
ntly inimical to perfect lithographic printing. Ab-
t papers, such as India paper, plate-paper, half-sized
paper, and fine printing paper yield the best im-
ns; common writing paper, hand-made writing,
r other hand-made English-sized papers should be
nly when the work is for business or similar purposes.

ce the invention of photography, and its wide ap-
on to processes connected with art, artistic lith-
hy, except in the way of color printing, has been
ps rather less in demand than formerly. Many
finest British examples of lithographic art date
nore than twenty to thirty years back, when artists
as J. D. Harding, Samuel Prout, Louis Haghe,
ıar, William Simpson, and others were largely—
of them almost exclusively—engaged in its prac-
Harding, although practising as a water-color
r, devoted much of his time to lithography. The
rity and brilliancy of his execution give to his
in this style a peculiar charm, altogether wanting
ɜ more labored productions of the professional
raphic artist. Of this quality in Harding's draw-
n stone, Mr. Ruskin writes—"His execution, *in*
y, no one can at all equal. The best chalk draw-
Calame and other foreign masters is quite child-
ıd feeble in comparison." Samuel Prout, also a
-color painter, produced many admirable works in
raphy. Mr. Ruskin's testimony may again be
d:—"All his published lithographic sketches are
e greatest value, wholly unrivalled in power of
osition, and in love and feeling of architectural
t." "His lithographic work (*Sketches in Flan-*
and Germany), which was, I believe, the first of
ind, still remains the most valuable of all, numer-
nd elaborate as its various successors have been.
value is much increased by the circumstance of
being drawn by the artist's own hand upon the
." Louis Haghe's work on the *Architecture of the*
le Ages in Germany and the Netherlands, Rob-
Holy Land and Egypt (drawn on stone by Haghe),
Simpson's drawings of the Crimean war may also
ed as excellent examples of artistic lithography.
graphic studies of heads and figures by Julien of
, and other foreign artists, were at one time
ly employed as copies by drawing masters; the new
system of teaching introduced of late years has almost put an end to their use for this purpose, and they are now less frequently met with. Although lithography is increasingly employed for commercial and other purposes, artists of first-rate ability now seem, on the whole, to prefer other processes for the reproduction of their works. (G. RE.)

LITHUANIANS, a people (about 3,000,000 in number) of Indo-European origin, which inhabits several western provinces of Russia, and the north-eastern parts of Poland and Prussia, on the shores of the Baltic Sea, and in the basins of the Niemen and of the Duna. Very little is known about their origin, and nothing about the time of their appearance in the country they now inhabit. Ptolemy mentions (lib. iii. chap. 5) two clans, the Galindæ and Sudeni, most probably Lithuanians of the western branch of this nationality, the Borussians. In the 10th century they were already known under the name of Litva, and, together with two other branches of the same stem,—the Borussians and the Letts,—they occupied the south-eastern coast of the Baltic Sea from the Vistula to the Duna, extending north-east towards the Lakes Wierzi-yärvi and Peipus, south-east to the watershed between the affluents of the Baltic and those of the Black Sea, and south to the middle course of the Vistula (Brest Litovsky),—a tract bounded by Finnish tribes in the north, and by Slavonians elsewhere.

The country which since that time they have continued to inhabit is flat, undulating, and covered by numberless small lakes, ponds, and wide marshes, which, though to a great extent drained during the last ten centuries, nevertheless still cover immense tracts of land. The costly work of artificial draining has been actively carried on during late years, but in the south the marshes are disappearing slowly. The soil, being sandy in the north, and a hard boulder-clay elsewhere, is unproductive. Thick forests cover it, and—though considerable tracts have been destroyed by fires and by the hatchets of the *budniki* who during many centuries have cleared the most remote thickets, founding there their villages, while, later, wide forest regions, given by Catherine II. as gifts to her officials, have quite disappeared—there still remain immense tracts of land covered with nearly virgin forests; thus, the Byelovyesh Pushcha covers no less than 550,000 acres of land on the level plateau 650 feet high, where tributaries of the Nareff and Bug have a common origin in marshes. These forests have played an important part in the history of the Lithuanians, giving many original features to their history, as well as to their mythology, poetry, and music. They protected them from foreign invasions, and have contributed to the maintenance of their national character, notwithstanding the vicissitudes of their history, and of their primitive religion until the 14th century. Their chief priest, the Krive-Kriveyto (the judge of the judges), under whom were no less than seventeen different classes of priests and elders, worshipped in the forests; the Waidelots brought their offerings to the divinities at the foot of mighty oaks, and even during the 14th century an unextinguishable fire, the "zincz," was maintained in the midst of the "pushta," or "pushcha;" even now, the worship of great oaks is a widely spread custom in the villages of the Lithuanians, and even of the Letts. In the absence of great forests they worship isolated trees.

Even at that time the Lithuanian stem was divided into three main branches:—the *Borussians* or *Prussians*; the *Letts* (who call themselves *Latvis*, whilst the name under which they are known in Russian chronicles, *Letygola*, is an abbreviation of *Latvin-galas*, "the confines of Lithuania"); and the *Lithuanians*, or rather *Lituanians*, *Litva*, or *Letuvininkaï*,—these last being subdivided into Lithuanians proper, and *Jmud'* (*Zmudz*, *Samoghitians*, or *Zemailey*), the "Lowlanders." To these three main branches, which have maintained their national distinctions uninterrupted until the present time, must be added also the *Yatvyags*, or

Yadzvings, a warlike, black-haired people who inhabited the thick forests at the upper tributaries of the Niemen and Bug, and the survivors of whom are easily distinguishable now as a mixture with White-Russians and Mazurs in some parts of the governments Grodno and Plotsk, and in several north-eastern parts of those of Lomza and Warsaw. Nestor's chronicle distinguishes also the *Jemgala*, who later became known under the name of *Semigallia*, and inhabited in the 10th century the left bank of the Duna. Several authors consider also as Lithuanians the *Kors* of Russian chronicles, or *Courons* of Western authors, who inhabited the peninsula of Courland, and the *Golad'*, a clan settled on the banks of the Porotva, tributary of the Moskva river, which seems to have been thrown far from the main stem during its migration to the north.[1] The *Krivitchi*, who inhabited what is now the government of Smolensk, whose name recalls the Krive-Kriveyto, and whose ethnological features recall the Lithuanians, seem to belong to the same stem; but now these are rather a mixture of Lithuanians and Slavonians.

All these peoples are only ethnographical subdivisions, and each of them was subdivided in its turn into numerous independent clans and villages, separated from one another by forests and marshes; they had no towns or fortified places, a feature which has struck many earlier Occidental writers. The Lithuanian territory thus lay open to foreign invasions, and the warlike Russian *Kniaz'es*, as well as the German crusaders, availed themselves of the opportunity. The Borussians soon fell under the dominion of Germans, and ceased to constitute a separate nationality, leaving only their name to the state which later became Prussia. The Letts were driven farther to the north, mixing there with Livs and Ehsts, and fell under the dominion of the Livonian order. Only the Lithuanians proper, together with Samoghitians, succeeded in forming an independent state. The early history of this state is but imperfectly known, all the more that the old Lithuanian chronicles have suffered from subsequent alterations (Antonovitch, *loc. cit.*). During the continuous petty war carried on against Slavonic invasions, the military chief of one of the clans, Ryngold, acquired, in the first half of the 13th century, a certain preponderance over other clans of Lithuania and Black Russia (Yatvyags), as well as over the republics of Red Russia. At this time, the invasions of the Livonian order becoming more frequent, and always extending southward, there was a general feeling of the necessity of some organization to resist them, and Ryngold's son, Mendowg, availed himself of this opportunity to pursue the policy of his father. He made different concessions to the order, ceded to it several parts of Lithuania, and even agreed to be baptized, in 1250, at Novograd Litovsky, receiving in exchange a crown from Innocent IV., with which he was crowned king of Lithuanians. He ceded also the whole of Lithuania to the order in case he should die without leaving offspring. But he had accepted Christianity only to increase his influence among other clans; and, as soon as he had consolidated a union between Lithuanians, Samoghitians, and Cours, he relapsed, proclaiming, in 1260, a general uprising of the Lithuanian people against the Livonian order. The yoke was shaken off, but internal wars followed, and three years later Mendowg was killed. About the end of the 13th century a new dynasty of rulers of Lithuania was founded by Lutouver, whose second son, Gedymin (1316–1341), with the aid of fresh forces he organized from his relations with Red Russia, established something like regular government; he extended at the same time his dominions over Russian countries—over Black Russia (Novogrodok, Zditoff, Grodno, Slonim, and Volkovysk) and the principalities of Polotsk, Tourovsk, Pinsk, Vitebsk, and Volhynia. He named himself *Rex Lethowinorum et multorum Ruthenorum*. In 1325 he concluded a treaty with Poland against the Livonian order, which treaty was the first step towards the union of both countries realized two centuries later. The seven sons of Gedymin considered themselves as quite independent; but two of them, Olgerd and Keistut, soon became the more powerful. They represented two different tendencies which existed at that time in Lithuania. Olgerd, whose family relations attracted him towards the south, was the advocate of union with Russia; rather politician than warrior, he increased his influence by diplomacy and by organization. His wife and sons being Christians, he also soon agreed to be baptized in the Greek Church. Keistut represented the revival of the Lithuanian nationality. Continually engaged in wars with Livonia, and remaining true to the national religion, he became the national legendary hero. In 1345 both brothers agreed to re-establish the great principality of Lithuania, and, after having taken Vilna, the old sanctuary of the country, all the brothers recognized the supremacy of Olgerd. His son Yagello, who married the queen of Poland, Yadviga, after having been baptized in the Latin Church, was crowned, on February 14, 1386, king of Poland. At the beginning of the 15th century Lithuania was a mighty state, extending her dominions as far east as Vyazma on the banks of the Moskva river, the present government of Kaluga, and Poutivl, and south-east as far as Poltava, the shores of the Sea of Azoff, and Hadji-bey (Odessa), thus including Kieff and Loutsk. The union with Poland remained, however, but nominal until 1569, when Sigismund Augustus was king of Poland. In the 16th century Lithuania did not extend its power so far east and south-east as two centuries before, but it constituted a compact state, including Polotsk, Moghileff, Minsk, Grodno, Kovno, Vilna, Brest, and reaching as far south-east as Tchernigoff. From the union with Poland, the history of Lithuania becomes a part of Poland's history, Lithuanians and White-Russians partaking of the fate of the Polish kingdom. After its three partitions, they fell under the dominion of the Russian empire. In 1792 Russia took the provinces of Moghileff and Polotsk, and in 1793 those of Vilna, Troki, Novgorod-Syeversk, Brest, and Vitebsk. In 1797 all these provinces were united together, constituting the "Lithuanian government" (Litovskaya Gubernia). But the name of Lithuanian provinces was usually given only to the governments of Vilna and Kovno, and, though Nicholas I. prohibited the use of this name, it is still used, even in official documents. In Russia, all the White-Russian population of the former Polish Lithuania are mostly considered as Lithuanians, the name of Jmud being restricted to Lithuanians proper.

The ethnographical limits of the Lithuanians are quite undefined, and their number is estimated very differently by different authors. The Letts occupy a part of the Courland peninsula (according to M. Rittich, they numbered there 305,300 in 1870, to which several authors added 185,800 Cours) of Livonia (416,400 at same date), and of Vitebsk (185,600), a few other settlements being spread also in the governments of Kovno (18,500), St. Petersburg (2700), and Moghileff (1000). The Lithuanians proper inhabit the governments of Kovno (435,810), Vilna (350,700), Suvalki (54,300), and Grodno (2500); whilst the Samoghitians, or Jmud, inhabit the governments of Kovno (498,900), and Suvalki (165,200). To these must be added about 200,000 Borussians, the whole number of Lithuanians being 2,687,000 in 1870 (2,873,000 with the Cours), or, taking into account the rate of increase of population for different governments, about 3,014,700 in 1882 (3,231,000 with the Cours). Other authors estimate the number of Lithuanians in the Polish provinces at 277,050 in 1869, probably including Yatvyags, mixed to some extent with Mazurs. In this case the number of Lithuanians would be in 1882 about 3,062,000 (3,298,000 with Cours). They are now slowly extending towards the south, especially the Letts, who leave their country in consequence of want of land and of the difficulty they experience in getting means of subsistence; numerous emigrants have already penetrated into Slavonic lands as far as the government of Voronesh.

The Lithuanians are well built; the face is mostly elongated, the features fine; the very fair hair, blue eyes, and delicate skin distinguish them from Poles and Russians. Their dress is usually plain in comparison with that of Poles, and the predominance in it of grayish colors has been frequently noticed. Their language has great similarities to the Sanskrit. It is affirmed that whole Sanskrit phrases are well understood by the peasants of the banks of the Niemen. But it contains also a considerable amount of Slavonic words. The vocabulary is very copious, especially in words referring to natural phenomena, and which express certain pathological states of the mind. Diminutives are exceedingly numerous, and various diminutive forms are applied even to adjectives and verbs. But, as a whole, the Lithuanian language is at a very low stage of development, and the written literature is very poor; only religious books, a few translations, and a single newspaper are published in it. On the other hand, the unwritten popular literature is very rich, and contains true treasures of poetry. It was long doubted if Lithuanians have any epic poetry; it now appears, however, that there are, scattered in songs, fragments of a great Lithuanian epic poem. But the popular poetry is especially rich in idyllic and lyric songs, imbued with tenderest love and melancholy, and a most poetical feeling of nature, and remarkable by their absolute chastity; the irony which sometimes appears in them is usually refined and gentle. The elegies (*raudas*) are very melancholy, and of a rare beauty. The national character is fully expressed in these songs,—not warlike at all, melancholy, very lovely, and not very sociable.

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[1] W. B. Antonovitch, *A Sketch of History of the Great Principality of Lithuania*, and Professor Barsoff, *Russian Historical Geography*, both in Russian.

The language of the Letts is, according to Schleicher, as similar to the Lithuanian as the Italian to the Latin, but contains a greater mixture of German and Slavonic words. The literary language is more developed. A scientific Lettish grammar was published by Stender at the end of the last century, and the Letts possess translations of Shakespeare, Schiller, and other great poets. Five political papers were published in Lettish in 1876. A revival of national feeling having begun in this century, rich collections of Lettish songs were published by Germans, Russians, and Letts, M. Briwsemniak's collection, published by the Moscow Anthropological Society, being the most recent. The Lettish songs have the same characters as those of the Lithuanians, to which a special feature, the hatred of the people to the German landholders, must be added.

The Letts of Courland, with the exception of about 50,000 who belong to the Greek Church, are Lutherans. Nearly all can read. Those of the government of Vitebsk, who were under Polish dominion, are Catholics, as well as the Lithuanians proper, a part of whom, however, have returned to the Greek Church, in which they were before the union with Poland. The Samoghitians are Catholics; they more than other Lithuanians have conserved their national features. But all Lithuanians have maintained much of their heathen practices and creed; the names of pagan divinities, very numerous in the former mythology, are continually mentioned in songs, and also in common speech.

The chief occupation of Lithuanians is agriculture. The trades in towns are generally carried on by men of other races—mostly by Germans, Jews, or Poles. The only exception is afforded to some extent by the Letts. The Samoghitians are good hunters, and all Lithuanians are given to apiculture and cattle breeding. But the Lithuanians, as well in the Baltic provinces as in the central ones, were not until the most recent time proprietors of the soil they tilled. They have given a few families to the Russian nobility, but the great mass of the people became serfs of foreign landowners, German and Polish, who reduced them to the greatest misery. Since the Polish insurrection of 1863, the Russian Government has given to the Lithuanians the land of the Polish proprietors on much easier terms than in central Russia; but the allotments of soil and the redemption taxes are very unequally distributed; and a not insignificant number of peasants (the *tchinsheviki*) were even deprived of the land they had for centuries considered their own. The Letts remain in the same state as before, and are restrained from emigrating *en masse* only by coercive measures. (P. A. K.)

LITMUS (German, *Lackmus;* French, *Tournesol*), a coloring matter which occurs in commerce in the form of small blue tablets, which, however, consist mostly, not of the pigment proper, but of carbonate and sulphate of lime and other matter devoid of tinctorial value. Litmus is never used as a dye, but is extensively employed by chemists as a reagent for the detection of free acids and free alkalies. An aqueous infusion of litmus, when exactly neutralized by an acid, exhibits a violet color, which by the least trace of free acid is changed to red, while free alkali turns it to blue. The reagent is generally used in the form of test paper,—bibulous paper dyed red, purple, or blue by the respective kind of infusion. Litmus is manufactured in Holland from the same kinds of lichens (species of *Roccella* and *Lecanora*) as are used for the preparation of ARCHIL (*q. v.*).

What orcein is to archil, a substance "azolitmin," which Kane extracted from it, seems to be to litmus. At any rate, Kane's analysis supports the idea of its being formed from orcin, thus:—

$$\underset{\text{Orcin.}}{C_7H_8O_2} + NH_3 + O_3 = H_2O + \underset{\text{Azolitmin.}}{C_7H_9NO_4}.$$

A solution of this substance when treated with nascent hydrogen loses its color. So does litmus solution when left to itself in closely stoppered bottles. When preserved in contact with air it retains its color.

LITTLE FALLS, a village and township in Herkimer county, New York, on the Erie canal, 73½ miles west-north-west of Albany by the New York Central and Hudson River Railroad, at a point where the Mohawk river passes by a series of rapids through a picturesque defile. The water-power is turned to account in the manufacture of paper, woollen and cotton goods, starch, etc. The village, which lies partly in the township of Manheim, had a population of 6910 in 1880. Little Falls has the largest cheese market in the United States.

LITTLE ROCK, capital of the State of Arkansas, United States, as well as of Pulaski county, is situated on the south bank of the Arkansas river, about 250 miles from its mouth, and near the centre of the State. It derives its name from occupying the top of a rocky cliff about 50 feet in height, which is much less conspicuous than the precipitous cliffs that line the river just above the city. The river, which is navigable by large steamers to this point during two-thirds of the year, is crossed here by an iron drawbridge on the St. Louis, Iron Mountain, and Southern Railway. Little Rock, founded in 1820, contains the State house, the State asylums for the blind and for deaf mutes, the State prison, the State library, St. John's Military College, and other schools. It is also the seat of the United States court of the eastern district of Arkansas, and a United States arsenal and land office. Flour-mills, carriage-works, and foundries are among the chief industrial establishments. Population in 1880, 13,138.

LITTLETON, THOMAS DE, of Frankley in Worcestershire, judge of the court of common pleas in the reign of Edward IV., and author of the well-known work on *Tenures*. Littleton's surname was that of his mother, who was the sole daughter and heiress of Thomas de Littleton, lord of Frankley. She married one Thomas Westcote. Thomas was the eldest of four sons of the marriage, and took the name of Littleton, or, as it seems to have been more commonly spelt, Luttelton. The date of his birth appears to be uncertain. He is said by Sir E. Coke to have been a member of the Inner Temple, and to have lectured there on the Statute of Westminster II., *De Donis Conditionalibus*. His name occurs in the Paston letters about 1445 as that of a well-known counsel. He appears to have been recorder of Coventry in 1450, to have been made king's sergeant in 1455, and afterwards to have been a justice of assize on the northern circuit. In 1466 he was made a judge of the common pleas, and in 1475 a knight of the Bath. He died, according to the inscription on his tomb in Worcester cathedral, on August 23, 1481. He married Joan, widow of Sir Philip Chetwind of Ingestre in Staffordshire, and by her had three sons, through whom he became ancestor of the families in which are the existing peerages of Lyttelton and Hatherton.

The work on tenures was probably written late in his life. It is addressed to his second son Richard, who went to the bar, and whose name occurs in the year books of the reign of Henry VII. The book, both historically and from its intrinsic merit, may be characterized as the first text-book upon the English law of property. The law of property in Littleton's time was mainly concerned with rights over land, and it was the law relating to this class of rights which Littleton set himself to digest and classify. The time was right for the task. Ever since the Conquest regular courts of justice had been at work administering a law which had grown out of an admixture of Teutonic custom and of Norman feudalism. Under Henry II. the courts had been organized, and the practice of keeping regular records of the proceedings had been carefully observed. The centralizing influence of the royal courts and of the justices of assize, working steadily through three centuries, had made the rules governing the law of property uniform throughout the land; local customs were confined within certain prescribed limits, and were only recognized as giving rise to certain well-defined classes of rights, such, for instance, as the security of tenure acquired by villeins by virtue of the custom of the manor, and the rights of freeholders, in some towns, to dispose of their land by will. Thus, by the time of Littleton (Henry VI. and Edward IV.), an immense mass of material had been acquired and preserved in the rolls of the various courts. Reports of important cases were published in the "year books." A glance at Statham's *Abridgment*, the earliest digest of decided cases, published nearly at the same time as Littleton's *Tenures*, is sufficient to show the enormous bulk which reported cases had already attained as materials for the knowledge of English law.

Littleton's treatise was written in French, or rather in that peculiar dialect compounded of Norman-French and English phrases called law French. Although it had been provided by a statute of 36 Edward III. that *viva voce* proceedings in court should no longer be conducted in the French tongue, "which was much unknown in the realm," the practice of reporting proceedings in that language, and of using it in legal treatises, lingered till a much later period, and was at length prohibited by a statute passed in the time of the Commonwealth in 1650. Unlike the preceding writers on English law, Glanville, Bracton, and the authors of the treatises known by the names of Britton and Fleta, Littleton borrows nothing from the sources of Roman law or the commentators. He deals purely and exclusively with English law.

The book is written on a definite system, and is the first attempt at something like a scientific classification of rights over land. Littleton's method is to begin with a definition, usually clearly and briefly expressed, of the class of rights with which he is dealing. He then proceeds to illustrate the various characteristics and incidents of the class by stating particular instances, some of which refer to decisions which had actually occurred, but more commonly they are hypothetical cases put by way of illustration of his principles. He occasionally but rarely refers to reported cases. His book is thus much more than a mere digest of judicial decisions; to some extent he pursues the method which gave to Roman law its breadth and consistency of principle. In Roman law this result was attained through the practice of putting to jurisconsults hypothetical cases to be solved by them. Littleton, in like manner, is constantly stating and solving by reference to principles of law cases which may or may not have occurred in actual practice.

In dealing with freehold estates Littleton adopts a classification which has been followed by all writers who have attempted to systematize the English law of land, especially Sir M. Hale and Sir William Blackstone. It is indeed the only possible approach to a scientific arrangement of the intricate "estates in land" known to English law. He classifies estates in land by reference to their duration, or in other words by reference to the differences between the persons who are entitled to succeed upon the death of the person in possession or "tenant." First of all, he describes the characteristics of tenancy in fee simple,—an interest in lands which devolves on the death of the tenant to his heir, whether such heir be of the same line or collateral. This is still as it was in Littleton's time the largest interest in land known to the law. Next in order comes tenancy in fee tail, the outcome, as Littleton informs us, of the Statute of Westminster II., 13 Edward I. c. 1, "De Donis Conditionalibus," which enacted in the interest of the great lords that a gift to a man and "the heirs of his body" should no longer bear the construction which the courts had put upon the words, holding the donee to be thereby invested with full power over the land so soon as he had issue born, but should descend according to the form of the gift to lineal descendants so long as lineal descendants should exist. The various classes of estates tail are sketched by Littleton with brevity and accuracy, but he is silent as to the important practice, which first received judicial recognition shortly before his death, of "suffering a recovery," whereby through a series of judicial fictions a tenant in tail was enabled to convert his estate tail into a fee simple, thus acquiring full power of alienation. After discussing in their logical order other freehold interests in land, he passes to interests in land called by later writers interests less than freehold, namely, tenancies for terms of years and tenancies at will. With the exception of tenancy from year to year, now so familiar to us, but which was a judicial creation of a date later than the time of Littleton, the first book is a complete statement of the principles of the common law, as they for the most part still exist, governing and regulating interests in lands. The first book concludes with a very interesting chapter on copyhold tenures, which marks the exact point at which the tenant by copy of court roll, the successor of the villein, who in his turn represented the freeman reduced to villenage by the growth of the manorial system, acquired security of tenure by the judicial recognition of the fact that the "will of the lord" was controlled by and could only be exercised in accordance with the "custom of the manor."

The second book relates to the reciprocal rights and duties of lord and tenant, and is mainly of historical interest to the modern lawyer. It contains a complete statement of the law as it stood in Littleton's time relating to homage, fealty, and escuage, the money compensation to be paid to the lord in lieu of military service to be rendered to the king, a peculiar characteristic of English as distinguished from Continental feudalism.

Littleton then proceeds to notice the important features of tenure by knight's service with its distinguishing incidents of the right of wardship of the lands and person of the infant heir or heiress, and the right of disposing of the ward in marriage. The non-military freehold tenures are next dealt with; we have an account of "socage tenure," into which all military tenures were subsequently commuted by a now unrecognized Act of the Long Parliament in 1650, afterwards re-enacted by the well-known statute of 12 Charles II. c. 24, and of "frankalmoign," or the spiritual tenure by which churchmen held, their duty being "to make orisons, prayers, masses, and other divine services for the souls of their grantor or feoffor, and being bound to no fealty to the lord, because that this divine service is better for them before God than any doing of fealty." In the description of burgage tenure and tenure in villenage, the life of which consists in the validity of ancient customs recognized by law, we recognize survivals of a time before the iron rule of feudalism had moulded the law of land in the interests of the king and the great lords. Finally he deals with the law of rents, discussing the various kinds of rents which may be reserved to the grantor upon a grant of lands and the remedies for recovery of rent, especially the remedy by distress.[1]

The third and concluding book of Littleton's treatise deals mainly with the various ways in which rights over land can be acquired and terminated in the case of a single possessor or several possessors. This leads him to discuss the various modes in which several persons may simultaneously have rights over the same land, as parceners:—daughters who are co-heiresses, or sons in gavelkind; joint tenants, where the interest does not pass to the heir of the deceased joint tenant, but devolves upon the surviving joint tenant; and tenants in common, where the interest is separate and descends to the heir of each of the co-tenants, though the land over which the right exists is undivided and held in common with one or more other persons. Next follows an elaborate discussion upon what are called estates upon condition,—a class of interests which occupied a large space in the early common law, ise on one side to estates tail on another to mort- In Littleton's time a mortgage, which he carefully s, was merely a conveyance of land by the tenant ortgagee, with a condition that, if the tenant paid ortgagee a certain sum on a certain day, he might and have the land again. If the condition was lled, the interest of the mortgagee became absolute, tleton gives no indication of any modification of ct rule, such as was introduced by courts of equity, ng the debtor to redeem his land by payment of was due to the mortgagee although the day of t had passed, and his interest had become at law ible. The remainder of the work is occupied with sition of a miscellaneous class of modes of acquiring f property, the analysis of which would occupy too pace.

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[1] These two books are stated, in a note to the table at the conclusion of the work, to have been made for the better understanding of certain chapters of the *Antient Book of Tenures*. This refers to a tract called *The Old Tenures*, said to have been written in the reign of Edward III. By way of distinguishing it from this work, Littleton's book is called in all the early editions "Tenores Novelli."

ork is thus a complete summary of the common t stood at the time. It is nearly silent as to the ble class of rights which had already assumed vast l importance—equitable interests in lands. These noticed incidentally in tho chapter on "Releases." as already clear in Littleton's time that this class s would become the most important of all. Little- n will, which has been preserved, may be adduced f of this assertion. Although nothing was more to the spirit of Norman feudalism than that a of lands should dispose of them by will, we find n directing by his will the feoffees of certain to make estates to the persons named in his will. r words, in order to acquire over lands powers un- to the common law, the lands had been conveyed ffees" who had full right over them according to mon law, but who were under a conscientious obli- o exercise those rights at the direction and for the e benefit of the person to whose "use" the lands ld. This conscientious obligation was recognized orced by the chancellor, and thus arose the class of le interests in lands. Littleton is the first writer lish law after these rights had risen into a promi- sition, and it is curious to find to what extent they red by him. Unlike their treatment of copyhold s, the common lawyers wholly refused to recognize ht of the real or beneficial owner, when the legal was vested in another, though the latter had then semblance without the reality of ownership. Hence that the most important class of rights developed the common law. After an unhappy attempt to the classes of legal and equitable interests by the of Uses (27 Henry VIII. c. 10), the effect of which introduce still greater technicality and complication e law of real property, the two classes have con- to exist side by side, until in our own time the ure Act of 1873, by uniting in one court the tribu- e difference between which originally gave rise to tinction between legal and equitable interests, has paved the way for a simpler and more rational ation of rights over land.

ork of Littleton occupies a place in the history of typog- s well as of law. The earliest printed edition seems to by John Lettou and William de Machlinia, two printers obably came from the Continent, and carried on their s in partnership, as their note to the edition of Littleton in civitate Londoniarum, juxta ecclesiam omnium sanc- The date of this edition is uncertain, but the most e conjecture, based on typographical grounds, places it e latter part of 1481. The next edition is one by Machlinia robably about two or three years later than the former. ia was then in business alone "juxta pontem quæ vulgo Fleta brigge." Next came the Rohan or Rouen edition, usly stated by Sir E. Coke to be the earliest, and to have inted about 1533. It was, however, of a much earlier omlins, the latest editor of Littleton, gives reasons for g that it cannot have been later than 1490. It is stated in o have been printed at Rouen by William le Tailleur tantiam Richardi Pynson." Copies of all these editions he British Museum. In all these editions the work is *enores Novelli*, probably to distinguish it from the "Old ."

are three early MSS. of Littleton in the University at Cambridge. One of these formerly contained a note first page to the effect that it was bought in St. Paul's yard on July 20, 1480. It was therefore in circulation in n's lifetime. The other two MSS. are of a somewhat later ut one of them contains what seems to be the earliest translation of the *Tenures*, and is probably not later than

e 16th century editions of Littleton followed in rapid suc- from the presses of Pynson, Redmayne, Berthelet, Tottyl, ers. The practice of annotating the text caused several ns to be introduced, which, however, are easily detected parison of the earlier copies. In 1581 West divided the o seven hundred and forty-six sections, which have ever een preserved. Many of these editions were printed with argins for purposes of annotation, specimens of which seen in Lincoln's Inn Library.

ractice of annotating Littleton was very general, and was d by many eminent lawyers besides Sir E. Coke, amongst others by Sir M. Hale. One commentary of this kind, by an unknown hand of earlier date than Sir E. Coke's, was edited by Cary in 1829. Following the general practice of dealing with Littleton as the great authority on the law of England, "the most perfect and absolute work that ever was written in any human language," Sir E. Coke makes it the text of that portion of his work which he calls the first part of the institutes of the law of England, in other words, the law of property.

The first printed English translation of Littleton was by Rastell, who seems to have combined the professions of author, printer, and sergeant-at-law, between 1514 and 1533. Many English editions by various editors followed, the best of which is Tottyl's in 1556. Sir E. Coke adopted some translation earlier than this, which has since gone by the name of Sir E. Coke's translation. He, however, throughout comments not on the translation but on the French text; and the reputation of the commentary has to some extent overlaid and obscured the intrinsic merit of the original. (K. E. D.)

LITTRÉ, PAUL MAXIMILIEN ÉMILE (1801–1881), the compiler of tho best dictionary of any living language, and the Frenchman of most encyclopædic knowledge since Diderot, was born at Paris on February 1, 1801. His father had been a gunner, and afterwards sergeant-major of marine artillery, in the French navy, and was deeply imbued with the revolutionary ideas of the day. Settling down as a collector of taxes, he married Sophie Johannot, a free-thinker like himself, and devoted himself to the education of his son Émile. The boy was sent to the Lycée Louis-le-Grand, where he had for friends Hachette and Eugène Burnouf, and he distinguished himself alike in his work and in all athletic exercises. After he had completed his course at school, he hesitated for a time as to what profession he should adopt, and meanwhile made himself master, not only of the English and German languages, but of the classical and Sanskrit literature and philology. At last he determined to study medicine, and in 1822 entered his name as a student of medicine. He passed all his examinations in due course, and had only his thesis to prepare in order to obtain his degree as doctor when in 1827 his father died, leaving his mother absolutely without resources. He at once renounced his degree, and, while attending the lectures of Rayer and taking a keen interest in medicine, began teaching Latin and Greek for a livelihood. He carried a musket on the popular side in the Revolution of February, 1830, and was one of the national guards who followed Charles X. to Rambouillet. At last, in 1831, when quite thirty years of age, he obtained an introduction to Armand Carrel, the editor of the *National*, who gave him the task of reading the English and German papers for excerpts. Carrel by the merest chance, in 1835, discovered the ability of his reader, who from that time became a constant contributor, and eventually director of the paper. In 1836 he began to contribute articles on all sorts of subjects to the *Revue des Deux Mondes*; in 1837 he married; and in 1839 appeared the first volume of his edition of the works of Hippocrates. This volume at once placed Littré in the forefront of the literary and scientific world; its ability was recognized by his election the same year into the Académie des Inscriptions et Belles-Lettres. At the age of thirty-eight then he had won for himself a high reputation as a learned man of letters and of science, but was still tormented by the unsettled ideas and thoughts which generally beset younger men, and were only increased by the study of his favorite authors Byron and Senancour. At this epoch he came across the works of Auguste Comte, the reading of which formed, as he himself said, "the cardinal point of his life," and from this time onward appears the influence of positivism on his own life, and, what is of even more importance, his influence on positivism, for he gave at least as much to positivism as he received from it. He brought to it a wide knowledge of science and literature, a great and growing reputation, and a clear head. He soon became an intimate friend of Comte's, and set to work to popularize his ideas in numerous works on the positivist philosophy, while at the same time continuing his edition of Hippocrates, which was not completed till 1862, publishing a similar edition of Pliny's *Natural History*, assisting after 1844 in the place of Fauriel at the committee engaged on the

Histoire littéraire de la France, where his knowledge of the early French language and literature was invaluable, and contributing largely to the *National* and *Revue des Deux Mondes*. In the revolution of July, 1848, he took a keen interest, and himself took part in the repression of the extreme republican party in June, 1849, under the banner of order. His essays, contributed during this period to the *National*, were collected together and published under the title of *Conservation, Révolution, et Positivisme* in 1852, and show, not only a lively faith in a good time coming, but a thorough acceptance of all the doctrines propounded by Comte. However, during the later years of his master's life, he began to perceive that he could not wholly accept all the dogmas or the more mystic ideas of his friend and master, but he studiously concealed his differences of opinion almost from himself, and Comte failed to perceive that his pupil had outgrown him, as he himself had outgrown his master Saint-Simon. Comte's death in 1858 freed Littré from any fear of embittering his master's later years, and he published his own ideas in his *Paroles de la Philosophie Positive* in 1859, and at still greater length in his work in *Auguste Comte et la Philosophie positive* in 1863. In this book he traces the origin of Comte's ideas through Turgot, Kant, and Saint-Simon, then eulogizes Comte's own life, his method of philosophy, his great services to the cause, and the effect of his works, and finally proceeds to show where he himself differs from him. He approved wholly of Comte's philosophy, his great laws of society, and his philosophical method, which indeed he defended warmly against J. S. Mill, but declared that, while he believed in a positivist philosophy, he did not believe in a religion of humanity. In the year 1863, after completing his Hippocrates and his Pliny, he set to work on his great French dictionary, bringing to the task an unexampled knowledge of old French, of modern and classical languages, and of modern philology, which were to make his dictionary unique in its interest and accuracy. In the same year he was proposed for the Académie Française, but rejected, owing to the opposition of the fiery bishop of Orleans, who denounced him as the chief of the French materialists. He also at this time started with M. Wyrouboff the *Philosophie Positive*, a review which was to embody the views of modern positivists, and to which he largely contributed. His life was thus absorbed in literary work, and flowed quietly on, till the overthrow of the empire called on him to take a part in politics. He felt himself too old to undergo the privations of the siege of Paris, and retired with his family to Britanny, whence he was summoned by M. Gambetta to Bordeaux, to lecture on history, and thence to Versailles to take his seat in the senate to which he had been chosen by the department of the Seine. In December, 1871, he was elected a member of the Académie Française in spite of the renewed opposition of the Mgr. Dupanloup, bishop of Orleans, who resigned his seat rather than receive him. His dictionary was completed in 1873, and he lived on full of years and honors, for in 1874 he was elected a life senator. The most notable of his productions in these latter years were his political papers attacking and unveiling the confederacy of the Orleanists and legitimists, and in favor of the republic, his republication of many of his old articles and books, among others the *Conservation, Révolution, et Positivisme* of 1852 (which he reprinted word for word, appending a formal, categorical renunciation of many of the Comtist doctrines therein contained), and a little tract *Pour la dernière fois*, in which he maintained his unalterable belief in materialism. When it became obvious that the old man could not live much longer, his wife and daughter, who had always been fervent Catholics, strove to convert him to their religion. He had long interviews with Père Millériot, a celebrated controversialist, and was much grieved at his death; but it is hardly probable he would have ever been really converted. Nevertheless, when on the point of death, his wife had him baptized, and his funeral was conducted with the rites of the Catholic Church. He died June 2, 1881.

It is almost impossible to characterize the varied learning and immense intellectual activity of Littré. As a philosopher he had popularised and sifted the ideas of Comte, and had succeeded Comte as Comte succeeded Turgot, Kant, and Saint-Simon; as a lexicographer he has been compared to Johnson, though his work is as far ahead of Johnson's as the philological knowledge of the 19th century is in advance of that of the 18th; and as a man of almost universal knowledge, and a writer on every sort of subject, from barbarian learning and modern science to epic poetry and the military genius of Napoleon, he remains unrivalled, even in a country which can boast of Diderot and Comte.

It would take too much space to give a complete list of all Littré's voluminous works, but the following are those of greatest importance:—his editions of Hippocrates, 1839–61, and of Pliny's *Natural History*, 1848–50; his translation of Strauss's *Vie de Jésus*, 1839–40, and Müller's *Manuel de Physiologie*, 1851; his edition of the works of Armand Carrel, with notes, 1854–58; the *Histoire de la langue française*, a collection of magazine articles, 1862; and his *Dictionnaire de la langue française*, 1863–72. In the domain of science must be noted his edition, with Charles Robin, of Nysten's *Dictionnaire de médicine de chirurgie*, etc., 1855; in that of philosophy, his *Analyse raisonnée du cours de philosophie positive de M. A. Comte*, 1845; *Application de la Philosophie positive au Gouvernement*, 1849; *Conservation, Révolution, et Positivisme*, 1852 (2d edition with supplement, 1879); *Paroles de la Philosophie positive*, 1859; *Auguste Comte et la Philosophie positive*, 1863; *La Science au point de vue philosophique*, 1873; *Fragments de philosophie et de sociologie contemporaine*, 1876; and his most interesting miscellaneous works, his *Études et Glanures*, 1880; *La Verité sur la mort d'Alexandre le Grand*, 1865; *Études sur les barbares et le moyen âge*, 1867; *Médecine et Médecins*, 1871; *Littérature et Histoire*, 1875; and *Discours de Reception à l'Académie française*, 1873.

For his life consult Sainte-Beuve's notice, 1862, and the numerous articles published after his death in the newspapers and reviews, of which the best are the notices of M. Durand Gréville in the *Nouvelle Revue* of August, 1881, of M. Caso in the *Revue des Deux Mondes*, and of M. Frédéric Godefroy in the *Lettres chrétiennes*. (H. M. S.)

LITURGY. The word "Liturgy" technically denotes the "Order for the Celebration and Administration of the Eucharist." It has come to be used in a more popular sense to denote any or all of the various services of the Christian church, whether contained in separate volumes or bound up together in the form of a Book of Common Prayer. We propose to treat of "the liturgy" chiefly, but not exclusively, in the former and stricter sense, and without further discussion of the use of the word in Biblical or patristic literature, and without entering into various questions with reference to their origin, growth, first committal to writing, etc., to give our readers some account of the principal liturgies which exist, or have existed, in the Christian church.

There are five main families or groups of liturgies, three of them Eastern in origin and use, one Eastern in origin but Western in use, one Western both in origin and use. They are known either by the names of the apostles with whom they are traditionally connected, or by the names of the countries or cities in which they are known or believed to have been once or always in use.

GROUP I. *St. James, West Syria, Jerusalem.*—The principal liturgies to be enumerated under this group are the Clementine, so called from being found in the eighth book of the *Apostolic Constitutions*, which have been erroneously referred to St. Clement, first bishop of Rome (lib. viii. 10–15); the Greek and Syriac liturgies of St. James; the Greek liturgies of St. Basil and St. Chrysostom; the Armenian liturgy of St. Gregory the Illuminator, first patriarch of Armenia; a large number of later Syriac liturgies springing from the Syriac liturgy of St. James. Of these liturgies, that of St. Chrysostom is used now by the Orthodox Eastern Church, except on the first five Sundays in Lent, rsday and Saturday in Holy Week, the vigils of istmas and Epiphany, and St. Basil's Day, when liturgy of St. Basil is used; and in Lent (except days and Saturdays and Lady Day), when the gy of the pre-sanctified is used.

his group, like all the purely Eastern liturgies, is ked by an absence of flexibility as to number and e of prefaces, collects, etc. Its special feature, if nay adopt a recently employed canon of differentia- , is the position of the great intercession for quick dead, for rulers in church and state, for the sick, travellers, for the fruits of the earth, etc., after the ecration of the elements has been completed by the cation of the Holy Spirit (C. E. Hammond, *Lit. tern and Western*, pp. 26–29).

ROUP II. *St. Mark*, *Egyptian*, *Alexandria*.—This p includes the Greek liturgies of St. Mark, St. il, and St. Gregory; the Coptic liturgies of St. l, St. Basil, and St. Gregory; the Ethiopic liturgy wn as the "Canon Universalis" or "Liturgy of all Apostles," together with sixteen other subordinate iopic liturgies. They are distinguished by the posi- of the great intercession in the middle of the pref- as well as by the prominent part assigned through- to the deacon.

ROUP III. *St. Adæus*, *East Syrian*, *Edessa*.— re are three extant liturgies belonging to this p, now exclusively used by Nestorian Christians,— e of SS. Adæus and Maris, Theodore of Mopsues- and Nestorius; the titles of three lost liturgies have preserved,—those of Narses, Barsumas, and Dio- s of Tarsus. The liturgy of the Christians of St. mas, on the Malabar coast of India, formerly be- ed to this group, but it was almost completely milated to the Roman liturgy by Portuguese Jesuits he synod of Diamper in 1599. The characteristic his group is the position of the great intercession he middle of the consecration, between the words nstitution (or, to speak more accurately, the place re the words of institution must have occurred) and invocation.

ROUP IV. *St. John*, *Hispano-Gallican*, *Ephesus*.— group of Latin liturgies, which once prevailed very ely in western Europe, has been almost universally erseded by the liturgy of the Church of Rome. ere it survives it has been either partially or almost pletely assimilated to the Roman pattern. It pre- ed once throughout Spain, France, part of northern y, and Great Britain and Ireland, in forms of which tailed account is appended. The term "Ephesine" been applied to this family of liturgies, chiefly by lern English liturgiologists, to denote a theory as to r origin which, although upheld by other than Eng- writers, must be regarded rather as a possible hy- hesis than a proved fact (Leslie, *Pref. to Mozar. sal*, sect. 25; Bickell, *Messe und Pascha*, p. 10). many traces of Eastern influence in their composi- , and the close connection which is known to have ted at a very early period between the churches of ns and of western Asia Minor, have suggested the ry that the latter country must have been the birth- e of this class of liturgies. The names of the apostle John and of Ephesus his place of residence have n pressed into service as further particularizations he same theory. The special feature of these litur- is the position of the great intercession after the rtory, before the commencement of the preface and on.

he chief traces of Oriental affinity lie in the follow- points:—(1) the various proclamations made by the con, including that of "Silentium facite" before the stle (Migne, tom. lxxxv. p. 534); (2) the presence a third lesson, preceding the epistle, taken from the l Testament; (3) the occasional presence of "pre- ," a series of short intercessions resembling the eek "Ektene," or deacon's litany; (4) the position the kiss of peace at an early point in the service, ore the canon, instead of the Roman position after consecration; (5) the exclamation "sancta sanctis" occurring in the Mozarabic rite, the counterpart of the Eastern τὰ ἅγια τοῖς ἁγίοις; (6) traces of the presence of the "Epiklesis," that is to say, the invocation of the Holy Spirit, in its Eastern position, after the words of institution, as in the collect styled the Postpridie in the Mozarabic service for the second Sunday after Epiphany:—"We beseech Thee that Thou wouldst sanctify this oblation with the permixture of Thy Spirit, and conform it with full transformation into the Body and Blood of our Lord Jesus Christ." On the other hand, the great variableness of its parts, and its immense number of proper prefaces, ally it to the Western family of liturgies.

We now proceed to give a more detailed account of the chief liturgies of the Hispano-Gallican group.

1. *The Mozarabic Liturgy*.—This was the national liturgy of the Spanish Church till the close of the 11th century, when the Roman liturgy was forced upon it. Its use, however, lingered on, till in the 16th century Cardinal Ximenes, anxious to prevent its becoming quite obsolete, had its books restored and printed, and founded a college of priests at Toledo to perpetuate its use. It survives now only in that and one other church in Spain, and even there not without certain Roman modifications of its original text and ritual.

Its date and origin, like the date and origin of all existing liturgies, are uncertain, and enveloped in the mists of antiquity. It is evidently not derived from the Roman liturgy. Its whole structure, and every separate detail, disprove such a parentage, and therefore it is strange to find St. Isidore of Seville (*Lib. de Eccles. Offic.*, i. 15) attributing it to St. Peter. No proof is adduced, and the only value which can be placed upon such an unsupported assertion is that it shows that a very high and even apostolic antiquity was claimed for it. A theory, originating with Pinius, that it may have been brought by the Goths from Constantinople when they invaded Spain, is as improbable as it is unproven. It may have been derived from Gaul. The Gallican liturgy stood to it in the relation of twin-sister, if it could not claim that of mother. The resemblance was so great that, when Charles the Bald (843–877) wished to gain some idea of the character of the already obsolete Gallican rite, he sent to Toledo for some Spanish priests to perform mass according to the Mozarabic rite in his presence. But there is no record of the conversion of Spain by Gallican missionaries. Christianity existed in Spain from the earliest time. Probably St. Paul travelled there (Rom. xv. 24–28). It may be at least conjectured that its liturgy was Pauline rather than Petrine or Johannine.

2. *Gallican Liturgy*.—This was the ancient and national liturgy of France till the commencement of the 9th century, when it was suppressed by order of Charlemagne, who directed the Roman missal to be everywhere substituted in its place. All traces of it seemed for some time to have been lost, until three Gallican sacramentaries were discovered and published by Thomasius in 1680, under the titles of *Missale Gothicum*, *Missale Gallicum*, and *Missale Francorum*, and a fourth was discovered and published by Mabillon in 1687, under the title of *Sacramentarium Bobbiense*. Fragmentary discoveries have been made since then. Mone discovered fragments of eleven Gallican masses, and published them at Carlsruhe in 1850. Other fragments from the library of St. Gall have been published by Bunsen (*Anal. Ante-Nic.*, iii. 263–66), and from the Ambrosian library at Milan by Cardinal Mai (*Scrip. Vet. Vat. Coll.*, iii. 2, 247). More of this MS. is being prepared for publication by Dr. Ceriani. A single page was discovered in the library of Gonville and Caius College, Cambridge, in 1867, which has not yet been published. These documents, illustrated by early Gallican canons, and by allusions in the writings of Sulpicius Severus, Cæsarius of Arles, Gregory of Tours, Germanus of Paris, and other authors, enable scholars to reconstruct the greater part of this liturgy. The pre-

viously enumerated signs of Eastern origin and influence are found here as well as in the Mozarabic liturgy, together with certain other more or less minute peculiarities, which would be of interest to professed liturgiologists, but which we must not pause to specify here. They point to the possibility of the theory that the Gallican liturgy was introduced into use by Irenæus, bishop of Lyons (*c.* 130–200), who had learned it in the East from St. Polycarp, the disciple of the apostle St. John.

3. *Ambrosian Liturgy.*—Considerable variety of opinion has existed among liturgical writers as to the proper classification of the "Ambrosian" or "Milanese" liturgy. If we are to accept it in its present form, and to make the present position of the great intercession the test of its *genus*, then we must place it under Group V., the "Petrine," and consider it as a branch of the Roman family. If, on the other hand, we consider the important variations from the Roman liturgy which yet exist, and the still more marked and numerous traces of variation which confront us in the older printed and MS. copies of the Ambrosian rite, we shall detect in it an original member of the Ephesine group of liturgies, which for centuries past has been undergoing a gradual but ever increasing assimilation to Rome. We know this as a matter of history, as well as a matter of inference from changes in the text itself. Charlemagne adopted the same policy towards the Milanese as towards the Gallican Church. He carried off all the Milanese Church books which he could obtain, with the view of substituting Roman books in their place, but the completeness of his intentions failed, partly through the attachment of the Lombards to their own rites, partly through the intercession of a Gallican bishop named Eugenius (Mabillon, *Mus. Ital.*, i., ii. p. 106). It has been asserted by Joseph Vicecomes that this is an originally independent liturgy drawn up by St. Barnabas, who first preached the gospel at Milan (*De Missæ Rit.*, i. chap. xi., xii.), and this tradition is preserved in the title and proper preface for St. Barnabas Day in the Ambrosian missal (Pamelius, i. 385, 386).

We can trace the following points in which the Milanese differs from the Roman liturgy, many of them exhibiting distinct lines of Ephesine or Eastern influence. Some of them are no longer found in recent Ambrosian missals, and only survive in the earlier MSS. published by Pamelius (*Liturgicon*, tom. i. p. 293), Muratori (*Lit. Rom. Vet.*, i. 132), and Ceriani (in his edition, 1881, of an ancient MS. at Milan).

(*a*) The collect entitled "oratio super sindonem," corresponding to the εὐχὴ μετὰ τὸ ἀπλωθῆναι τὸ εἰλητόν; (*b*) the proclamation of silence by the deacon before the epistle; (*c*) the litanies said after the Ingressa (introit) on Sundays in Lent, closely resembling the Greek Ektene; (*d*) varying forms of introduction to the Lord's Prayer, in Cœna Domini (Ceriani, p. 116) in Pascha (*ib.*, p. 129); (*e*) the presence of passages in the Prayer of Consecration which are not part of the Roman canon, and one of which at least corresponds in import and position, though not in words, to the Greek Ἐπίκλησις: *Tuum vero est, omnipotens Pater, mittere*, etc. (*ib.*, p. 116); (*f*) the survival of a distinctly Gallican form of consecration in the Post-Sanctus, "in Sabbato Sancto:" *Vere Sanctus vere benedictus Dominus noster*, etc. (*ib.*, p. 125); (*g*) the varying nomenclature of the Sundays after Pentecost; (*h*) the position of the fraction before the Lord's Prayer; (*i*) the omission of the second oblation after the words of institution (Muratori, *Lit. Rom. Vet.*, i. 133); (*k*) a third lection or *Prophetia* from the Old Testament preceding the epistle and gospel; (*l*) the lay offering of the oblations and the formulæ accompanying their reception (Pam., i. 297); (*m*) the position of the ablution of the hands in the middle of the canon just before the words of institution; (*n*) the position of the "oratio super populum" which corresponds in matter but not in name to the collect for the day before the Gloria in Excelsis.

4. *Celtic Liturgy.*—We postpone the consideration of this subject to a position under the heading of the liturgies of Great Britain and Ireland.

GROUP V. *St. Peter, Italian, Rome.*—There is only one liturgy to be enumerated under this group, viz., the present liturgy of the Church of Rome, which, though originally local in character and circumscribed in use, has come to be nearly coextensive with the Roman Church, sometimes cuckoo-like ejecting earlier national liturgies, as in France and Spain, sometimes incorporating more or less of the ancient ritual of a country into itself, and producing from such incorporation a subclass of distinct uses, as in England, France, and North Italy. Even these subordinate uses have for the most part become, or are rapidly becoming, obsolete. The genius and policy of Rome are in favor of uniformity; and it requires no keen powers of vision to foretell that, liturgically speaking, she will be, before long, within all her dominions supreme.

The date, origin, and early history of the Roman liturgy are obscure. The first Christians at Rome were a Greek-speaking community, and their liturgy must have been Greek, and is possibly represented in the so-called Clementine liturgy. But the date when such a state of things ceased, when and by whom the present Latin liturgy was composed, whether it is an original composition, or, as its structure seems to imply, a survival of some intermediate form of liturgy,—all these are questions which are waiting for their solution, and to which no certain answer can be given, unless and until some further discovery shall be given of earlier liturgical remains.

One MS. exists which claims to represent the Roman liturgy as it existed in the time of Leo I., 440–61. It was discovered at Verona by Blanchini in 1735, assigned by him to the 8th century, and published under the title of *Sacramentarium Leonianum;* but this title was from the first purely conjectural, and is in the teeth of the internal evidence which the MS. itself affords, and is now being gradually abandoned. It is impossible here to enter into the minutiæ of the evidence for this and other conclusions. The question is discussed at some length by Muratori, *Lit. Rom. Vet.*, i. chap. 3.

A MS. of the 9th or 10th century was found at Rome by Thomasius, and published by him in 1680 under the title of *Sacramentarium Gelasianum.* But it was written in France, and is certainly not a pure Gelasian codex; and, although there is historical evidence of that pope (492–96) having made some changes in the Roman liturgy, and although other MSS. have been published by Gerbertus and others, claiming the title of Gelasian, we neither have nor are likely to have genuine and contemporary MS. evidence of the real state of the liturgy in that pope's time.

The larger number of MSS. of this group are copies of the Gregorian sacramentary, that is to say, MSS. representing, or purporting to represent, the state of the Roman liturgy in the days of Gregory the Great (590–604). But they cannot be accepted as certain evidence, for the following reasons:—not one of them was written earlier than the 9th century; not one of them was written in Italy, but every one north of the Alps; every one contains internal evidence of a post-Gregorian date in the shape of masses for the repose or for the intercession of St. Gregory, and in various other ways.

The Roman liturgy was introduced into England in the 7th, into France in the 9th, and into Spain in the 11th century. In France certain features of the service and certain points in the ritual of the ancient national liturgy became interwoven with its text, and formed those many varying mediæval Gallican uses which are associated with the names of the different French sees.

The distinguishing characteristics of the Petrine liturgy are these:—(*a*) the position of the great intercession within the canon, the commemoration of the living being placed just before, and the commemoration of the departed just after, the words of institution; (*b*) the absence of the Epiklesis or Invocation of the Holy Spirit; (*c*) the position of the Pax, or "Kiss of Peace" after the consecration and just before the communion, whereas in other liturgies it occurs at a much earlier point in the service.

Liturgies of the British Islands.

PERIOD I. *The Celtic Church.*—Until recently almost nothing was known of the character of the litural service of the vast Celtic Church which existed in se islands before the Anglo-Saxon conquest, and ich continued to exist in Ireland, Scotland, Wales, l Cornwall for very considerable though varying iods of time after that event. But recently a good l of light has been thrown on the subject, partly by publication of the few genuine works of SS. Patrick, umba, Columbanus, and other Celtic saints; partly the discovery of liturgical remains in the Scottish *ok of Deer*, and in the Irish *Books of Dimma and lling* and the *Stowe Missal;* partly by the publica- 1 of mediæval Irish compilations such as the *Leab- · Breac, Liber Hymnorum*, etc., which contain eccle- stical calendars, legends, treatises, etc., of considerable very varying antiquity. The evidence collected from se sources is sufficient to prove that the liturgy of Celtic Church was of the Ephesine type. In cen- l England the churches, together with their books l everything else belonging to them, were destroyed heathen invaders from Jutland, Schleswig, and lstein at the close of the 5th century; but the Celtic urch in the remoter parts of England, as well as in neighboring kingdoms of Scotland and Ireland, re- ned its liturgical independence for many centuries erward.

n examination of its few extant service books and frag- nts of service books yields the following evidence of the nesine origin and character of the Celtic liturgy:—(*a*) e presence of whole collects and anthems which occur in Gallican and Mozarabic but not in the Roman liturgy; various formulæ of thanksgiving after communion; (*c*) quent addresses to the people in the form of Gallican *sfationes*; (*d*) the Gallican form of consecration prayer, ng a variable Post-Sanctus leading up to the words of titution; (*e*) the complicated rite of fraction as described an Irish tract at the end of the Stowe missal finds its y counterpart in the elaborate ceremonial of the Moz- bic Church; (*f*) the presence of the Gallican ceremonial *Pedilavium* or "Washing of Feet" in the earliest Irish tismal office. For a further description of these and of er features which seem to be peculiar to the Celtic rgy the reader is referred to Warren's *Liturgy and Ritual he Celtic Church*, 1881.

PERIOD II. *The Anglo-Saxon Church.*—We find selves here on firmer ground, and can speak with tainty as to the nature of the liturgy of the English urch after the beginning of the 7th century. In- mation is drawn from the liturgical allusions in the ant canons of numerous councils, from the volumi- us writings of Bede, Alcuin, and many other ecclesi- ical authors of the Anglo-Saxon period, and above from a very considerable number of service books itten in England before the Norman Conquest. ree of these books are manuscript missals of more less completeness, and, as none of them have yet en published, their names are appended:—(1) the ofric missal, a composite 10th to 11th century MS., sented to the cathedral of Exeter by Leofric, the t bishop of that see (1046–1072), now in the Bodleian brary at Oxford; (2) the missal of Robert of Jumièges, hbishop of Canterbury (1051–52), executed probably Winchester, and presented by Archbishop Robert to old monastery of Jumièges in the neighborhood of uen, in the public library of which town it now lies;) the Red Book of Derby, an incomplete missal of e second half of the 11th century, now in the library Corpus Christi College, Cambridge.

A perusal of these volumes proves, what we should ve expected *a priori*, that the Roman liturgy was in e in the Anglo-Saxon Church. This was no doubt e case from the very first. That church owed its undation to the forethought of a Roman pontiff, and e energy of a band of missionaries, headed by St. ugustine, who came directly from Rome, and who ought, as we are expressly assured by Bede, their urgical codices with them from their native country *Tist. Ec.*, ii. 28). Accordingly, when we speak of Anglo-Saxon missal, we mean a Roman missal only hibiting one or more of the following features which differentiate it from an Italian missal of the same century.

(*a*) Rubrics, and other entries of a miscellaneous character, written in the vernacular language of the country; (*b*) the commemoration of national or local saints in the calendar, in the canon of the mass, and in the litanies which occur on Easter eve, and in the baptismal offices; (*c*) the presence of a few special masses in honor of these national saints, together with a certain number of collects of a necessarily local character, for the rulers of the country, for its natural produce, etc.; (*d*) the addition of certain peculiarities of liturgical structure and arrangement interpolated into the purely Roman service from an extraneous source. There are two noteworthy examples of this in Anglo-Saxon service books. Every Sunday and festival, and almost every votive mass, has its proper preface, although the number of such prefaces in the Gregorian sacramentary of the same period had been reduced to eight. There were a large but not quite an equal number of triple episcopal benedictions to be pronounced by the bishop after the Lord's Prayer and before the communion. This custom must either have been perpetuated from the old Celtic liturgy, or directly derived from a Gallican source.

PERIOD III. *Anglo-Norman Church.*—The influx of numerous foreigners, especially from Normandy and Lorraine, which preceded, accompanied, and followed the Conquest, and the occupation by them of the highest posts in church as well as state, had a distinct effect on the liturgy of the English Church. These foreign ecclesiastics brought over with them a preference for and a habit of using certain features of the Gallican liturgy and ritual, which they succeeded in incorporating into the service books of the Church of England. One of these prelates named Osmund, a Norman count, earl of Dorset, chancellor of England, and bishop of Salisbury, 1078–99, undertook the revision of the English service books, and the missal which he produced in 1085, which he knew as the *Sarum Missal*, or the *Missal according to the use of Sarum*, practically became the liturgy of the English Church. It was not only received in the province of Canterbury, but was largely adopted beyond those limits—in Ireland in the 12th, and in various Scottish dioceses in the 12th and 13th centuries.

It would be outside the scope of a general article like the present to tabulate the numerous and frequently minute differences between a mediæval Sarum and the earlier Anglo-Saxon or contemporaneous Roman liturgy. They lie mainly in differences of collects and lections, variations of ritual on Candlemas, Ash Wednesday, and throughout Holy Week, the introduction into the canon of the mass of certain clauses and usages of Ephesine character or origin, the wording of rubrics in the subjunctive or imperative tense, the peculiar "Preces in Prostratione," the procession of Corpus Christi on Palm Sunday, the forms of ejection and reconciliation of penitents, etc. The varying episcopal benedictions as used in the Anglo-Saxon Church were retained, but the numerous proper prefaces were discarded, the number being reduced to ten.

Besides the famous and far-spreading use of Sarum, other uses, more local and less known, grew up in various English dioceses. In virtue of a recognized diocesan independence, bishops were able to regulate or alter their ritual, and to add special masses or commemorations for use within the limits of their jurisdiction. The better known and the more distinctive of these uses were those of York and Hereford, but we also find traces of, or allusions to, the uses of Bangor, Lichfield, Lincoln, Ripon, St. Asaph, St. Paul's, Wells, and Winchester.

Other Service Books.—The Eucharistic service was contained in the volume called the MISSAL (*q. v.*), as the ordinary choir offices were contained in the volume known as the BREVIARY (*q. v.*). But besides these two volumes there were a large number of other service books. Mr. Maskell has enumerated and described ninety-one such volumes in the use of the Western Church only. It must be understood, however, that many of these ninety-one names are synonyms (*Mon. Rit. Eccles. Anglic.*, 1846, vol. i. p. cxiv.). The list might be increased, but it will be possible here only to name and describe a few of the more important of them. (1) *Agenda* = *Rituale*. (2) The *Antiphonary* contained the antiphons sung at the canonical hours, and certain other minor portions of the service. (3) The *Benedictional* contained those triple episcopal benedictions previously described as used on Sundays and the chief festivals throughout the year. (4) The *Collectarium* contained the collects for the season, together with a few other parts of the day offices. It was an inchoate Breviary. (5) The *Epistolarium* contained the epistles, and (6) the *Evangelistarium* the gospels for the year. (7) The *Gradual* contained the introit, gradual, sequences, and the other portions of the communion service which at high mass were sung by the choir. (8) The *Legenda* contained the lections read at matins and at other times, and may be taken as a generic term to include the *Homiliarium*, *Martyrology*, *Passional*, and other volumes. (9) The *Manual* was the term usually employed in England to denote the *Rituale*. (10) The *Pontifical* contained the order of ordination, consecration, and such other rites as could, ordinarily, only be performed by the bishop. (11) The *Rituale* or *Ritual* comprised the occasional offices for baptism, marriage, burial, and those other offices which it ordinarily fell to the lot of the parish priest to execute. To these we must add a book which was not strictly a church office book, but a handy book for the use of the laity, and which was in very popular use, and often very highly embellished in the 14th to 16th century, the *Book of the Hours*, or *Horæ Beatæ Mariæ Virginis*. It contained portions of the canonical hours, litanies, the penitential psalms, and other devotions of a miscellaneous and private character.

The Eastern Church, too, possessed and still possesses numerous and voluminous office books, of which the chief are the following:—The *Euchologion*, containing the liturgy itself with the remaining sacramental offices bound up in the same volume; the *Horologion*, containing the unvarying portion of the Breviary, the *Menæa* being equivalent to a complete Breviary; the *Menologion*, or martyrology; the *Octoechus* and *Paracletice*, containing Troparia, and answering to the Western Antiphonary; the *Pentecostarion*, containing the services from Easter Day to All Saints' Sunday, as the *Triodion* contained those from Septuagesima Sunday to Easter eve. The *Typicum* was a general book of rubrics corresponding to the Ordinale or the Pie of Western Christendom.

PERIOD IV. *The Reformed Church.*—The liturgy of the English Church passed through a more marked phase of change in the 16th century than during any of those periods which we have briefly described. The desire for some reform, and the sense of its necessity, which had been manifesting itself in various ways for more than a century and a half, culminated in the reign of Edward VI., and caused the appearance, with the full sanction of church and state, of the First Prayer Book of Edward VI. which was published on March 7, 1549, and came into general use on the feast of Whitsunday, June 9, 1549. Without attempting to enumerate particular points, we will summarize the general features which marked this change, and will exhibit the gains of such a reform, which, from an Anglican point of view, constitute its complete justification.

(*a*) Simplification in the number and character of books required for divine service. The Prayer Book is a compendium of most of the volumes which have been recently named and described. Its matins and evensong are a compilation from the Breviary; the office of Holy Communion, with the collects, epistles, and gospels, is a translation and adaptation of the missal; the occasional offices represent the ritual or manual, and the offices of confirmation and of ordination are taken, with modification, from the pontifical.

(*b*) The removal from the service of a vast quantity of legendary matter which was read in the form of lections, and which was objectionable partly because it was unhistorical, partly because it was ludicrous and almost profane. As an instance of unhistorical matter, we quote a passage from the fourth lection for the festival of St. Silvester, December 31, bishop of Rome, 314-335:—

> "In which office of the priesthood he (Silvester) distinguished himself above the rest of the clergy, and afterwards succeeded Melchiades on the papal throne in the reign of Constantine. That emperor suffered from leprosy, and, in order to cure himself, by the advice of his physicians he ordered a bath to be prepared of infants' blood. But the holy apostles Peter and Paul appeared to him in private, and told him that, if he wished to be free from his leprosy, he should abandon the mad plan of an impious bath, and send for Silvester dwelling in seclusion at Mount Soracte, that by him the emperor should be refreshed in the bath of salvation, and should order temples to be built in every province of the Roman empire after the fashion of the Christians, and that he should do away with the images of vain deities, and institute the worship of the true God. Constantine, therefore, in obedience to the divine warnings, made diligent search for and summoned Silvester, by whom, recognising the description of the apostles, he was baptized, and incited to defend and extend the Christian religion."

This lection retains its position in the present Roman Breviary, although its unhistorical character can be abundantly proved and is generally acknowledged. The Breviary in fact is still, and was even more so then, full of legends which once passed for but have long since been abandoned as history.

As examples of the ludicrous we quote the first lection for the festival of St. Fœlanus from the Aberdeen Breviary of 1509, fol. xxvi., and the eighth lection for the festival of St. Serf from the same Breviary (July 2, fol. xvi.):—

> "He (Fœlanus) was born, as it was foretold of him, with a stone in his mouth, on account of which he was so despised by his father that he was ordered immediately after his birth to be thrown into a neighboring pond and drowned. In this pond he was miraculously nourished by angels for a whole year. But after the lapse of a year he was found by Bishop Ibarus, to whom a divine revelation of the fact had been given, playing among the angels. He was taken out of the pond safe and sound, was baptized, and afterwards became distinguished in sacred literature."
>
> "A certain robber carried off one day a sheep which used to live and feed in the house of St. Serf, and killed it and ate it. Diligent inquiry was made for the thief but without success. At length suspicion fell on the robber, and he hastened into St. Serf's presence, prepared to deny the accusation with an oath. He swore a big oath that he was innocent of the charge laid against him, when, wonderful to relate (a fact which would not be believed on merely human testimony), the sheep which had lately been eaten began to baa in the stomach of the robber. Whereupon in confusion the man fell prostrate to the ground, and humbly asked for pardon, and the saint prayed for him."

There was also a quantity of objectionable matter introduced by a process of adaptation, or sometimes, as it was technically termed, by a process of farsing, into the older prayers. The Gloria in Excelsis in the Sarum Missal is printed thus (Burntisland edit., 1861, p. 586)—the farsed words are represented by italics:—

"Qui tollis peccata mundi, suscipe deprecationem nostram, *ad Mariæ gloriam*. Qui sedes ad dexteram Patris, miserere nobis. Quoniam tu solus sanctus, *Mariam sanctificans*. Tu solus Dominus, *Mariam* gubernans. Tu solus altissimus, *Mariam coronans*, Jesu Christe, cum Sancto Spiritu in gloria Dei Patris. Amen."

(*c*) For the first time, so far as can be ascertained, in the history of the English Church, the vernacular tongue was employed.

(*d*) The numerous litanies to and invocations of the saints, especially of the Virgin Mary, were expunged.

(*e*) There was a very great extension of the portion of Holy Scripture read in divine service, partly by the excision of non-Scriptural matter, partly by the lengthening of lessons which sometimes consisted only of one or two verses, so "that many times there was more business to find out what should be read than to read it when it was found out."

(*f*) There was a general simplification of the services, by the reduction of the number of saints' days, by the cutting away of anthems, invitatories, and responds, by the compression of the seven canonical hours into the two daily services of matins and evensong, etc.

(*g*) The various offices for the dead were abolished, and numerous prayers which involved a belief in the mediæval idea of the penal flames of purgatory made way for the present burial office and the commemoration of the departed in the Eucharistic service.

The first reformed Prayer Book of 1549 remained in use till 1552, when by Act of Uniformity passed on April 6 it was ordered that a further reformed Prayer Book should come into general use on the feast of All Saints (November 1) following. This second Prayer Book, commonly spoken of as the Second Prayer Book of King Edward the VI., marks the furthest point in the Puritan direction which was ever reached by the liturgy of the Church of England. An idea of its character may be gained by mentioning some of the features retained in the first and discarded in the Second Prayer Book, and some of the features added in the Second but absent from the First Prayer Book.

In the former class are—(*a*) the sign of the cross used in consecration, confirmation, marriage, and visitation of the sick; (*b*) the use of exorcism, chrisom, and chrism in baptism; (*c*) unction of the sick; (*d*) certain prayers for the dead, and a special Eucharist for funerals; (*e*) the mention of vestments with albs and tunics for Eucharistic use, and of the pastoral staff and cope for bishops; (*f*) the ceremonies of crossing and knocking on the breast left optional; (*g*) the invocation of the Holy Ghost before consecration; (*h*) the mixed chalice; (*i*) directions to communicants to receive the consecrated bread in their mouths, and for reservation for the sick. In the latter class are—(*a*) the addition of the Scriptural sentences, exhortation, confession, and absolution before morning and evening prayer; (*b*) the addition of the Jubilate, Cantate, and Deus Misereatur as alternative canticles; (*c*) the words "commonly called the mass" omitted from the title of Holy Communion; (*d*) the words "militant here on earth" added to the title of the prayer for the whole state of Christ's Church; (*e*) the decalogue introduced at the commencement of the communion service; (*f*) the second clause in the formula of sacramental distribution was substituted for the first, the two being subsequently combined in 1559. These are merely samples out of many more points which might be named.

It has not been ascertained that this Prayer Book ever received the sanction of Convocation, and it probably never came into complete use. Such use was in any case short-lived, for Edward VI. died on July 6, 1553, and the English Prayer Book was abolished and the Latin missal restored to use by one of the first Acts of Queen Mary, in October, 1553. Queen Mary died on November 17, 1558, and another complete change of policy took place. The reformed Prayer Book was brought into use again on June 24, 1559, not in the exact shape which it bore in 1552, but with various modifications, which we forbear to enumerate in detail. It may be said of them, as of the various alterations introduced subsequently into the Prayer Book, that their general tendency was conservative rather than destructive, and in a Catholic rather than in a Protestant direction. The next important revision of the Prayer Book took place in 1604, under James I., after the Hampton Court Conference, and in 1661–2, after the restoration of Charles II. The Book of Common Prayer had been abolished under the Commonwealth, and it could only be used under the risk of heavy penalties from 1645 to 1661. It was now restored with a considerable number of additions and alterations, after having been discussed without any satisfactory result between churchmen and Puritans at the Savoy conference in 1661. When these had received the sanction of the Convocations of Canterbury and York, it was attached to an Act of Uniformity which received the royal assent on May 19, 1662, by the provisions of which Act it came into general use on St. Bartholomew's Day, August 24, 1662. Since that date although various slight changes have been made in recent years, nothing has been done amounting to a revision or new edition of the Prayer Book, or demanding notice in these columns.

A few words are added about other national versions of the reformed liturgy.

The Liturgy of the Scottish Episcopal Church.—This liturgy in nearly its present form was compiled by Scottish bishops in 1636, and imposed, or, to speak more accurately, attempted to be imposed upon the Scottish people by the royal authority of Charles I. in 1637. The prelates chiefly concerned in it were Spottiswood, bishop of Glasgow; Maxwell, bishop of Ross; Wedderburn, bishop of Dunblane; and Forbes, bishop of Edinburgh. Their work was approved and revised by certain members of the English episcopate, especially Laud, archbishop of Canterbury, Juxon, bishop of London; and Wren, bishop of Norwich. This liturgy has met with varied fortune, and passed through several editions. It is now used as an alternative form with the English communion office in the Scottish Episcopal Church.

Among its more noteworthy features are—(*a*) the retention in its integrity and in its primitive position after the words of institution, of the invocation of the Holy Spirit;[1] (*b*) the reservation of the sacrament is permitted for the purpose of communicating the absent or the sick; (*c*) the mixed chalice is explicitly ordered; (*d*) the minimum number of communicants is fixed at one or two, instead of three or four. The general arrangement of the parts approximates more closely to the First Prayer Book of Edward VI. than to the present Anglican Book of Common Prayer.

The American Liturgy.—The Prayer Book of the "Protestant Episcopal Church" in America was adopted by the General Convention of the American Church held in 1789. It is substantially the same as the English Book of Common Prayer, but among the more important variations we may name the following:—(*a*) the arrangement and wording of the communion office rather resembles that of the Scottish than of the Anglican liturgy, especially in the position of the oblation and invocation immediately after the words of institution; (*b*) the Magnificat, Nunc Dimittis, and Athanasian creed are disused; (*c*) ten selections of psalms are appointed to be used as alternatives for the psalms of the day. In addition to these there are various verbal and other unimportant alterations.

The Irish Prayer Book.—The Prayer Book in use in the Irish portion of the United Church of England and Ireland was the Anglican Book of Common Prayer, but after the disestablishment of the Irish Church several changes were introduced into it by a synod held in Dublin in 1870. These changes included (*a*) the excision of all lessons from the Apocrypha, (*b*) of the rubric ordering the recitation of the Athanasian creed, (*c*) of the rubric ordering the vestments of the second year of Edward VI., (*d*) of the form of absolution in the office for the visitation of the sick, (*e*) the addition of one question and answer in the Church Catechism, bringing out more clearly the spiritual character of the real presence.

The Presbyterian Church.—The Presbyterian churches of Scotland at present possess no liturgy properly so called. Certain general rules for the conduct of divine service are contained in the "Directory for the Public Worship of God," agreed upon by the Assembly of Divines at Westminster, with the assistance of commissioners from the Church of Scotland, approved and established by an Act of the General Assembly and by an Act of Parliament, both in 1645. In 1554, John Knox had drawn up an order of liturgy, closely modelled on the Genevan pattern, for the use of the English congregation to which he was then ministering at Frankfort. On his return to Scotland this form of liturgy was adopted by an Act of the General Assembly in 1560, and became the established form of worship in the Presbyterian Church, until the year 1645, when the Directory of Public Worship took its place. Herein regulations are laid down for the conduct of public worship, for the reading of Scripture, and for extempore prayer before and after the sermon and in the administration of the sacraments of baptism and the Lord's supper, for the solemnization of marriage, visitation of the sick, and burial of the dead, for the observance of days of public fasting and public thanksgiving, together with a form of ordination, and a directory for family worship. In all these cases, although the general tenor of the prayer is frequently indicated, the wording of it is left to the discretion of the minister, with these exceptions:—at the act of baptism this formula must be used—"I baptize thee in the name of the Father, and of the Son, and of the Holy Ghost;" and for the Lord's Supper these forms are suggested, but with liberty to the minister to use "other the like, used by Christ or his apostle upon this occasion:"—

"According to the holy institution, command, and example of our blessed Saviour Jesus Christ, I take this bread, and, having given thanks, break it, and give it unto you. Take ye, eat ye; this is the body of Christ which is broken for you; do this in remembrance of him." And again; "According to the institution, command, and example of our Lord Jesus Christ, I take this cup and give it unto you; this cup is the New Testament in the blood of Christ, which is shed for the remission of the sins of many; drink ye all of it."

There is also an unvarying form of words directed to be used before the minister by the man to the woman and by the woman to the man in the case of the solemnization of matrimony. The form of words on all other occasions, including ordination, is left to the discretion of the officiating minister, or of the presbytery.

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[1] The present clause runs thus:—"And we most humbly beseech thee O merciful Father to hear us, and of Thy almighty goodness vouchsafe to bless and sanctify with Thy word and Holy Spirit these and Thy gifts and creatures of Bread and Wine, that they may become the Body and Blood of Thy most dearly-beloved Son." This petition is found in the Eastern but not in the Roman or Anglican liturgies.

Continental Protestant Churches. The Calvinistic Churches.—Rather more of the liturgical element, in the shape of a set form of words, enters into the service of the French and German Calvinistic Protestants. The Sunday morning service, as drawn up by Calvin, was to open with a portion of Holy Scripture and the recitation of the Ten Commandments. Afterwards the minister, inviting the people to accompany him, proceeded to a confession of sins and supplication for grace. Then one of the Psalms of David was sung. Then came the sermon, prefaced by an extempore prayer and concluding with the Lord's Prayer, creed, and benediction. The communion service began with an exhortation leading up to the apostles' creed; then followed a long exhortation, after which the bread and cup were distributed to the people, who advanced in reverence and order, while a Psalm was being sung or a suitable passage of Scripture was being read. After all had communicated, a set form of thanksgiving was said by the minister. Then the hymn of Simeon was sung by the congregation, who were then dismissed with the blessing. This form of service has been modified in various ways from time to time, but it remains substantially the type of service in use among the Reformed Churches of Germany, Switzerland, and France.

The Lutheran Church.—Luther was far more conservative than the rest of the Protestant Reformers, and his conservatism appeared nowhere more than in the service books which he drew up for the use of the church which bears his name. In 1523 he published a treatise *Of the Order of the Service in the Congregation*, and in 1526 he published the *German Mass*. Except that the vernacular was substituted for the Latin language, the old framework and order of the Roman missal were closely followed, beginning with the Confiteor, Introit, Kyrie Eleison, Gloria in Excelsis, etc. The text of this and other Lutheran services is given in *Agende für christliche Gemeinden des lutherischen Bekenntnisses*, Nördlingen, 1853. At the same time Luther was tolerant, and expressed a hope that different portions of the Lutheran Church would from time to time make such changes or adaptations in the order of service as might be found convenient. The Lutheran Churches of northern Europe have not been slow to avail themselves of this advice and permission. Most of them have drawn up liturgies for themselves, sometimes following very closely, sometimes differing considerably from the original service composed by Luther himself. In 1822, on the union of the Lutheran and Reformed (Calvinistic) Churches of Prussia, a new liturgy was published at Berlin. It is used in its entirety in the chapel royal, but great liberty as to its use was allowed to the parochial clergy, and considerable variations of text appear in the more recent editions of this service book.

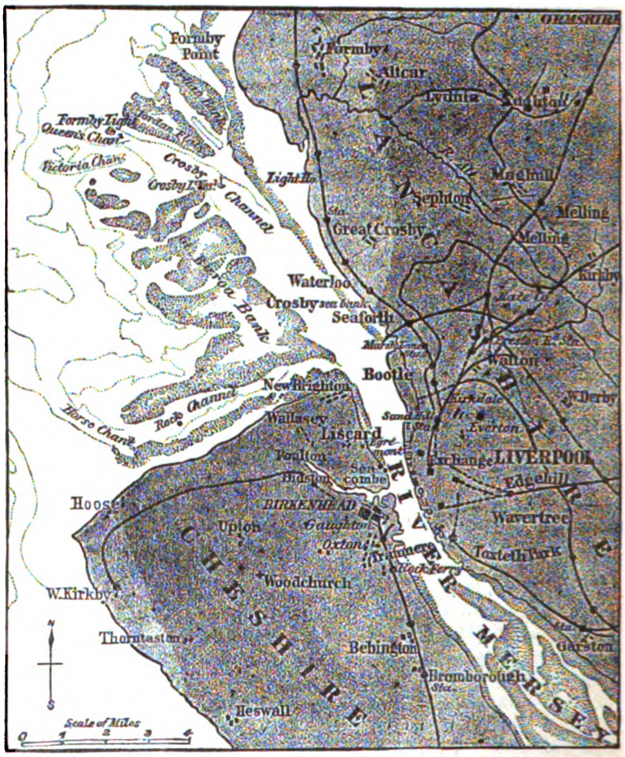
The Swedenborgians, Irvingites, and other Protestant bodies have drawn up liturgies for themselves, but they are hardly of sufficient historical importance to be described at length here.

The Old Catholics, lastly, published a *Rituale* in 1875 containing the occasional offices for baptism, matrimony, burial, etc., and a form for reception of holy communion, in the German language. The latter is for temporary use in anticipation of a revised and not yet published missal, corresponding to the order of communion in English published March 8, 1548, in anticipation of the complete office in the Prayer Book of 1549. (F. E. W.)

LIUTPRAND (*c.* 922–972), Italian chronicler, was born towards the beginning of the 10th century, of a good Lombard family. The name is sometimes spelled Liudprand and even Luitprand. In 931 he entered the service of King Hugo of Italy as page; he afterwards rose to a high position at the court of Hugo's successor Berengarius, having become chancellor, and having been sent (949) on an embassy to the Byzantine court. Falling into disgrace with Berengarius, he attached himself to the emperor Otto I., whom in 961 he accompanied into Italy, and by whom in 962 he was made bishop of Cremona. He was frequently employed in missions to the pope, and on two occasions (968, 971) to Byzantium to negotiate on behalf of the younger Otto (afterwards Otto II.) for the hand of Theophano. Liutprand died in 972.

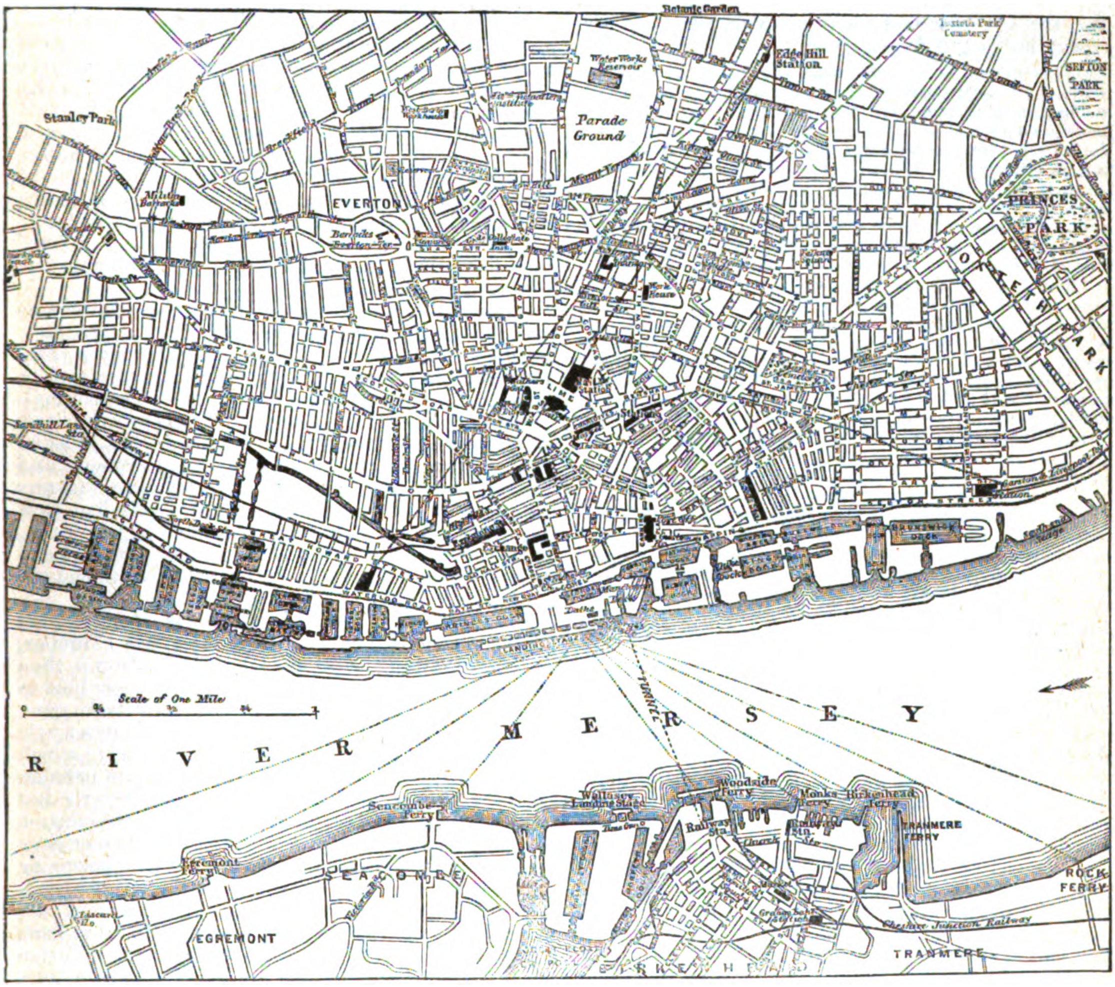
He wrote (1) *Antapodoseos, seu rerum per Europam gestarum, Libri VI.*, an historical narrative, relating to the events from 887 to 949, compiled, as its name almost implies, with the object of avenging himself upon Berengarius and Willa his queen; (2) *Historia Ottonis*, unfortunately covering only the years from 960 to 964; and (3) *Relatio de Legatione Constantinopolitana* (968–969). All are to be found in the *Monum. Germ. Hist.* of Pertz, and in the *Rer. Ital. Script.* of Muratori; there is a recent edition by Dümmler (1877); and a partial translation into German, with an introduction by Wattenbach, is given in the second volume of the *Geschichtschreiber der Deutschen Vorzeit* (1853). Compare Wattenbach, *Deutschlands Geschichtsquellen im Mittelalter* (3d ed., 1873). Three other works, entitled *Adversaria*, *Chronicon* (606–960), and *Opusculum de vitis Romanorum pontificum*, are usually, but wrongly, assigned to Liutprand.

LIVERPOOL, a city and seaport of England, in the hundred of West Derby, in the county palatine of Lancaster, is situated on the right bank of the estuary of the Mersey, about three miles from the open sea. The form of the city is that of an irregular semicircle, having the base line formed by the docks and quays extending about six miles along the east bank of the estuary, which here runs nearly north and south, and is about a mile in breadth. On the north the city is bounded by the borough of Bootle, along which the line of docks is continued. The area of the city is 5210 acres.



Port of Liverpool.

General Aspect and Features.—The subsoil of Liverpool is the Bunter stratification of the New Red Sandstone, overlying the Coal-measures, which rise up some distance to the eastward. In the lower districts there is a deposit of boulder clay, which has been extensively used for the manufacture of bricks. The sandstone rises in long ridges to the eastward, in the highest points about 250 feet above the sea-level. The city therefore lies on a continuous slope varying in gradient, but in some districts very steep. Exposed to the western sea breezes, with a dry subsoil and excellent natural drainage, the site is naturally salubrious, but neglect and perverseness have in past times done much to neutralize these advantages. The old borough, lying between the pool and the river, was a conglomeration of narrow alleys and mean houses packed together without any regard to sanitary provisions; and during the 16th and 17th centuries it was several times visited by the plague, which carried off many of the inhabitants. When the town burst its original limits, and expanded up the slopes beyond, a better state of things began to exist. The older parts of the town have at successive periods been entirely taken down and renovated. The streets of shops—Church Street, Bold Street, etc.—are equal in display to similar establishments in London. The commercial part of the city is remarkable for the number of palatial-looking piles of offices, built of hewn stone, principally in the Italian Renaissance style, amongst which the banks and insurance offices stand pre-eminent. The demand for cottages about the beginning of the present century led to the construction of what are called "courts," being narrow *culs de sac*, close packed, with no thorough ventilation. This, combined with the degraded habits of a population brought together indiscriminately, resulted in a very high rate of mortality, to contend with which enormous sums have been expended in sanitary reforms of various kinds. The more modern cottages, erected on the higher grounds, are all that can be desired for that class of habitation.



Plan of Liverpool.

Parks.—The public parks of Liverpool now form a prominent feature in the aspect of the town. The earliest, the Prince's Park, was laid out in 1843 by private enterprise. Sefton Park, the most extensive, containing about 400 acres, was commenced in 1865, and completed at a cost of £410,000. A large portion of the land round the margin has been leased for the erection of villas. Wavertree, Newsham, Sheil, and Stanley Parks have also been constructed at the public expense. Connected with Wavertree Park are the botanic gardens, with the usual plant houses, and a large and lofty palm house. The suburbs are rapidly extending, and those on the south contain many good private residences. A boulevard, about a mile in length, planted with trees in the centre, leads to the entrance to Prince's Park.

Public Buildings.—The old town has been so completely renovated during the present century that scarcely any of the public buildings date from an earlier period.

The earliest, and in many respects the most interesting, is the town-hall in Castle Street. This was erected from the designs of John Wood, the architect of the squares and crescents of Bath, and was opened in 1754. The building has since undergone considerable alterations and extensions, but the main features remain unchanged. It is a classical rectangular stone building in the Corinthian style, with an advanced portico in front, and crowned with a lofty dome surmounted by a seated statue of Minerva. The interior was destroyed by fire in 1795, and was entirely remodelled in the restoration. It now contains a splendid suite of apartments, including a ball-room about 100 feet by 60, approached by a noble staircase. The building is occupied by the mayor as the municipal mansion house. A range of municipal offices was erected in Dale Street in 1860. The building is in the Palladian style, of considerable extent and imposing design, with a dominating tower and square pyramidal spire.

The crowning architectural feature of Liverpool is St. George's Hall, completed in 1854. The original intention was to erect a music hall suited for the triennial festivals which had been periodically held in the town. About the same time the corporation proposed to erect law courts for the assizes, which had been transferred to Liverpool and Manchester. In the competitive designs, the first prize was gained in both cases by Harvey Lonsdale Elmes. He was employed to combine the two objects in a new design, of which the present building is the outcome.

The structure is one of which the city may well feel proud, and notwithstanding some defects it will always hold a high and honorable place amongst the erections of modern times. It is fortunate in its situation, occupying the most central position in the town, and surrounded by an area sufficiently extensive to exhibit its proportions to the best advantage. Another advantage it possesses is that of size; there are few buildings in the country, forming a solid mass under one roof, which surpass it in dimension. The plan is simple in arrangement, and easily described. The centre is occupied by the great hall, 169 feet in length, and, with the galleries, 87 feet wide and 74 feet high, covered with a solid vault in masonry. Attached to each end, and opening therefrom, are the law courts. A corridor runs round the hall and the courts, communicating with the various accessory rooms. Externally the east front is faced with a fine portico of sixteen Corinthian columns about 60 feet in height. An advanced portico of similar columns fronts the south end crowned with a pediment filled with sculpture, with the inscription—

"Artibus, Legibus, Consiliis
Locum Municipia Constituerunt
Anno Domini MDCCCXLI."

The style is Roman, but the refinement of the details is suggestive of the noblest period of Grecian art.

The great hall is finished with considerable richness in polished granite columns, marble balustrades and pavements, polished brass doors with rich foliated tracery, etc. The organ, built by Messrs. Willis of London, from the specification of Dr. Samuel Wesley, is equal to any in the country for extent, power, and beauty of tone. Mr. Elmes, a young architect of great promise, having died during the progress of the work, the building was completed by the late Mr. C. R. Cockerell, R. A.

Next to the public buildings belonging to the city, the most important is the exchange, forming three sides of a quadrangle, adjoining the town-hall on the north side. The town-hall was originally built to combine a mercantile exchange with municipal offices, but the merchants perversely preferred to meet in the open street adjoining. This, with other circumstances, led to the erection of the new exchange, a building of considerable merit, which was commenced in 1803 and opened in 1808. It had scarcely been in use for more than fifty years when it was found that the wants of commerce had outstripped the accommodation, and the structure was taken down to make room for the present building, in which greater convenience has been attained, with considerable sacrifice of æsthetic effect.

The revenue buildings, commenced in 1828, on the site of the original Liverpool Dock, combine the customs, inland revenue, post-office, and dock board departments. It is a huge heavy structure, with three advanced porticoes in the Ilyssus Ionic style. Near by stands the sailors' home, a large building in the Semi-Gothic or Elizabethan style.

The Philharmonic Hall in Hope Street, with not much pretension externally, is one of the finest music rooms in the kingdom; it accommodates an audience of about 2500.

The group of buildings forming the free public library, museum, and gallery of art are finely situated on the brow of the slope opposite St. George's Hall. The library and gallery of art are separate buildings connected by the circular reading-room in the middle. The latter possesses some novelties in construction, having a circular floor 100 feet in diameter without columns or any intermediate support, and a lecture-room underneath, amphitheatrical in form, with grades or benches hewn out of the solid rock.

Railways.—There are three passenger stations in Liverpool, the London and North-Western, the Lancashire and Yorkshire, and the combined station of the Midland, Great Northern, and Manchester and Sheffield. The rapid increase of traffic has led to large extensions of the North-Western, and a very large addition to the Lancashire and Yorkshire is in progress (1882). The tunnel under the Mersey now in course of construction will give access for the Great Western and Cumbrian systems into Liverpool.

Water and Gas Supply.—The original supply of water was from wells in the sandstone rock, but in 1846 an Act was passed, under which extensive works were constructed at Rivington, about 25 miles distant, by which a much larger supply was obtained. The vast increase of population led to further requirements, and in 1880 another Act gave power to impound the waters of the Vyrnwy, one of the affluents of the Severn. This scheme, which it is expected will give a copious supply for many years to come, is now being carried out. The gas-works are the property of a company. Efforts have been made to effect a purchase by the city, but hitherto without success.

Administration of Justice.—The city has quarter sessions for criminal cases, presided over by the recorder, but the sessions are really held eight times in the year. The court of passage for civil cases is a very ancient institution, dating from the foundation of the borough by King John, originally intended for cases arising out of the imports and exports passing through. Its jurisdiction has been confirmed and settled by parliament, and it is now competent, by consent, to try causes to any amount. The mayor is nominally the president, but the actual judge is an assessor appointed by the crown. There are two police courts which sit daily, one presided over by the lay magistracy, the other by the stipendiary magistrate.

Ecclesiastical.—The parish, which was separated from Walton-on-the-Hill in 1699, contained two churches, St. Nicholas, the ancient chapel, and St. Peter's, then built. There were two rectors, the living being held in medieties. Of recent years changes have been sanctioned by parliament. The living is now held by a single incumbent, and a large number of the churches which have since been built have been formed into parishes by the ecclesiastical commissioners. St. Peter's has been constituted the pro-cathedral, pending the erection of a more suitable building. Besides the two original parish churches, there are sixty-seven others belonging to the establishment.

The Roman Catholics form a very numerous and powerful body in the city, and it is estimated that from a third to a fourth of the entire population are Catholics. A large part of these are Irish settlers or their descendants, but this district of Lancashire has always been a stronghold of Catholicism, many of the landed gentry belonging to old Catholic families.

Charities.—These are numerous, and are maintained with no niggardly hand. The earliest foundation is the Blue Coat hospital, established in 1708, for orphans and fatherless children born within the borough. The building, erected in 1717, is a quaint and characteristic specimen of the architecture of the period. It now maintains two hundred and fifty boys and one hundred girls. There is an orphan asylum, established in 1840, for boys, girls, and infants, and a seamen's orphan asylum, commenced in 1858, for boys and girls. The Roman Catholics have similar establishments. The medical charities are large and flourishing. The royal infirmary has had a school of medicine attached, which has been very successful, and is now merged in the new University College. The medical charities are aided by simultaneous collections in the churches and chapels on łospital Sunday," the first Sunday in the year, the ɔunt averaging about £10,000.

iterature, Art, and Science.—The free library, mu- m, and gallery of arts, established and managed by city council, was originated in 1850. The library lding was erected by Sir William Brown at a cost of),000. The Derby museum, containing the collec- s of Edward, the thirteenth earl, were presented by son. The Mayer museum of historical antiquities art was contributed by Mr. Joseph Mayer, F. S. A. Andrew Walker erected the art gallery which bears name at an expense of £35,000. The Picton cir- ar reading-room, and the Rotunda lecture-room were lt by the corporation at the cost of £25,000. The ary contains nearly 100,000 volumes. An annual iibition of paintings has been established, the sales m which average about £12,000 per annum. A manent gallery has also been formed, which is now ng enlarged at a cost of about £12,000.

he literary and philosophical society was established 1812, and still flourishes. There are also philomathic, logical, chemical, historic, and various other societies the cultivation of almost every branch of knowledge l inquiry. An art club has been established with at success, and possesses an excellent club-house and lery. The royal institution, established by Roscoe 1817, possesses a fine gallery of early art, and is centre of the various literary institutions of the m.

Education.—Elementary education has always met h cordial support in Liverpool, and is now carried on h vigor by the school board, supplemented by vol- tary schools. For middle class and higher education re have existed for many years three institutions. ich have been very successful, viz., the school at- hed to the royal institution, the collegiate institution Shaw Street, and the Liverpool institute high school. further effort has been successfully made resulting in foundation of University College, the inaugural eting of which was held on January 14, 1882. This lege is affiliated to the Victoria university of the north- st of England. The sum of £135,000 has been sed by voluntary subscription, to which £30,000 have n contributed by the corporation. Seven chairs been lowed, and professors appointed, and a suitable ilding has been provided.

Recreation and Social Life.—There are eight atres, besides many minor music halls and places of usement. The most fashionable and exclusive is Philharmonic Hall, which is a large handsome ilding open only to proprietors, where concerts take ce every fortnight during the season. The Philhar- nic concerts, and the balls at the Wellington Rooms e Almacks of Liverpool), afford the principal oppor- ities for the gatherings of the fashionable world. e Alexandra theatre, the new Court theatre, the ince of Wales theatre, and Hengler's cirque are all t could be desired in point of decoration and the *e en scene.* The minor houses are conducted on the ole with great propriety and success.

Population.—According to the census of 1881 (pre- inary report) the number of inhabitants within the rliamentary and the municipal borough—the limits which are conterminous—amounted to 552,425 per- s, 271,640 being males and 280,785 females. At end of the 17th century the population of Liver- ol was 5145, but since then it has steadily increased follows:—

1710	8,168	1811	94,376
1720	10,446	1821	135,000
1753	22,000	1831	205,572
1769	34,000	1871	488,845
1785	41,000	1881	552,425
1801	77,653		

If the boroughs of Bootle and Birkenhead, which component parts of the port, are included, Liver- ol has now a population of about three quarters of a llion.

Trade and Commerce.—The progress of the commerce of Liverpool during the present century is almost without a parallel. In 1800 the tonnage of ships entering the port was 450,060; in 1880 it reached 7,933,620 tons. In 1800 4746 vessels entered, averaging 94 tons; in 1880 there were 20,249, averaging 440 tons. The only British port which can at all come into competition with Liverpool is London, the total trade of which, comprising exports and imports, amounted in 1880 to 16,479,108 tons, against 14,496,364 in Liverpool. A large proportion of this, however, is a coasting trade, indicated by the smaller size of the ships, averaging 240 tons each in London as compared with 440 tons in Liverpool. The coasting trade in Liverpool has rather fallen off owing to the superior advantages of railway traffic. The proportion of steamers to sailing ships has very largely increased of late years. The return for 1881 gives 5,534,462 tons of steam navigation to 2,379,466 tons in sailing ships. If we take the value of the imports as a criterion, London is far in advance of Liverpool, the values in 1880 being £141,442,907 and £107,460,187, but the London imports consist, to a great extent, of very valuable commodities, such as tea, silk, indigo, wines, etc., whilst the Liverpool imports principally consist of grain, food, and raw produce, the materials for manufacture. If we looks at the exports the balance is reversed, Liverpool, in 1880, having exported the value of £84,029,651, against £52,600,929 from London. In the number of ships registered as belonging to the port, Liverpool stands first in the world, the tonnage belonging to Liverpool being 1,554,871, against 1,120,359 in London, and 1,005,894 in the whole of the ports on the Clyde.

The commerce of Liverpool extends to every part of the world, but probably the intercourse with America stands pre-eminent, there being five lines of steamers to New York alone, besides lines to Philadelphia, Boston, Halifax Canada, New Orleans, etc. The size of the ships has greatly increased, having reached 8000 tons burden, with 10,000 horse-power.

The imports into Liverpool comprise produce of every description from every region under the sun. Cotton, however, is the great staple, almost the whole trade of the commodity centring here. Grain comes next, American and Australian corn occupying a large proportion of the market. Within the last few years an enormous trade in American provisions, including live cattle, has sprung up. Tobacco has always been a leading article of import into Liverpool, along with the sugar and rum from the West Indies. Timber, principally from Canada, forms an important part of the imports, the stacking yards extending for miles along the northern docks. At one time tea from China, and wool from Australia, promised to be imported with advantage, but the financial arrangements with London have drawn these trades almost entirely away. In regard to exports, Liverpool possesses decided advantages; lying so near the great manufacturing districts of Lancashire and the West Riding of Yorkshire, this port is the natural channel of transmission for their goods and, if everything else fails, there are always coal and salt from Wales and Cheshire ready to make up a cargo. The consequence is that many ships, after discharging their homeward cargoes at London and the eastern ports, come round in ballast to Liverpool for an outward cargo.

Manufactures.—The manufactures of Liverpool are not extensive. Attempts have been repeatedly made to establish cotton-mills in and near the city, but have resulted in uniform failure. Engineering works, especially as connected with marine navigation, have naturally grown up, and have been carried on successfully on a large scale. Shipbuilding, in the days of the old wooden walls, in the early part of the present century, was active and prosperous, several frigates and sloops-of-war for Government having been built here, but the keen competition of the Clyde and the north of England drew away a large portion of the trade. There are now four shipbuilding establishments on the Mersey. In the year 1880–81 there were launched from these yards thirty-three iron ships, with a tonnage of 53,971 tons. At one period the soap manufacture filled a large space in the industry of Liverpool, but it has almost entirely departed. During the latter half of last century and the beginning of the present, the pottery and china manufacture flourished in Liverpool. John Sadler, a Liverpool manufacturer, was the inventor of printing on pottery, and during the early period of Josiah Wedgwood's career, all his goods which required printing had to be sent to Liverpool. A large establishment, called the Herculaneum Pottery, was founded in a suburb on the banks of the Mersey, and was carried on with success for many years, but the whole trade has long disappeared. One manufacture, established at an early period, still continues to flourish—the watch and chronometer trade. Litherland, the inventor of the lever watch, was a Liverpool manufacturer, and Liverpool-made watches have always been held in high estimation. There are several extensive sugar refineries, and two large tobacco manufactories.

Docks.—The docks of Liverpool on both sides of the Mersey are under the same trust and management, and equally form part of the port of Liverpool. On the Liverpool side they extend along the margin of the estuary 6½ miles, of which 1½ miles is in the borough of Bootle. The Birkenhead docks have not such a frontage, but they extend a long way backward. The water area of the Liverpool docks and basins is 333½ acres, with a lineal quayage of 22 miles. The Birkenhead docks, including the great float of 120 acres, contain a water area of 160 acres, with a lineal quayage of 9 miles. The system of floating docks was commenced by the corporation in 1709. With the advancing demands of commerce the docks were extended north and south. They constituted from the first a public trust, the corporation never having derived any revenue from them, though the common council of the borough were the trustees, and in the first instance formed the committee of management. Gradually the dock ratepayers acquired influence, and were introduced into the governing body, and ultimately, by the Act of 1856, the corporation was entirely superseded. Under the present constitution, the management is vested in the Mersey Docks and Harbor Board, consisting of twenty-eight members, two of whom are nominated by the Board of Trade and the rest elected by the dock ratepayers, of whom a register is kept and annually revised. The affairs of the board are of considerable magnitude. The revenue is derived from tonnage rates on ships, dock rates on goods, town dues on goods, with various minor sources of income. These amounted in the year ending July 1, 1881, to £1,226,497. The amount of debt outstanding is £16,284,881, for which a rate of interest averaging 4½ per cent. is paid.

Down to 1843 the docks were confined to the Liverpool side of the Mersey. Several attempts made to establish docks in Cheshire had been frustrated by the Liverpool corporation, who bought up the land and kept it in their own hands. In 1843 a scheme was privately concocted for the construction of docks at Birkenhead. Plans were prepared by Mr. Rendel, C. E., the money subscribed, and arrangements made with the Admiralty,—the corporation being kept in ignorance of the proceedings. Application was then made by private individuals to purchase 200,000 square yards of land on the margin of an inlet called Wallasey Pool. The common council, which had been reformed in 1836, innocently fell into the snare, and in the ensuing session of parliament a rival scheme of docks for Birkenhead was brought out and passed. The great expectations which were entertained of their successful competition with Liverpool have been signally falsified. After a twelve years' struggle and litigation, the Birkenhead dock affairs had fallen into a hopeless state of insolvency, without any prospect of recovery, and in 1855 the docks were transferred to the corporation of Liverpool on payment to the bondholders of 13s. in the pound on their claims. Under the Act of 1856, settling the future constitution of the dock board, the Birkenhead docks were transferred to the Mersey Docks and Harbor Board. The result on the whole has been disastrous. The amount expended on the Birkenhead docks down to 1881 has been nearly 6 millions. The returns for this immense outlay do little more than defray the working expenses, the difference having to be made up from the revenue on the Liverpool side,—so that, in consequence of this unfortunate rivalry, the shipping frequenting the port is taxed to the amount of £270,000 per annum, which otherwise might have been remitted. The Birkenhead great float, of 120 acres, though it contributes little to the revenue, is valuable as a depôt for ships lying up, so as not to interfere with the working docks. In addition to the floating docks, there are in Liverpool eighteen graving docks and three in Birkenhead, and two gridirons on the Liverpool side.

The great landing stage of Liverpool is unique in its dimensions and utility. It was originally constructed in 1857, from the plans of Mr. J. Cubitt, and greatly enlarged and extended in 1874, making the entire cost £373,000. The grand fabric had just been completed, and was waiting to be inaugurated by the duke of Edinburgh, when on the 28th July, 1874, it accidentally caught fire, and, the timber being impregnated with kreosote, the flames spread with unexampled rapidity, and in a few hours the whole was destroyed. It was again constructed with improvements. Its length is 2063 feet, or about ⅜ths of a mile, and its breadth 80 feet. It is supported on floating pontoons rising and falling with the tide, connected with the quay by seven bridges, besides a floating bridge for heavy traffic 550 feet in length. The southern half is devoted to the traffic of the Mersey ferries, of which there are eight—New Brighton, Egremont, Seacombe, Birkenhead, Tranmere, Rock Ferry, New Ferry, and Eastham. The northern half is used for sea-going steamers, and for the tenders of the great "liners." The warehouses for storing produce form a very prominent feature in the commercial part of the city. Down to 1841 these were entirely in private hands, distributed as chance might direct, but in that year a determined effort was made to construct docks with warehouses around on the margin of the quays. This met with considerable opposition from those interested, and led to a municipal revolution, but the project was ultimately carried out in the construction of the Albert dock and warehouses, which were opened by Prince Albert in 1845. Other docks since constructed have been similarly surrounded. The Albert warehouses form an immense pile standing between the dock and the river, imposing from their huge dimensions, but otherwise the very incarnation of bald ugliness.

Grain warehouses on a large scale have been constructed by the dock board both at Liverpool and Birkenhead. The machinery for elevating, distributing, drying, and discharging is of the most complete and thorough construction. The rental received from the warehouses in the year 1880–81 was £240,394.

History.—There are no archæological difficulties attending the origin of the town, which is clearly defined by documentary evidence. The part of the country in which Liverpool is situated was not very distinguished in the earlier periods of English history. No Roman remains have been discovered within a considerable distance. Under the Saxons the site formed part of the kingdom or province of Deira, the river Mersey (Mœre-sea) forming the boundary between that kingdom and Mercia. During the Danish irruptions of the 8th century colonies of Norsemen made settlements on both sides of the Mersey, as is indicated by the names of the villages and townships in the districts. After the Conquest, the site of Liverpool formed part of the fief (inter Ripam et Mersham) granted by the Conqueror to Roger de Poitou, one of the great family of Montgomery. After various forfeitures and regrants from the crown, it was ultimately handed over by Henry II. to Warine, the keeper of the castle and prison of Lancaster. In a deed executed by King John, then earl of Mortaigne, about 1190, confirming the grant of this with other manors to Henry Fitzwarine, son of the former grantee, the name of *Liverpul* first occurs.

The name is spelt in a variety of ways, and much ingenuity has been exercised in the endeavor to explain its etymology. Probably the most plausible is the derivation from Cymric *Llyvrpwl*, "the expanse of the pool," or "the pool at the confluence," which exactly expresses the peculiarity of the original site. It is, however, open to the objection that the Welsh language had died out in the locality long before Liverpool was founded.

The immediate origin of Liverpool was owing to the following circumstances. After the partial conquest of Ireland by Strongbow, earl of Pembroke, under Henry II., the principal ports of communication were Bristol for the south and Chester for the north. The gradual silting up of the river Dee soon so obstructed the navigation as to render Chester a very unsuitable place of embarkation. A quay was then constructed at Shotwick, about 8 miles below Chester, with a castle to protect it from the incursions of the neighboring Welsh; but a better site was sought and soon found. Into the tidal waters of the Mersey, a small stream, fed by a peat moss on the elevated land to the eastward, ran in an oblique direction from north-east to south-west, forming at its mouth an open pool or sea lake, of which many existed on both sides of the river. The triangular piece of land thus separated formed a promontory of red sandstone rock, rising in the centre about 50 feet above the sea-level, sloping on three sides to the water. The pool was admirably adapted as a harbor for the vessels of that period, being well protected, and the tide rising from 15 to 21 feet. King John repurchased the manor from Henry Fitzwarine, giving him another in exchange, and here he erected a castle on the usual Plantagenet plan of round bastions connected by curtain walls, with an inner ballium and buildings. He also founded a town by the erection of burgage tenements, one hundred and sixty-eight in number, and in 1207 he issued the following letter patent or charter:—

Carta Regis Johannis.

"Rex omnibus qui burgagia apud villam de Liverpul habere voluerint, &c. Sciatus quod concessimus omnibus qui burgagia apud Liverpul cepint quod habeant omnes libertates et liberas consuetudines in villa de Liverpul quas aliquis liber burgemotus super mare habet in terra nostra. Et nos vobis mandamus quod secure et in pace nostra illuc veniatis ad burgagia nostra recipienda et hospitanda. Et in hujus rei testimonium has litteras as patentes vobis transmittimus. Testo Simon de Pateshill l Winton xxviij die Aug. anno regni nostri nono."

Charter of King John.

he king to all who may be willing to have burgages at the of Liverpul, &c. Know ye that we have granted to all who take burgages at Liverpul that they shall have all liberties free customs in the town of Liverpul which any free borough e sea hath in our land. And we command you that sec rely in our peace you may come there to receive and inhabit our ages. And in testimony hereof we transmit to you these our rs patent. Witness, Simon de Pateshill, at Winchester, the day of August, in the ninth year of our reign."

rom the Patent Rolls and the sheriff's accounts we learn considerable use was made of Liverpool in the reign ohn for shipping stores and reinforcements to Ireland Wales. In 1215 the town was garrisoned for the king ing the rising which took place after the granting of Great Charter.

1229 a charter of incorporation was granted by Henry , authorizing the formation of a merchant's guild, a hanse and other liberties and free customs, with sac soc, toll and thean, etc., and freedom from toll in all other seaports. Charters were subsequently granted uccessive monarchs down to the reign of William and y, which last was the governing charter to the date of Municipal Reform Act (1835). In 1880 when the new ese of Liverpool was created, the borough was trans- ned into a city by royal charter.

he crown revenues from the burgage rents and the l customs were leased in fee-farm from time to time, etimes to the corporation, at other times to private ons. The first lease was from Henry III., in 1229, at per annum. In the same year the borough with all appurtenances was bestowed, with other lands, on ulf, earl of Chester. During the subsequent two cen- es the fief was repeatedly forfeited and regranted, il it finally passed into the hands of John of Gaunt, e of Lancaster, and from the accession of his son Henry it merged in the crown. In 1628 Charles I., in great its for means which were refused by parliament, red for sale about a thousand manors, among which erpool was included. The portion containing Liver- l was purchased by certain merchants of London, who, 1632, reconveyed the crown rights, including the fee- n rent of £14, 6s. 8d., to Sir Rd. Molyneux, recently ated Lord Maryborough, for the sum of £450. In 1672 these rights and interests were purchased by the cor- ation.

part from the national objects for which Liverpool was nded, its trade developed very slowly. From £10 per um, in the beginning of the 13th century, the crown enues had increased towards the end of the 14th cen- y, to £38—in modern currency about £570; but then y underwent a decline. The Black Death, the fatal urge of the 14th century, passed over Liverpool about 0, and carried off a large part of the population. The rs of the Roses, in the 15th century, unsettled the north- stern districts, and repressed all progress for at least a tury. The crown revenues diminished from £38 to less n half that sum, and were finally leased at £14, 6s. 8d., which they continued until the sale by Charles I.

Liverpool sent no representatives to Simon de Montfort's liament in 1264, but to the first royal parliament, called 1296, the borough sent two members, and again in 1306. e writs of summons were then suspended for two centu- s and a half. During the 14th and 15th centuries nearly whole of the returns of the sheriffs of Lancaster were the following effect:—"There is not any city or borough m which any citizens or burgesses are able or accus- ned to come, according to the tenor of the writ, by rea- of their debility and poverty." In 1547 Liverpool, with rest of the Lancashire boroughs, resumed the privilege returning members. In 1588 the borough was repre- ted by Sir Francis Bacon, the immortal philosopher and tesman. During the civil war the town was fortified d garrisoned by the parliament. It sustained three ges, and in 1644 was escaladed and taken by Prince pert with considerable slaughter.

The true rise of the commerce of Liverpool dates from e restoration. Down to that period its population had en either stationary or retrogressive, never exceeding out 1000 souls. Its trade was chiefly with Ireland, ance, and Spain, exporting fish and wool to the Conti- nt, and importing wines, iron, and other commodities. he rise of the manufacturing industry of South Lan- shire, and the opening of the American and West Indian ade, gave the first impulse to the progress which has er since continued. The importation of sugar led to the tablishment of sugar refineries, which after the lapse of o centuries continue to form an important branch of cal industry. By the end of the century the population d increased to 5000. The town burst the narrow limits within which it had hitherto been confined, and extended itself across the pool stream. In 1699 the borough was constituted a parish district from Walton, to which it had previously appertained. In 1709 the small existing harbor being found insufficient to accommodate the shipping, several schemes were propounded for its enlargement, which resulted in the construction of a wet dock closed with flood-gates impounding the water, so as to keep the vessels floating during the recess of the tide. This dock in Liverpool was the first of the kind, and was the parent of all the magnificent structures which have attracted the admiration of the world. The name of the engineer, Thomas Steers, deserves recording, as the author of the practical application of a principle already known leading to a world-wide utility, of a similar class to the adaptation of the railway by George Stephenson at a subsequent period.

About this date the merchants of Liverpool entered upon a traffic which, however questionable in point of morality, became very profitable during the remainder of the century,—the slave trade, into which they were led by their connection with the West Indies. In 1709 a single barque of 30 tons burden made a venture from Liverpool and carried 15 slaves across the Atlantic. Little was done during the next twenty years, but in 1730, encouraged by parliament, Liverpool went heartily into the new trade. In 1751 53 ships sailed from Liverpool for Africa, of 5334 tons in the aggregate. From this time the trade set in with such a steady current that it soon became one of the most lucrative branches of the commerce of the port. The voyage was threefold. The ships sailed from Liverpool to the west coast of Africa, where they shipped the slaves, and thence to the West India Islands, where the slaves were sold and the proceeds brought home in cargoes of sugar and rum. In 1765 the number of Liverpool slavers had increased to 86, carrying 24,200 slaves. By the end of the century five-sixths of the African trade centred in Liverpool. Just before the abolition in 1807 the number of Liverpool ships engaged in the traffic was 185, carrying 43,755 slaves in the year.

Another branch of maritime enterprise which attracted the attention of the merchants of Liverpool was privateering, which during the latter half of the 18th century was a favorite investment. After the outbreak of the Seven Years' War with France and Spain, in 1756, the commerce of Liverpool suffered severely, the French having overrun the narrow seas with swift well-armed privateers, and the premiums for insurance against sea risks having risen to an amount almost prohibitory. The Liverpool merchants took a lesson from the enemy, and armed and sent out their ships as privateers. Some of the early expeditions having proved very successful, almost the whole community rushed into privateering, with results of a very chequered character. When the War of Independence broke out in 1776 American privateers swarmed about the West India Islands, and crossing the Atlantic intercepted British commerce in the narrow seas. The Liverpool merchants again turned their attention to retaliation. Between August, 1778, and April, 1779, 120 privateers were fitted out in Liverpool, carrying 1986 guns and 8754 men. The results, though in some cases very profitable, were exceedingly demoralizing.

During the whole of the 18th century the commerce of Liverpool kept steadily increasing in spite of external war and internal competition, and has so continued to the present time. The increase of the population supplies a fair index to the growth of its commerce.

The Municipality.—Under the Municipal Reform Act of 1835, the boundaries of the original borough were extended by the annexation of portions of the surrounding district. The city is divided into sixteen wards, returning three members each to the common council, with sixteen aldermen, making sixty-four in all. The wards were originally divided according to population, but the lapse of nearly half a century has so completely disturbed the proportions that, whilst some of the wards in the commercial localities have diminished in population, the Everton and Kirkdale ward, originally a rural suburb, now contains a population of 150,000, with a constituency of more than 20,000 electors. The electoral franchise, before the Reform Act restricted to the freemen, is still enjoyed by their successors, but their number is exceedingly small.

The arms of the city as set forth in the confirmation by the Heralds' College, in 1797, are described as follows:—"Argent, a Cormorant, in the beak a branch of seaweed called Laver, all proper, and for the crest, on a wreath of the colors, a Cormorant, the wings elevated; in the beak a branch of Laver proper." The supporters, granted at the same time, are—"The dexter Neptune with his sea-green mantle flowing, the waist wreathed with Laver, on his head an eastern crown or, in the right hand a trident sable, the left supporting a banner of the arms of Liverpool; on the sinister a Triton wreathed as the dexter and blowing his shell; all proper." The motto is "Deus nobis hæc otia fecit."

The corporation of Liverpool has possessed from a very early period considerable landed property, the first grant having been made by Thomas, earl of Lancaster, in 1309. This land was originally of value only as a turbary, but in modern times its capacity as building land has been a fruitful source of profit to the town, a large proportion of the southern district being held in freehold by the corporation, leased for terms of seventy-five years, renewable from time to time on a fixed scale of fines. The income from this source amounted in 1879 to £83,746. There was formerly another source of income now cut off. The fee farm rents and town dues originally belonging to the crown were purchased from the Molyneux family in 1672 on a long lease, and subsequently in 1777 converted into a perpetuity. With the growth of the commerce of the port these dues enormously increased, and became a cause of great complaint by the shipping interest. In 1856 a bill was introduced into parliament and passed, by which the town dues were transferred to the Mersey Docks and Harbor Board on payment of £1,500,000, which was applied in part to the liquidation of the bonded debt of the corporation, amounting to £1,150,000. The town dues at that time produced £132,592 per annum, which has increased in 1881 to £260,698. The markets produce an income of about £12,000 clear of expenses.

The council form the sanitary authority of the city, in which capacity they expended in the year 1880–81 the sum of £255,738, derived from rates. In the same year there was expended for lighting and watching, £75,263; for parks and places of recreation, £49,178; for town improvements, £33,192. These amounts are partly defrayed out of the corporate funds; the part for the constabulary is paid by Government, and the rest out of rates.

The mayor has an annual allowance of £2700 to sustain the dignity of his office and maintain the hospitality of the town-hall.

The city returns three members to parliament.

The see of Liverpool was created in 1880 under the Act of 1879, by the authority of the Ecclesiastical Commissioners, an endowment fund of about £100,000 having been subscribed for the purpose.

See Leland's *Itinerary;* Camden's *Britannia;* R. Blome, *Britannia;* Daniel Defoe, *Tour through Great Britain;* W. Enfield, *Hist. of Leverpool* (*sic*), 1774; J. Aikin, M. D., *Forty Miles round Manchester*, 1795; T. Troughton, *Hist. of Liverpool*, 1810; M. Gregson, *Fragments relating to Hist. of Lancashire*, 1817–24; H. Smithers, *Liverpool, its Commerce*, etc., 1825; R. Syers, *Hist. of Everton*, 1830; Ed. Baines, *Hist. of County Palatine of Lancashire*, vol. iv., 1836; Thos. Baines, *Hist. of Commerce and Town of Liverpool*, 1852; Rd. Brooke, *Liverpool during the last quarter of 18th Century*, 1853; J. A. Picton, *Memorials of Liverpool*, 2 vols. 2d ed., 1875. (J. A. P.)

LIVERPOOL, Charles Jenkinson, first Earl of (1727–1808), was the eldest son of Colonel Jenkinson, Walcot, Oxfordshire, where he was born 16th May, 1727. He was educated at Charterhouse school and at University College, Oxford, where after a career of special distinction he graduated M. A. in 1752. Almost immediately on entering parliament as member for Cockermouth in 1761, he was appointed under-secretary of state under Lord Bute, and, as he soon shared equally with that nobleman the favor of the king, his political advancement was rapid and uninterrupted while the friends of the king remained in office. By Grenville he was in 1763 appointed secretary of state; in the Grafton administration he, in 1766, obtained a seat at the Admiralty Board; and from 1778 till the close of Lord North's ministry he was secretary at war. On the accession of Pitt to power in 1784, he became president of the Board of Trade, retaining office till Pitt's resignation in 1801. Besides direct political power he also enjoyed a large share both of substantial and honorary political rewards. In 1773 he became member of the privy council, and obtained the vice-treasurership of Ireland, which he afterwards exchanged for the clerkship of the pells; and from 1786 to 1802 he was chancellor of the duchy of Lancaster. In 1786 he was created Baron Hawkesbury, and ten years afterwards earl of Liverpool. He died 17th December, 1808. Lord Liverpool was generally believed to be the chief political adviser of George III. His prudence, practical talents, and knowledge of the details both of home and foreign politics rendered him a specially safe and useful member of a cabinet.

He was the author of several political works, which display industry and discrimination, but, with the exception of his well-known *Treatise on the Coins of the Realm*, 1805 are without striking merits. His other writings are—*National and Constitutional Force in England*, 1756; *Treaties between Great Britain and other Powers, 1648–1783*, 3 vols., 1785; *The Conduct of Great Britain in respect to Neutral Nations, 1785*, 3 vols., 1801.

LIVERPOOL, Robert Banks Jenkinson, second Earl of (1770–1828), son of the above by his first wife Amelia, daughter of Mr. Watts, governor of Bengal, was born June 7, 1770. He was educated at Charterhouse and at Christ Church, Oxford, where he had Canning, afterwards his close political associate, for a contemporary. In 1791 he entered parliament as member for Rye, but he first held office in 1801 as foreign secretary in Addington's administration, when he conducted the negotiations for the abortive treaty of Amiens. On the accession of Pitt to power in 1804, he obtained the home office, and till his elevation to the House of Peers he acted as leader of the party in the House of Commons. He declined the premiership on the death of Pitt in 1806, and remained out of office till the accession of Perceval in 1809, when he again became home secretary. After the assassination of Perceval in 1812 he became prime minister, and retained office till compelled in February, 1827, to resign by the illness (paralysis) which terminated his life, 4th December, 1828. The political career of Lord Liverpool was entirely of a negative character so far as legislation was concerned; the only principle which regulated his statesmanship was persistent opposition to every kind of change, especially in the direction of increased religious or political liberty. From the beginning he strongly resisted Catholic emancipation, and he was also prominent in delaying the emancipation of the slaves. The energy of Castlereagh and Canning secured the outward success of the foreign policy of the cabinet, but in his home policy he was always unfortunate and retrograde. The Pains and Penalties Bill against Queen Caroline greatly increased his unpopularity, first originated by the severe measures of repression employed to quell the general distress, which had been created by undue taxation and was aggravated by blind adherence to protection. Though, therefore, actuated throughout by an honesty beyond all question, and though always commanding the sincere respect of his opponents by his dignified and considerate bearing, Lord Liverpool was destitute of wide and genial sympathies, and of true political insight, and his resignation of office was followed almost immediately by the complete and permanent reversal of his domestic policy.

LIVERWORTS. The Liverworts or *Hepaticæ* constitute a group of the higher *Cryptogamia*, allied to the mosses. Their shoots are either *thalloid*, in some genera (*Marchantia*) highly differentiated in structure, in others (*Anthoceros*) of simple homogeneous texture, with an upper and lower surface, the latter fixed to the ground by capillary rootlets, and generally margined with minute scales; or they are *foliose*, the central stem bearing on each side a row of leaves, consisting of one series of cells invested with a structureless epidermis, and destitute of nerves, such as prevail in the leaves of mosses. Frequently on the inferior aspect a third row of leaf-like scales is found, differing from the former, and known as stipules, bracteoles, or amphigastria. Hence the shoots, although typically trilateral, often appear bilateral. The reproductive organs of the *Hepaticæ* are of two kinds—sexual and asexual.

I. The sexual germs of the mosses and *Hepaticæ* were first described by Hedwig just one hundred years ago (1782). They consist, as in the higher plants, of germ-cells and sperm-cells. As the fronds approach maturity the terminal leaves become modified so as to form an involucrum, within which a special covering appears, the colesule or perianth, surrounding the pistillidia; this is tubular, conical, or compressed in form, with the mouth plicate and generally dentate.

On section of the colesule a number of minute flask-

ped bodies are found, attached to the apex of the
, which have been named archigonia or pistillidia.
r fertilization one of these enlarges, active cell for-
ion proceeding from the central cell at the base,
ain which appears the germ-cell, which in time be-
es the capsule, the ultimate contents producing
res arranged in fours, and elongated cells bearing
hin spiral filaments (elaters). Until the maturity of
spores, the sporangium remains at the base of the
sule, but at length the outer coat (calyptra) rup-
s near the summit, and by the rapid evolution of
cells of the fruit-stalk (seta) the capsule is borne
rards. At this stage, which is of brief duration, the
ds look as if dotted with black-headed pins on white
ks. Released from pressure, the hygrometric action
the elater soon ruptures the wall of the capsule,
ch divides, in the majority of species, into four
res, and the spores are scattered around.

he antheridia are sometimes found imbedded in
pts within the substance of the thallus (*Riccia*), or
pecial receptacles either sessile or raised above the
face of the same (*Marchantia*). In the foliose *He-*
icæ they are usually seated in the axils of modified
res (perigonial), sometimes appearing beneath the
ile involucra (monœcious), or on special branches
the same plant (parœcious), or they occur on sepa-
e plants (diœcious). The antheridia are much small-
than the capsules, spherical or ovoid in form, and
ted on a short footstalk. They are invested with a
gle coat of tabular cells. Before maturity they are
enish, but when ripe their color turns to yellow. On
ssure they rupture irregularly, and allow the escape
crowds of lenticular cells, which revolve actively un-
the microscope until the ciliated phytozoa within
m are released.

The phytozoa of mosses were first figured by Unger
34), who described them as consisting of a thick
ly, and a thin thread-like prolongation, which goes
advance when the body is in motion, and is spiral in
m. Thuret has since shown that the so-called "tail"
ars two long oscillating cilia. Hofmeister first ob-
ved the formation of the free germinal vesicle within
basal cell of the pistillidium as the direct result of
tilization.

II. *Asexual Germs.*—Beyond the true fructification,
the majority of *Hepaticæ*, certain bodies are met with,
ich are known as gemmæ, but which differ from each
er in complexity and significance.

(1) In some *Marchantiæ* basket-like or crescentic re-
ptacles are found, containing lenticular bodies, which,
der favorable conditions, will produce new fronds.

(2) On the borders of the leaves, especially near the
ex of the shoots, prolification from the ordinary cel-
ar tissue is met with in most *Hepaticæ*, in the form
detached cells or tufts of such cells. These are gen-
lly described as gemmæ, but resemble more closely
gonidia of lichens, and probably aid in the diffusion
diœcious species, which from the absence of ♂ or ♀
nts would otherwise become extinct.

(3) Another process has been ascribed to gemmation,
t has been more happily named by Dr. A. Braun
uvenescence (*Verjungung*). In decayed or apparently
thered fronds, certain cells, after a period of rest, as-
me new activity and multiply so as to give rise to new
lividuals (*Anthoceros*, *Riccia*, etc.).

Distinction between Hepaticæ and Musci.—There is scarcely
haracter in the definition of *Hepaticæ* which might not
fer to some genus of mosses, although the definition as a
ole may be sufficiently distinctive, and practically
ere is no difficulty in distinguishing one from the other.
In *Musci* the urn-case or capsule generally opens by
eans of a lid, and the mouth is surrounded by a peristome
vided into four, eight, or more teeth. A columella is
arly always present, and the spores ripen in a sac between
e former and the walls of the capsule. From the early
ngation of the fruit rudiment, the calyptra is ruptured
an earlier stage, the upper part investing the urn-case
e a cap, during the development of the spores; the
wer remnant remains at the base of the seta (which, as well as the capsule, is composed of more ligneous texture than in *Hepaticæ*) as the vaginula. The spore gives rise to a confervoid prothallus, often extensively branched, and from this the leaf-buds arise. The leaves are imbricated on all sides of the stem, and the phyllotaxis is usually $\frac{1}{2}$, $\frac{2}{5}$, or $\frac{3}{8}$. The leaves are frequently strengthened by a midrib, and the rootlets are divided by numerous septa.

Habitat.—The *Hepaticæ* are cosmopolitan in range, and form a relatively important average of the alpine vegetation, being abundant in moist, equable and insular places, *e. g.*, Ireland, Scotland, New Zealand. They are also met with in more tropical zones, such as South America, India, Java, and the West Indies.

Classification.

I. *Marchantiaceæ.*—Fronds thalloid, prostrate, furcate; epidermis pierced with curious stomata; inner section areolate, occupied by green gonidial cells, lower surface simply cellular, emitting long rootlets, papillose within.

(*a*) *Marchantieæ.*—Capsules aggregate on a stalked receptacle: *e. g.*, *Marchantia*, *Asterella*, *Fegatella*, *Dumortiera*, *Lunularia*, etc.

(*b*) *Targioniceæ.*—Antheridia immersed; involucre like a split pea; capsule nearly sessile, below the apex.

(*c*) *Riccieæ.*—Antheridia and pistillidia immersed, the latter emitting the spores by the decay of the walls; spores without elaters: *e. g.*, *Riccia*, *Ricciella*, etc.

II. *Jungermanniaceæ.*—Capsule solitary terminal on the primary shoots or on short lateral ones, splitting into four valves.

* *Foliosæ.*

(*a*) Leaves *succubous*: *e. g.*, *Jungermannia*, *Scapania*, *Lophocolea*, etc.

(*b*) Leaves *incubous*: *e. g.*, *Lijennia*, *Frullania*, *Schisma*, *Lepidozia*, etc.

* * *Frondosæ*: *e. g.*, *Pellia*, *Blasia*, *Petalophyllum*, etc.

III. *Anthoceroteæ.*—Capsule horn or pod-like, opening by one or two valves, columella central, spores intermingled with deformed elaters: *e. g.*, *Anthoceros*, *Monoclæa*.

Uses.—At the present time the *Hepaticæ* are of little practical use to man. In the dark ages of medicine, when the doctrine of "signatures" was in fashion, the strongly-marked epidermic cells were supposed to resemble the structure of the liver, and the species were esteemed "a sovran remedy" in liver complaints. The *Hepatica fontana* (*Marchantia polymorpha*) of Casper Bauhine, "which grows near springs, wells, and watery places, very lowe, almost like a moss and puts out flowers about June, not unlike *stars*," is wonderfully commended by Schröder, in those disorders of the liver which arise from too much heat (*English Dispensary*, 1733). A few species possess a pungent, bitter taste (*Porella*) resembling that of *Sedum acre*. Many also evolve a musky odor, observable in the woods and fields after rain, and incorrectly referred to the smell of moist earth.

Beyond the beauty of tint and outline, which light up many a dreary ravine, they supply abundant material for the microscope, enabling us by the translucency of tissue, and their easy preservation, so long as moisture is supplied, to study cell and leaf structure, and the wonders of reproduction, as no other class will do.

Lastly, many fern-growers have of late included the *Hepaticæ* and *Musci* in their list of favorites, the variety adding immeasurably to the interest of their collections. Most of the species are readily cultivated in a cold frame or fernery, the atmosphere of which must be kept moist and equable. In the renowned ferneries of Mr. Backhouse of York, A. Stansfield of Todmorden, and the Glasnevin Gardens, Dublin, species have long been cultivated, many foreign to the climate, and introduced with foreign plants. (B. C.)

LIVINGSTON, EDWARD (1764–1836), American jurist and statesman, was born in Clermont, Columbia county, New York, May 26, 1764. He was a great-grandson of Robert Livingston, the first possessor under royal patent of "Livingston Manor," a tract of land on the Hudson, comprising the greater part of the present counties of Dutchess and Columbia. Having graduated at Princeton in 1781, he began to practise law in New York city, and rapidly rose to distinction as an advocate. He was a member of congress during 1794–98, and in 1801 was appointed United States district attorney for the State of New York, and while retaining that position was also elected mayor of New York city, then an office of high dignity and emolument. In the summer of 1803 New York was visited with a violent epidemic of yellow fever, during which Livingston displayed great courage and energy in his endeavors to prevent the spread of the disease, and to relieve the widespread distress. He suffered an attack of the fever in its most violent form, during which the people of the city gave many proofs of their attachment and anxiety. He recovered to find his private affairs, which he had neglected, in some confusion, and he was at the same time deeply indebted to the Government for public funds which had been lost through the mismanagement of a confidential clerk. Livingston at once surrendered all his property, and, having resigned his offices, removed to Louisiana, which had then just been ceded by France to the United States. He soon acquired a large law practice in New Orleans, and repaid the Government in full. Almost immediately upon his arrival in Louisiana he was appointed by the legislature to prepare a provisional code of judicial procedure, which was continued in force from 1805 to 1825. During the short war with England in 1814–15, Livingston was active in rousing the mixed population of New Orleans to resistance, and acted as adviser and aide-de-camp to Jackson. In 1821, by appointment of the legislature, Livingston began the preparation of a new code of criminal law and procedure, since widely known in Europe and America as the "Livingston Code." It was prepared in both French and English, as required by the necessities of practice in Louisiana, and, though substantially completed in 1824, and in greater part then adopted by the State, it was not printed entire until 1833. It was at once reprinted in England, France, and Germany, attracting wide interest and praise from the most distinguished sources by its remarkable simplicity and vigor, and more especially by reason of its philanthropic provisions, which have noticeably influenced the penal legislation of several countries. Livingston was a member of congress during 1823–29, was afterwards senator, and for two years secretary of state under President Jackson. From 1833 to 1835 he was minister plenipotentiary to France, and conducted with success negotiations of considerable difficulty and importance. He died May 23, 1836.[1]

See Livingston's *Life* by C. H. Hunt (New York, 1864), and his complete *Works* (2 vols., 1873).

LIVINGSTON, Robert R. (1746–1813), American statesman, brother of Edward Livingston noticed above, was born at New York, November 27, 1746. He graduated at King's College, New York, at the age of nineteen, became a practitioner of law, and, in 1773, recorder of the city, but was soon displaced by loyalist influence because of his sympathies with the revolution. In 1776 he was a member of the committee of congress which drew up the Declaration of Independence, and in 1777 was a prominent member of the convention at Kingston, which framed the first constitution of New York. Upon the adoption of that instrument in the same year he became the first chancellor of the State, which office he held until 1801, whence he is best known as "Chancellor" Livingston. He administered the oath of office to Washington at his first inauguration to the presidency in New York, April 30, 1789. In 1801 he was appointed by President Jefferson as minister to France, and in 1803 effected in behalf of his Government the purchase from France of the vast territory then known as Louisiana, comprising the entire territory between the Missisippi and the Rocky Mountains, from the Spanish to the British possessions. This was, perhaps, the most important transfer of territory by purchase ever made, but none of those who participated in it realized its importance. Napoleon's agent obtained ten million francs more than he had been instructed to accept for the cession, and Jefferson and Livingston were at the time bitterly censured for rashly concluding so useless a purchase. In 1804 Livingston withdrew from public life, and after spending a year in travel in Europe, returned to New York, where he occupied his remaining years in promoting various improvements in agriculture. He also assisted Fulton in his invention of the steamboat. He died in February, 1813.

LIVINGSTONE, David (1813–1873), missionary and explorer, was born on March 19, 1813, at the village of Blantyre Works, in Lanarkshire, Scotland. David was the second child of his parents Neil Livingston (for so he spelled his name, as did his son for many years) and Agnes Hunter. His parents were poor and self-respecting, typical examples of all that is best among the humbler families of Scotland. At the age of ten years David left the village school for the neighboring cotton-mill, and by strenuous efforts he qualified himself at the age of twenty-three to undertake a college curriculum. He attended for two sessions the medical and the Greek classes in Anderson's College, and also a theological class. In September, 1838, he went up to London, and was accepted by the London Missionary Society as a candidate. During the next two years he resided mostly in London, diligently attending medical and science classes, and spending part of his time with the Rev. Mr. Cecil at Ongar in Essex, studying theology and learning to preach. He took his medical degree in the Faculty of Physicians and Surgeons in Glasgow in November, 1840. Livingstone had from the first set his heart on China, and it was a great disappointment to him that the Society finally decided to send him to Africa. To an exterior in these early years somewhat heavy and uncouth, he united a manner which, by universal testimony, was irresistibly winning, with a fund of genuine but simple humor and fun that would break out on the most unlikely occasions, and in after years enabled him to overcome difficulties and mellow refractory chiefs when all other methods failed.

Livingstone sailed from England on December 8, 1840. From Algoa Bay he made direct for Kuruman, the mission station, 700 miles north, established by Hamilton and Moffat thirty years before, and there he arrived on July 31, 1841. The next two years Livingstone spent in travelling about the country to the northwards, in search of a suitable outpost for settlement. During these two years he had already become convinced that the success of the white missionary in a field like Africa is not to be reckoned by the tale of doubtful conversions he can send home each year,—that the proper work for such men was that of pioneering, opening up and starting new ground, leaving native agents to work it out in detail. The whole of his subsequent career was a development of this idea. He selected the valley of Mabotsa, on one of the sources of the Limpopo river, 200 miles north-east of Kuruman, as his first station. It was shortly after his settlement here that he was attacked by a lion, which crushed his left arm and nearly put an end to his career. The arm was imperfectly set, and it was a source of trouble to him at times throughout his life, and was the means of identifying his body after his death. To a house, mainly built by himself at Mabosta, Livingstone in 1844 brought home his wife, Mary Moffat, the daughter of Moffat of Kuruman. Here he labored till 1846, when he removed to Chonuane, 40 miles further north, the chief place of the Bakwain tribe under Sechele. In 1847 he again removed to Kolobeng, about 40 miles westwards, the whole tribe following their missionary. With the help of and in the company of two English sportsmen, Mr. Oswell and Mr. Murray, he was able to undertake a journey of great importance to Lake Ngami, which had never yet been seen by a white man. Crossing the Kalahari Desert, of which Livingstone gave the first detailed account, they reached the lake on August 1, 1849. In April next year he made an attempt to reach Sebituane, who lived 200 miles beyond the lake, this time in company with his wife and children, but again got no further than the lake, as the children were seized with fever. A year later, April, 1851, Livingstone, again accompanied by his family and Mr. Oswell, set out, this time with the intention of settling among the Makololo for a period. At last he succeeded, and reached the Chobe, a southern tributary of the Zambesi, and in the end of June discovered the Zambesi itself at the town of Sesheke. Leaving the Chobe on August

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[1] [His Uncle Philip (1716–78), of New York, was a Yale graduate, signed the Declaration of Independence, and died at York, Pa., while attending a session of the Continental Congress.—Am. Ed.]

13, the party reached Capetown in April, 1852. Livingstone may now be said to have completed the first period of his career in Africa, the period in which the work of the missionary had the greatest prominence. Henceforth he appears more in the character of an explorer, but it must be remembered that he regarded himself to the last as a pioneer missionary, whose work was to open up the country to others.

Having, with a sad heart, seen his family off to England, Livingstone left the Cape on June 8, 1852, and reached Linyanti, the capital of the Makololo, on the Chobe, on May 23, 1853, received in royal style by Sekeletu, and welcomed by all the people. His first object in this journey was to seek for some healthy high land in which to plant a station. Ascending the Zambesi, he, however, found no place free from the destructive tsetse insect, and therefore resolved to discover a route to the interior from either the west or east coast. To accompany Livingstone in his hazardous undertaking twenty-seven men were selected from the various tribes under Sekeletu, partly with a view to open up a trade route between their own country and the coast. The start was made from Linyanti on November 11, 1853, and, by ascending the Leeba, Lake Dilolo was reached on February 20, 1854. On April 4 the Coango was crossed, and on May 31 the town of Loanda was entered, much to the joy of the men,—their leader, however, being all but dead from fever, semi-starvation, and dysentery. Livingstone speaks in the warmest terms of the generosity of the Portuguese merchants and officials. From Loanda Livingstone sent his astronomical observations to Maclear at the Cape, and an account of his journey to the Royal Geographical Society, which in May, 1855, awarded him its highest honor, its gold medal. Loanda was left on September 20, 1854, but Livingstone lingered long about the Portuguese settlements. Making a slight detour to the north to Cabango, the party reached Lake Dilolo on June 13. Here Livingstone made a careful study of the watershed of the country in what is perhaps the most complicated river system in the world. He "now for the first time apprehended the true form of the river systems and the continent," and the conclusions he came to have been essentially confirmed by subsequent observations. The return journey from Lake Dilolo was by the same route as that by which the party came. Their reception all along the Barotse valley was an ovation, and Linyanti was reached in the beginning of September.

For Livingstone's purposes the route to the west was unavailable, and he decided to follow the Zambesi to its mouth. With a numerous following, he left Linyanti on November 8, 1855. A fortnight afterwards he made the great discovery with which, in popular imagination, his name is more intimately associated than with anything else he did,—the famous "Victoria" falls of the Zambesi, which, after a second examination in his subsequent journey, he concluded to be due to an immense fissure or fault right across the bed of the river, which was one means of draining off the waters of the great lake that he supposed must have at one time occupied the centre of the continent. He had already formed a true idea of the configuration of the continent as a great hollow or basin-shaped plateau, surrounded by a ring of mountains. Livingstone reached the Portuguese settlement of Tette on March 2, 1856, in a very emaciated condition, and after six weeks, left his men well cared for, and proceeded to Kilimane, where he arrived on May 20, thus having completed in two years and six months one of the most remarkable and fruitful journeys on record. The results in geography and in natural science in all its departments were abundant and accurate; his observations necessitated a reconstruction of the map of central Africa. Men of the highest eminence in all departments of science testified to the high value of Livingstone's work. In later years, it is true, the Portuguese, embittered by his unsparing denunciations of their traffic in slaves, attempted to depreciate his work, and to maintain that much of it had already been done by Portuguese explorers. When Livingstone began his work in Africa it was virtually a blank from Kuruman to Timbuctoo, and nothing but envy or ignorance can throw any doubt on the originality of his discoveries.

On December 12 he arrived in England, after an absence of sixteen years, and met everywhere with the welcome of a hero. He told his story in his *Missionary Travels and Researches in South Africa* (1857) with straightforward simplicity, and with no effort after literary style, and no apparent consciousness that he had done anything extraordinary. Its publication brought what he would have considered a competency had he felt himself at liberty to settle down for life. In 1857 he severed his connection with the London Missionary Society, with whom, however, he always remained on the best of terms, and in February, 1858, he accepted the appointment of "Her Majesty's consul at Kilimane for the eastern coast and the independent districts in the interior, and commander of an expedition for exploring eastern and central Africa."

The Zambesi expedition, of which Livingstone thus became commander, sailed from Liverpool in H. M. S. "Pearl" on March 10, 1858, and reached the mouth of the Zambesi on May 14, and the party ascended the river from the Kongone mouth in a steam launch, the "Ma-Robert," reaching Tette on September 8. The remainder of the year was spent in examining the river above Tette, and especially the Kebrabasa rapids. Most of the year 1859 was spent in the exploration of the river Shire and Lake Nyassa, which was discovered in September; and much of the year 1860 was spent by Livingstone in fulfilling his promise to take such of the Makololo home as cared to go. In January of next year arrived Bishop Mackenzie and a party of missionaries sent out by the Universities Mission to establish a station on the upper Shire.

After exploring the river Rovuma for 30 miles in his new vessel the "Pioneer," Livingstone and the missionaries proceeded up the Shire to Chibisa's; there they found the slave-trade rampant, desolating the country and paralyzing all effort. On July 15 Livingstone, accompanied by several native carriers, started to show the bishop the country. Several bands of slaves whom they met were liberated, and after seeing the missionary party settled in the highlands of Magomero to the south of Lake Shirwa, Livingstone spent from August to November in exploring Lake Nyassa. While the boat sailed up the west side of the lake to near the north end, the explorer marched along the shore. He returned more resolved than ever to do his utmost to rouse the civilized world to put down the desolating slave-trade. On January 30, 1862, at the Zambesi mouth, Livingstone welcomed his wife and the ladies of the mission, with whom were the sections of the "Lady Nyassa," a river steamer which Livingstone had had built at his own expense, absorbing most of the profits of his book, and for which he never got any allowance. When the mission ladies reached the mouth of the Ruo tributary of the Shire, they were stunned to hear of the death of the bishop and of Mr. Burrup. This was a sad blow to Livingstone, seeming to have rendered all his efforts to establish a mission futile. A still greater loss to him was that of his wife at Shupanga, on April 27, 1862.

The "Lady Nyassa" was taken to the Rovuma. Up this river Livingstone managed to steam 156 miles, but further progress was arrested by rocks. Returning to the Zambesi in the beginning of 1863, he found that the desolation caused by the slave-trade was more horrible and widespread than ever. It was clear that the Portuguese officials were themselves at the bottom of the traffic. Kirk and Charles Livingstone being compelled to return to England on account of their health, the doctor resolved once more to visit the lake, and proceeded some distance up the west side and then north-west as far as the watershed that separates the

Loangwa from the rivers that run into the lake. Meanwhile a letter was received from Earl Russell recalling the expedition by the end of the year. In the end of April, 1864, Livingstone reached Zanzibar in the "Lady Nyassa," and on the 30th he set out with nine natives and four Europeans for Bombay, which was reached after an adventurous voyage of a month, and on July 23 Livingstone arrived in England. He was naturally disappointed with the results of this expedition, all its leading objects being thwarted through no blame of his. For the unfortunate disagreements which occurred, and for which he was blamed in some quarters, he must be held acquitted, as he was by the authorities at home; though it is not necessary to maintain that Livingstone was exempt from the trying effects on the temper of African fever, or from the intolerance of lukewarmness which belongs to all exceptionally strong natures. Still the results at the time, and especially those of the future, were great. The geographical results, though not in extent to be compared to those of his first and his final expeditions, were of high importance, as were those in various departments of science. Details will be found in his *Narrative of an Expedition to the Zambesi and its Tributaries*, published in 1865.

By Murchison and his other staunch friends Livingstone was as warmly welcomed as ever. When Murchison proposed to him that he should go out again, although he seems to have had a desire to spend the remainder of his days at home, the prospect was too tempting to be rejected. He was appointed H. M. consul to central Africa without a salary, and Government contributed only £500 to the expedition. The chief help came from private friends. During the latter part of the expedition Government granted him £1000, but that, when he learned of it, was devoted to his great undertaking. The Geographical Society contributed £500. The two main objects of the expedition were the suppression of slavery by means of civilizing influences, and the ascertainment of the watershed in the region between Nyassa and Tanganyika. At first Livingstone thought the Nile problem had been all but solved by Speke, Baker, and Burton, but the idea grew upon him that the Nile sources must be sought farther south. and his last journey became in the end a forlorn hope in search of the "fountains" of Herodotus. Leaving England in the middle of August, 1865, *via* Bombay, Livingstone arrived at Zanzibar on January 28, 1866. He was landed at the mouth of the Rovuma on March 22, and started for the interior on April 4. His company consisted of thirteen sepoys, ten Johanna men, nine African boys from Nassick school, Bombay, and four boys from the Shire region, besides camels, buffaloes, mules, and donkeys. This imposing outfit soon melted away to four or five boys. Rounding the south end of Lake Nyassa, Livingstone struck in a north-north-west direction for the south end of Lake Tanganyika, over country much of which had not previously been explored. The Loangwa was crossed on December 15, and on Christmas day Livingstone lost his four goats, a loss which he felt very keenly, and the medicine chest was stolen in January, 1868. Fever came upon him, and for a time was his almost constant companion; this, with the fearful dysentery and dreadful ulcers and other ailments which subsequently attacked him, and which he had no medicine to counteract, no doubt told fatally on even his iron frame. The Chambeze was crossed on January 28, and the south end of Tanganyika reached March 31. Here, much to his vexation, he got into the company of Arab slave dealers, by whom his movements were hampered; but he succeeded in reaching Lake Moero. After visiting Lake Mofwa and the Lualaba, which he believed was the upper part of the Nile, he, on July 18, discovered Lake Bangweolo. Proceeding up the west coast of Tanganyika, he reached Ujiji on March 14, 1869, "a ruckle of bones." Supplies had been forwarded to him at Ujiji, but had been knavishly made away with by those to whose care they had been entrusted. Livingstone recrossed Tanganyika in July, and through the country of the Manyuema he tried in vain, for a whole year, to reach and cross the Lualaba, baffled partly by the natives, partly by the slave hunters, and partly by his long illnesses. It was, indeed, not till March 29, 1871, that he succeeded in reaching the Lualaba, at the town of Nyangwe, where he stayed four months, vainly trying to get a canoe to take him across. It was here that a party of Arab slavers, without warning or provocation, assembled one day when the market was busiest and commenced shooting down the poor women, hundreds being killed or drowned in trying to escape. Livingstone had "the impression that he was in hell," but was helpless, though his "first impulse was to pistol the murderers." The account of this scene which he sent home roused indignation in England to such a degree as to lead to determined and to a considerable extent successful efforts to get the sultan of Zanzibar to suppress the trade. In sickened disgust the weary traveller made his way back to Ujiji, which he reached on October 13. Five days after his arrival in Ujiji he was cheered and inspired with new life, and completely set up again, as he said, by the timely arrival of Mr. H. M. Stanley, the richly laden almoner of Mr. Gordon Bennett, of the *New York Herald*. Mr. Stanley's residence with Livingstone was almost the only bright episode of these last sad years. With Stanley Livingstone explored the north end of Tanganyika, and proved conclusively that the Lusize runs into and not out of it. In the end of the year the two started eastward for Unyanyembe, where Stanley provided Livingstone with an ample supply of goods, and bade him farewell. Stanley left on March 15, 1872, and after Livingstone had waited wearily at Unyanyembe for five months, a troop of fifty-seven men and boys arrived, good and faithful fellows on the whole, selected by Stanley himself. Thus attended, he started on August 15 for Lake Bangweolo, proceeding along the east side of Tanganyika. His old enemy dysentery soon found him out. In January, 1873, the party got among the endless spongy jungle on the east of Lake Bangweolo, Livingstone's object being to go round by the south and away west to find the "fountains." Vexatious delays took place, and the journey became one constant wade below, under an almost endless pour of rain from above. The doctor got worse and worse, but no idea of danger seems to have occurred to him. At last, in the middle of April, he had unwillingly to submit to be carried on a rude litter. On April 29 Chitambo's village on the Lulimala, in Ilala, on the south shore of the lake, was reached. The last entry in the journal is April 27:—"Knocked up quite, and remain—recover—sent to buy milch goats. We are on the banks of the Molilamo." On April 30 he with difficulty wound up his watch, and early on the morning of May 1 the boys found "the great master," as they called him, kneeling by the side of his bed, dead. His faithful men preserved the body in the sun as well as they could, and wrapping it carefully up, carried it and all his papers, instruments, and other things across Africa to Zanzibar. It was borne to England with all honor, and on April 18, 1874, was deposited in Westminster Abbey, amid tokens of mourning and admiration such as England accords only to her greatest sons. Government bore all the funeral expenses. His faithfully kept journals during these seven years' wanderings were published under the title of the *Last Journals of David Livingstone in Central Africa*, in 1874, edited by his old friend the Rev. Horace Waller.

In spite of his sufferings and the many compulsory delays, Livingstone's discoveries during these last years were both extensive and of prime importance as leading to a solution of African hydrography. No single African explorer has ever done so much for African geography as Livingstone during his thirty years' work. His travels covered one-third of the continent, extending from the Cape to near the equator, and from the Atlantic to the Indian Ocean. Livingstone was no hurried traveller; he did his journeying leisurely, carefully observing and recording all that was worthy of note, with rare geographical instinct and the eye of a trained scientific observer, studying the ways of the people, eating their food, living in their huts, and sympathizing with their joys and sorrows. It will be long till the tradition of his sojourn dies out among the native tribes, who almost, without exception, treated Livingstone as a superior being; his treatment of them was always tender, gentle, and gentlemanly. But the direct gains to geography and science are perhaps not the greatest results of Livingstone's journeys. He conceived, developed, and carried out to success a noble and many-sided purpose, with an unflinching and self-sacrificing energy and courage that entitle him to take rank among the great and strong who single-handed have been able materially to influence human progress and the advancement of knowledge. His example and his death have acted like an inspiration, filling Africa with an army of explorers and missionaries, and raising in Europe so powerful a feeling against the slave-trade that it may be considered as having received its deathblow. Personally Livingstone was a pure and tender-hearted man, full of humanity and sympathy, simple-minded as a child. The motto of his life was the advice he gave to some school children in Scotland,—"Fear God, and work hard."

See, besides his own narratives and Dr. Blaikie's *Life*, the publications of the London Missionary Society from 1840, the *Proceedings of the Royal Geographical Society*, the despatches to the Foreign Office sent home by Livingstone during his last two expeditions, and Mr. H. M. Stanley's *How I Found Livingstone*. (J. S. K.)

LIVIUS ANDRONICUS occupies the position of the oldest among the recognized poets of Rome. He determined the course which Roman literature followed for more than a century after his time. The imitation of Greek comedy, tragedy, and epic poetry, which produced great results in the hands of Nævius, Plautus, Ennius, and their successors, received its first impulse from him. To judge, however, by the very insignificant remains of his writings, and by the testimonies of Cicero and Horace to his merits, he can have had no pretension either to original genius or to artistic accomplishment. His real claim to distinction was that he was the first great schoolmaster of the Roman people, and the first acknowledged medium through which the genius of Greece acted on the Roman mind, and found for itself a rude expression in the Latin language. His name, in which the Greek *Andronicus* is combined with the gentile name of one of the great Roman houses, while indicative of his own position as a manumitted slave, is also significant of the influences by which Roman literature was fostered,—viz., the culture of men who were either Greeks or "semi-Græci" by birth and education, and the protection and favor afforded to them by the more enlightened members of the Roman aristocracy. He is supposed to have been a native of Tarentum, and to have been brought while still a boy, after the capture of that town in 272 B. C., as a slave to Rome. He lived in the household of a member of the *gens Livia*, probably of that branch of it to which M. Livius Salinator, the colleague of C. Claudius Nero in the year of the battle of the Metaurus, belonged. We learn from Suetonius that, like Ennius after him, he obtained his living by teaching Greek and Latin; and it was probably as a schoolbook, rather than as a work of literary pretension, that his translation of the *Odyssey* into Latin Saturnian verse was executed. This work was still used in schools when Horace was taught at Rome by the famous grammarian and disciplinarian Orbilius. From the few fragments of the translation that have been preserved it may be inferred that it was owing to the conservatism of educational methods, rather than to its fitness to impart to boys in the Ciceronian age instruction either in Greek literature or in the Latin language, that it enjoyed this distinction. But at the time when it appeared it must have satisfied a real want. In the wars with Pyrrhus and Tarentum the Romans had for the first time come into close contact with the Greeks; and during the First Punic War (from 261 to 241 B. C.), in which Sicily was the chief battleground of the combatants, this contact was much closer. The knowledge of Greek became essential to men in high position, as a means of intercourse with Greeks; and at the same time the new ideas and new interests of Greek literature began to exercise something of that stimulating and refining power over the minds of the leading men which it exercised in a later generation over Scipio Africanus, T. Quintius Flamininus, M. Fulvius Nobilior, and others like them. But the presence of the Roman armies in southern Italy and Sicily must have accustomed many who had no means of obtaining a literary education to the representations of the Greek tragic and comic poets. Although the great creative age of the Athenian drama was passed, the passion for the representation of the old plays still continued, and was not confined to Athens. The number of theatres of which the remains are still seen in Sicily—as at Segesta, Syracuse, Catania, Taormina—indicate that, in the island in which Epicharmus had produced his old Dorian comedies, the representation of tragedy and comedy continued to be a most important element in the life of the people. But the Romans and Italians had an indigenous drama of their own, known by the name of *Satura*, which prepared them for the reception of the more regular Greek drama. The distinction between this *Satura* and the plays of Euripides or Menander was that it had no regular plot. This the Latin drama first received from Livius Andronicus; but it did so at the cost of its originality. In the year 240, the year after the end of the First Punic War, he produced at Rome a translation of a Greek play (it is uncertain whether a comedy or tragedy), and this representation marks the beginning of Roman literature. In this translation he discarded the native Saturnian metre, and adopted the iambic, trochaic, and cretic metres, to which Latin more easily adapted itself than either to the hexameter or to the lyrical measures of a later time. He continued to produce plays for more than thirty years after this time. The titles of some of his tragedies are *Achilles*, *Ægisthus*, *Equus Trojanus*, *Hermione*, *Tereus*,—all suggestive of subjects which were treated by the later tragic poets of Rome. The titles of some of his comedies are *Gladiolus*, *Ludius*, etc. In the year 207, when, if he was a captive after the taking of Tarentum, he must have been of a great age, he was appointed to compose the hymn of thanksgiving for the victory of the Metaurus. Another tribute of national recognition paid him was that, as a compliment to him, the "college" or "guild" of poets obtained a place of meeting in the temple of Minerva on the Aventine.

A good account of his remains is to be found in Wordsworth's *Fragments and Specimens of Early Latin*. The fragments of his dramas are to be found in Ribbeck's *Tragicorum Latinorum Reliquiæ*, and *Comicorum Latinorum Reliquiæ*. (W. Y. S.)

LIVNY, a district town of Russia, in the government of Orel, 87 miles east-south-east of the chief town of the government, at the confluence of the rivers Livenka and Sosna. It has railway connection with the line between Orel and Gryazi. The town is an important centre for trade in grain, hemp, tallow, skins, and cattle. A large amount of grain is purchased in the neighboring governments, and the flour is sent to Moscow and the neighboring towns, as well as to the Baltic ports. Hemp is sent to St. Petersburg, and cattle to Moscow, or they are killed for the preparation of tallow. The 13,000 inhabitants of Livny find employment in trade and in the flour-mills, and hemp, tallow-candle, and oil works. The district of Livny is one of the most fertile and populous of central Russia, and is remarkable for its numerous large villages.

Livny was founded in 1586, at the junction of the three highways to Astrakhan, to Little Russia, and to the Crimea, along which the Tartars usually made their inroads on Russian provinces. It was several times destroyed by Tartars during the 16th and 17th centuries. In the great internal wars of the first half of the 16th century, Livny was a centre where all kinds of discontented persons and marauders met. Its fort, or kreml, with thick earthen and wooden walls, existed until 1784.

LIVONIA, or Livland (*Liflandia* of the Russians), one of the three Baltic provinces of Russia, is bounded by the Gulf of Riga on the W., Esthonia on the N., the governments of St. Petersburg, Pskov, and Vitebsk on the E., and Courland on the S. A group of islands situated at the entrance of the Gulf of Riga, of which Ösel, Mohn, Runo, and Paternoster are the largest, belong to this government. It covers, with the islands, a surface of 18,160 square miles, but of this the part of Lake Peipus, or Tchudskoye, which belongs to it occupies 1090. Its surface is diversified by several plateaus, those of Haanhoyff and of the Livonian Aa having an average height of 700 feet, whilst several summits reach from 800 to 1000 feet or more (such as the Munna-Mäggi, 1063 feet; Haisingkalns, 1028 feet; Vella-Mäggi, 946 feet; Teufelsberg, 847 feet). The edges of the plateaus are intersected by deep valleys, which give a hilly character to the country; the hilly tract between the Duna and its tributary the Livonian Aa has received from its picturesque narrow valleys, covered with deep forests and numerous lakes, the name of "Wendish Switzerland." The plateau of Odenpä, watered by the tributaries of the Embach river, which flows for 93 miles from lake Wierz-yärvi into Lake Peipus, occupies an area of 2830 square miles, and has an average height of 500 feet. More than a thousand lakes are scattered over Livonia, of which that of Wierz-yärvi, having a surface of 105 square miles (114 feet above sea-level), is the largest; marshes and peat-bogs occupy as much as one-tenth of the province. Of the very numerous rivers which water Livonia, only the Duna, which flows for 90 miles along its frontier, and the Embach are navigable.

The geological structure of Livonia has been elaborately examined. The Silurian formation which covers Esthonia, and much resembles the Norwegian Silurian, appears in the northern part of Livonia, the remainder of the province consisting of Devonian strata. The whole is covered with a mighty sheet of glacial deposits, sometimes 400 feet thick. The typical bottom moraine, with boulders of all sizes up to 20 feet in diameter, brought from Finland, extends all over the country, reaching even to the summit of Munna-Mäggi. Glacial furrows, striæ, and elongated troughs are met with everywhere, running mostly from north-west to south-east, as well as *åsar*, which have the same direction and consist of morainic nucleus covered with stratified sands and clays; sand-downs cover large tracts on the shores of the Baltic. As in Esthonia, no traces of marine deposits are found higher than 100 or 150 feet above the present sea-level. The soil is not very fertile. Forests cover about two-fifths of the surface of this government, several of them having a diameter of 150 to 250 miles. The climate is rather severe. The mean temperatures are 43° Fahr. at Riga (winter 23°; summer, 63°), and 42½° at Dorpat. The intensity and direction of winds are very variable; the average number of rainy and snowy days is one hundred and forty-six at Riga (rainfall 24·1 inches); fogs are not uncommon.

The population of Livonia, which was but 621,600 in 1816, reached 1,000,876 in 1870, and is now about 1,121,000 in 1882. Though it is often described as a German province, only about 7 per cent. of the population (64,120 in 1863) are Germans, the great bulk being Ehsts or Esthonians (47 per cent.) and Letts (41·6 per cent.). The Russians number about 35,000, Poles 5000, and Jews 7000. The Livonians, who have given their name to the country, and who formerly extended far east to Sebej in the government of Vitebsk, have nearly all passed away; only a few thousands (2050 in 1863) inhabit the forests at the utmost extremity of the Peninsula of Courland. Their native language, of Finnish origin, is rapidly disappearing, their present language being rather a Lettish patois. Sjögren, in 1846, had much difficulty in making a grammar and dictionary of it from the mouths of old people. The Ehsts, who greatly resemble the Finns of Tavastland, have maintained their ethnic features, their customs, national traditions, national songs and poetry, and their harmonious language. There is now a marked revival of national feeling, favored by "Young Esthonia," together with a tendency towards a union with Finland. No less than eight political papers are published in the Esthonian language. The prevailing religion is the Lutheran (746,654 in 1863); about 80,000 Ehsts in Livonia and Esthonia, and 50,000 Letts (see Lithuanians), as well as the Russians, belong to the Greek Church (156,874 in 1863); of the Russians, however, a considerable proportion are *raskolniks* (nonconformists), who have emigrated to the Baltic provinces in consequence of prosecutions; these last number about 14,500, of whom 8000 are found in the neighborhood of Riga. About 6000 are Catholics. The Germans belong to the nobility, or to the burgher class in the towns.

The efforts of the German conquerors to Germanize the country have completely failed. The Ehsts and Letts openly display their traditional hatred against the invaders. The teaching in primary schools is carried on in Esthonian and Lettish; German prevails in colleges and higher schools. The Russian Government has for some time been laboring for "Russification;" the Russian civil code was introduced in the Baltic provinces in 1835, and the use of Russian, instead of German, in official correspondence and in law courts was ordered in 1867, but not generally brought into practice; the fact that the privileges given by the military law to those who have received primary education extend only to those who know Russian contributes to the extension of that language.

Nearly all the soil belongs to the nobility, the extent of peasants' estates being only 15 per cent. Serfdom was abolished in 1819, when the peasants received personal liberty, remaining, however, under the jurisdiction of their landlords, who maintained also the right to have a predominant influence in the nomination of ministers. Since 1849 the contribution in forced labor which the peasants were compelled to pay to landlords has been gradually, though imperfectly, commuted to a money payment, and the peasants have received the right to purchase their allotments. But, owing to later limitations of this law, as well as to the high price of allotments and to the establishment of a minimum size of 80 acres, the redemption of the land is going on very slowly. The class of peasant proprietors being restricted to a small number of wealthy peasants, the great bulk have remained *Knechts*, that is, tenants at will; they are very miserable, and about one-fourth of them are continually wandering in search of work. They readily emigrate, even to such unfertile provinces as Novgorod and Vitebsk, and from time to time the emigration takes the shape of a mass movement, which the Government stops by forcible measures. The average size of landed estates is from 9500 to 11,000 acres, far above the general average for Russia. The estates of the nobility are generally as well cultivated as in western Europe, while the peasants' farms are mostly in a deplorable state. In 1877 21·4 per cent. of the surface of Livonia was under crop, yielding 1,942,600 quarters of grain, and 1,843,200 quarters of potatoes. There were at the same time 146,000 horses, 372,000 cattle, 312,000 sheep, and 150,000 pigs. The shores of the Baltic yield valuable fisheries. Manufactures are steadily increasing. The distilleries yield about 1,400,000 gallons of spirits, part of which is exported; the beer breweries (two hundred) produce beer worth about 650,000 roubles. There are woollen, cotton, and silk mills, saw-mills, and paper, glass, candle, tobacco, and machinery works,—the chief manufacturing districts being Pernau and Riga. Livonia carries on a large export trade, especially through Riga and Pernau, in flax, linseed, hemp, grain, timber, and wooden wares; the Duna is of course the chief channel for this trade. During the last ten years, however, Libau has entered into brisk competition with the more northern ports of Livonia. The imports, especially through Riga, are also most important, the custom-houses of Livonia having had in 1881 an income of 6,000,000 silver roubles. The government is divided into eleven districts—Riga (104,200), Wollmar (2050), Dorpat (22,600), Pernau (12,500), Wenden (65,000), Arensburg in the island Ösel (3150), Walk (2950), Fellin (2900), Werro (2050), Lämsall (1450), and Schlock (800). The capital of the government is Riga.

The first historical notices of Livonia are by Tacitus and Jordanes, but coins of the time of Alexander the Great, found on the island of Ösel, show that the coasts of the

were at an early time in commercial relations with
vilised world. The chronicle of Nestor mentions as
itants of the Baltic coast the Tchud, the Lives, the
a, Letgola, Semigallians, and Kors. It is probably
the 9th century that the Tchud became tributary to
aryago-Russian states. As they reacquired their in-
dence, Yaroslaff I. undertook in 1030 a campaign
st them, and founded Yourieff (Dorpat). The first
ans penetrated into Livonia in the 11th century, and
8 several Bremen merchants landed at the mouth of
una. In 1186 the emissaries of the archbishop of
en began to preach the Christian religion among the
and Letts, and in 1200 the archbishop of Livonia
ished his residence at the mouth of the Duna, at Riga.
02 or 1204 Innocent III. recognized the Order of
ers of the Sword (*Schwert-brüder*), the residence of its
master being at Wenden; and the order, spreading
hristian religion by sword and fire among the natives,
d on from that time a series of uninterrupted wars
st the Russian republics and Lithuania, as well as a
gle against the influence of the archbishop of Riga,
last was supported by the importance acquired by
as a centre for trade, intermediate between the Han-
towns and those of Novgorod, Pskov, and Polotsk.
irst active interference of Lithuania in the affairs of
ia dates from the times which immediately followed
eat outbreak of peasants on Ösel; Olgerd devastated
all southern Livonia. The order happening to pur-
the Danish part of Esthonia, in 1347, began with
forces the war against the bishop of Riga, as well as
st Lithuania, Poland, and Russia. The wars against
powers were terminated respectively in 1435, 1466,
483. About the end of the 15th century the master
order, Plettenberg, acquired a position of great im-
ice, and in 1527 he was recognized as a prince of the
e by Charles V. On the other hand, the authority
bishops of Riga was soon completely destroyed (1566).
var of the order with John IV. in 1550 led to a divis-
f Livonia,—its northern part, Dorpat included, being
by Russia, and the southern part falling under the
iion of Poland. From that time Livonia formed a
t of dispute between Poland and Russia, the latter
ormally abdicating its rights to the country in 1582.
21 it was the theatre of a war between Poland and
on, and was conquered by the latter power, enjoying
for twenty-five years a milder rule. In 1654, and
at the beginning of the 17th century, it became the
re of war between Poland, Russia, and Sweden, and
t was finally conquered by Russia. The official con-
n was confirmed by the treaty of Nystad in 1721,
a guaranteeing the privileges of the nobility and
ns, and the freedom of the evangelical confession.

(P. A. K.)

VY, the Roman historian, belonged by birth to
regions of northern Italy which had already given
oman literature Catullus, Cornelius Nepos, and
il. He was born in 59 B. C., the year of Cæsar's
onsulship, and was thus eleven years younger than
il and six years younger than Horace. His native
Padua (Patavium) could challenge comparison, in
lays of Augustus, even with such great centres of
stry as Alexandria or Gades; and, while its active
cipal life, and long traditions of hard won inde-
ence, may have quickened Livy's sympathies with
blican freedom, its ancient connection with Rome
rally helped to turn his attention to the study
h became the work of his life. For Padua claimed,
Rome, a Trojan origin, and Livy is careful to place
nor, the founder of Padua, side by side with
as. A more real bond of union was found in the
ers to which both had been exposed from the as-
s of the Celts (Livy, x. 2), and Padua must have
drawn to Rome, as the conqueror of her heredi-
foes, by much the same motives as those which led
Greeks in southern Italy to seek Roman aid against
Oscan invader. Moreover, at the time of Livy's
, Padua had long been in possession of the full
ian franchise, and it is possible that the historian's
ly name had been taken by one of his ancestors
of compliment to the great Livian gens at Rome,
se connection with Cisalpine Gaul is a well-estab-
d fact (Livy, xxvii. 35; Suet., *Tib.*, 3), and by one
hom his family may have been enfranchised.

ivy's easy, independent life at Rome, and his aris-
atic leanings in politics, have been taken as proof that he was the son of well-born and opulent parents: and it is certain that he was able to afford the luxury of a good education, for he was widely read in Greek literature, and a student both of rhetoric and philosophy. We have also evidence in his writings that he had prepared himself for his great work by researches into the history of his native town. His youth and early manhood, spent perhaps chiefly at Padua, were cast in stormy times, and the impression which they left upon his mind was ineffaceable. He was ten years old when Cæsar crossed the Rubicon and civil war began. In his fifteenth year came the murder of the great dictator, of whom he afterwards declared that he knew not "whether it were better for him to have been born or not," and one year later the murder of Cicero, to whose memory he paid an eloquent tribute. Of the part taken by Padua in the troubles which distracted the empire from 49 B. C. till the decisive victory at Actium we know nothing beyond the fact that in 43 B. C. it closed its gates against Antony, and was afterwards punished for doing so by Asinius Pollio. Livy's personal sympathies were with Pompey and the republican party (Tac., *Ann.*, iv. 34); but far more lasting in its effects was his experience of the license, anarchy, and confusion of these dark days. The rule of Augustus he seems to have accepted as a necessity, but he cannot, like Horace and Virgil, welcome it as inaugurating a new and glorious era. While he endeavors to stifle his recollections of the horrors he had witnessed, by fixing his whole mind on older and better times, he writes of the present with despondency as a degenerate and declining age; and, instead of triumphant prophecies of world-wide rule, such as we find in Horace, Livy contents himself with pointing out the dangers which already threatened Rome, and exhorting his contemporaries to learn, in good time, the lessons which the past history of the state had to teach.

It was probably about the time of the battle of Actium that Livy established himself in Rome, and there he seems chiefly to have resided until his retirement to Padua shortly before his death. We have no evidence that he travelled much, though he must have paid at least one visit to Campania (xxxviii. 56), and he never, so far as we know, took any part in political life. Nor, though he enjoyed the personal friendship and patronage of Augustus (Tac., *Ann.*, iv. 34), and stimulated the historical zeal of the future emperor Claudius (Suet., *Claud.*, xli.), can we detect in him anything of the courtier. There is not in his history a trace of that rather gross adulation in which even Virgil does not disdain to indulge. His republican sympathies were freely expressed, and, it should be added, as freely pardoned by Augustus. We must imagine him devoted to the great task which he had set himself to perform, with a mind, as he tells us himself in his preface, free from all disturbing cares, and in the enjoyment of all the facilities for study afforded by the Rome of Augustus, with its liberal encouragement of letters, its newly-founded libraries, and its brilliant literary circles. As his work went on, the fame which he had never coveted came to him in ample measure. He is said to have declared in one volume of his history that he had already won glory enough, and the younger Pliny (*Epist.*, ii. 3) relates that a Spaniard came all the way from Gades merely to see him, and, this accomplished, at once returned home satisfied. The accession of Tiberius (14 A. D.) materially altered for the worse the prospects of literature in Rome, and Livy may have feared for himself the fate which afterwards befell Cremutius Cordus, who was tried before the senate, for having in his annals spoken of Brutus and Cassius as the last of the Romans (Tac., *Ann.*, iv. 34). However this may have been, Livy retired to Padua, and died there in the third year of the reign of Tiberius (17 A. D.), at the ripe age of seventy-six. When we have added that he had at least one son (Quintil., x. 1), who was possibly also an author (Pliny, *Nat. Hist.*, i. 5, 6), and a daughter married to a certain L. Magius, a rhetorician of no great merit (Seneca, *Controv.*, x. 29, 2), we have reached the end of all that is known with certainty of Livy's personal history; and the apocryphal nature of the details which have been added by later admirers has been too often exposed to make it necessary to deal with them here.[1]

But for us, as for Livy himself, the interest of his life centres in the work to which the greater part of it was devoted. For we must decline to believe with Niebuhr that his history was all written in his later years. On the contrary, various indications point to the period from 27 to 20 B. C., as that during which the first decade was written. In the first book (i. 19) the emperor is called Augustus, a title which he assumed early in 27 B. C., and in ix. 18 the omission of all reference to the restoration, in 20 B. C., of the standards taken at Carrhæ seems to justify the inference that the passage was written before that date. In the third decade, the allusion in xxviii. 12 to victories in Spain may, as Weissenborn thinks, refer to Agrippa's campaigns in 19 B. C., but the words "*ductu* auspicioque Augusti Cæsaris" point more naturally to those of Augustus himself, 27-25 B. C. In the epitome of book lix. there is a reference to a law of Augustus which was passed in 18 B. C. The books dealing with the civil wars must have been written during Augustus's lifetime, as they were read by him (Tac., *Ann.*, iv. 34), while there is some evidence that the last part of the work, from book cxxi. onwards, was published after his death (14 A. D.).

Livy's history begins with the landing of Æneas in Italy, and closes with the death of Drusus, 9 B. C., though it is possible that he intended to continue it as far as the death of Augustus. The original title of the work is unknown, but of its general plan it is possible to speak with more certainty. The division into decades is certainly not due to the author himself, and is first heard of at the end of the 5th century; on the other hand, the division into "libri" or "volumina" seems to be original. It is referred to by Livy himself (x. 31, "per quartum jam volumen;" xxxi. 1, "multa volumina"), as well as by Pliny (*N. H.*, *præf.*) and by later writers. That the books were grouped and possibly published in sets is rendered probable both by the prefaces which introduce new divisions of the work (vi. 1, xxi. 1, xxxi. 1) and by the description in one MS. of books cix.-cxvi. as "bellorum civilium libri octo." Such arrangement and publication in parts were moreover common with ancient authors, and in the case of a lengthy work almost a necessity.

Of the 142 "libri" composing the history, the first 15 carry us down to the eve of the great struggle with Carthage, a period, as Livy reckons it, of 488 years (xxxi. 1); 15 more (xvi.-xxx.) cover the 63 years of the two great Punic wars. With the close of book xlv. we reach the conquest of Macedonia in 167 B. C. Book lviii. described the tribunate of Tiberius Gracchus, 133 B. C. In book lxxxix. we have the dictatorship of Sulla (81 B. C.), in ciii. Cæsar's first consulship (59 B. C.), in cix.-cxvi. the civil wars to the death of Cæsar (44 B. C.), in cxxiv. the defeat of Brutus and Cassius at Philippi, in cxxxiii. and cxxxiv. the battle of Actium and the accession of Augustus. The remaining eight books give the history of the first twenty years of Augustus's reign.

Such in outline was the vast work of which Martial (xiv. 190) complains that his whole library could not contain it. But a small portion of it, however, has come down to modern times; only thirty-five books are now extant (i.-x., xx.-xlv.), and of these xli. and xliii. are incomplete. The lost books seem to have disappeared between the 7th century and the revival of letters in the 15th,—a fact sufficiently accounted for by the difficulty of transmitting so voluminous a work in times when printing was unknown, for the story that Pope Gregory I. burnt all the copies of Livy he could lay his hands on rests on no good evidence. Only one important fragment has since been recovered,—the portion of book xc. discovered in the Vatican in 1772, and edited by Niebuhr in 1820. Very much no doubt of the substance of the lost books has been preserved both by such writers as Plutarch and Dion Cassius, and by epitomizers like Florus and Eutropius. But our knowledge of their contents is chiefly derived from the so-called "periochæ" or epitomes, of which we have fortunately a nearly complete series, the epitomes of books cxxxvi. and cxxxvii. being the only ones missing. These epitomes have been ascribed without sufficient reason to Florus (2d century); but, though they are probably of even later date, and are disappointingly meagre, they may be taken as giving, so far as they go, a fairly authentic description of the original. They have been expanded with great ingenuity and learning by Freinsheim in Drakenborch's edition of Livy.[2]

The received text of the extant thirty-five books of Livy is taken from different sources, and no one of our MSS. contains them all. The MSS. of the first decade, some thirty in number, are with one exception derived, more or less directly, from a single archetype, viz., the recension made in the 4th century by the two Nicomachi, Flavianus and Dexter (not by one only, as Niebuhr thought), and by Victorianus. This is proved in the case of the older MSS. by written subscriptions to that effect, and in the case of the rest by internal evidence. Of all these descendants of the Nicomachean recension, the oldest is the Codex Parisinus of the 10th century, and the best the Codex Mediceus or Florentinus of the 11th. An independent value attaches to the ancient palimpsest of Verona, of which the first complete account was given by Mommsen as recently as 1868 (*Berliner Monatsber.*, January). It contains the third, fourth, fifth, and fragments of the sixth book, and, according to Mommsen, whose conclusions are accepted by Madvig (*Emend. Livianæ*, 2d ed., 1877, p. 37), it is derived, not from the Nicomachean recension, but from an older archetype common to both.

For the third decade our chief authority is the Codex Puteanus, an uncial MS. of the 8th century, now at Paris. For the fourth we have two leading MSS.,—Codex Bambergensis, 11th century, and the slightly older Codex Moguntinus, which is only known through the Mainz edition of 1518-19. What remains of the fifth decade depends on the Laurishamensis or Vindobonensis from the monastery of Lörsch, edited at Basel in 1531. It belongs to the 6th century.

If we are to form a correct judgment on the merits of Livy's history, we must, above all things, bear in mind what his aim was in writing it, and this he has told us himself in the celebrated preface which Niebuhr rather unaccountably denounces as "the worst part of his work" (*Introd. Lect.*, p. 60). He set himself the task of recording the history of the Roman people, "the first in the world," from the beginning. The task was a great one, and the fame to be won by it uncertain, yet it would be something to have made the attempt, and the labor itself would bring a welcome relief from the contemplation of present evils; for his readers too this record will, he says, be full of instruction: they are invited to note especially the moral lessons taught by the story of Rome, to observe how Rome rose to greatness by the simple virtues and unselfish devotion of her citizens, and how on the decay of these qualities followed degeneracy and decline.

He does not therefore write, as Polybius wrote, for students of history. With Polybius the greatness of Rome is a phenomenon to be critically studied and scientifically explained; the rise of Rome forms an important chapter in universal history, and must be dealt with, not as an isolated fact, but in connection with the general march of events in the civilized world. Still less has Livy anything in common with the naive anxiety of Dionysius to make it clear to his fellow Greeks that the irresistible people who had mastered them was in origin, in race, and in language Hellenic like themselves.

Livy writes as a Roman, to raise a monument worthy of the greatness of Rome, and to keep alive, for the guidance and the warning of Romans, the recollection alike of the virtues which had made Rome great and of the vices which had threatened her with destruction. In so writing he was in close agreement with the traditions of Roman literature, as well as with the conception of the nature and objects of history current in his time. To a large extent Roman literature grew out of pride in Rome, for, though her earliest authors took the form and often the language of their writings from Greece, it was the greatness of Rome that inspired the best of them, and it was from the annals of Rome that their themes were taken. And this is naturally true in an especial sense of the Roman historians; the long list of annalists begins at the moment when the great struggle with Carthage had for the first time brought Rome into direct connection with the historic peoples of the ancient world, and when Romans themselves awoke to the importance of the part reserved for Rome to play in universal history. To write the annals of Rome became at once a task worthy of the best of her citizens. Though other forms of literature might be thought unbecoming to the dignity of a free-born citizen, this was never so with history. On the contrary, men of high rank and tried statesmanship were on that very account thought all the fitter to write the chronicles of the state they had served. And history in Rome never lost either its social prestige or its intimate and exclusive connection with the fortunes of the Roman people. It was well enough for Greeks to busy themselves with the manners, institutions, and deeds of the "peoples outside." The Roman historians, from Fabius Pictor to Tacitus, cared for none of these things. This exclusive interest in Rome was doubtless encouraged by the peculiar characteristics of the history of the state. The Roman annalist had not, like the Greek, to deal with the varying fortunes and separate doings of a number of petty communities, but with the continuous life of a single city. Nor was his attention drawn from the main lines of political history by the claims of art, literature, and philosophy, for just as the tie which bound Romans together was that of citizenship, not of race or culture, so the history of Rome is that of the state, of its political constitution, its wars and conquests, its military and administrative system.

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[1] For Livy's life see the introduction to Weissenborn's edition, Berlin, 1871, and the article in Smith's *Dictionary of Biography*.

[2] The various rumors once current of complete copies of Livy in Constantinople, Chios, and elsewhere are noticed by Niebuhr, *Introd. Lect.*, p. 67, Eng. transl. See also Pauly, *Real-Encyclopädie*, *s. v.*

Livy's own circumstances were all such as to render these views natural to him. He began to write at a time when, after a century of disturbance, the mass of men had been contented to purchase peace at the price of liberty. The present was at least inglorious, the future doubtful, and many turned gladly to the past for consolation. This retrospective tendency was favorably regarded by the Government. It was the policy of Augustus to obliterate all traces of recent revolution, and to connect the new imperial regime as closely as possible with the ancient traditions and institutions of Rome and Italy. The *Æneid* of Virgil, the *Fasti* of Ovid, suited well with his own restoration of the ancient temples, his revival of such ancient ceremonies as the Ludi Sæculares, his efforts to check the un-Roman luxury of the day, and his jealous regard for the purity of the Roman stock. And, though we are nowhere told that Livy undertook his history at the emperor's suggestion, it is certain that Augustus read parts of it with pleasure, and even honored the writer with his assistance and friendship.

Livy was deeply penetrated with a sense of the greatness of Rome. From first to last its majesty and high destiny are present to his mind. Æneas is led to Italy by the fates that he may be the founder of Rome (i. 1; comp. i. 4, "debebatur fatis tantæ origo urbis"). Romulus after his ascension declares it to be the will of heaven that Rome should be mistress of the world; and Hannibal marches into Italy, that he may "set free the world" from Roman rule. But if this ever-present consciousness often gives dignity and elevation to his narrative, it is also responsible for some of its defects. It leads him occasionally into exaggerated language (*e. g.*, xxii. 33, "nullius usquam terrarum rei cura Romanos effugiebat") or into such misstatements as that in xxi. 99, where he explains the course taken by the Romans in renewing war with Carthage by saying that "it seemed more suitable to the dignity of the Roman people." Often his jealousy for the honor of Rome makes him unfair and one-sided. In all her wars not only success but justice is with Rome (*e. g.*, the war with Perseus of Macedon; see Cobet in *Mnemosyne* for 1881). When Hieronymus of Syracuse deserts Rome for Hannibal, Livy says nothing of the complaints against Rome, by which, according to Polybius, he justified his change of policy. To the same general attitude is also due the omission by Livy of all that has no direct bearing on the fortunes of the Roman people. "I have resolved," he says (xxxix. 48), "only to touch on foreign affairs so far as they are bound up with those of Rome." The operations of the Rhodians in Asia Minor (197 B. C., xxxiii. 20) he curtly dismisses in a sentence, that he may pass "ad ea quæ propria Romani belli sunt;" and so again (xli. 25) "it is not worth my while to recount in detail the wars of foreigners with each other; it is as much and more than I can do to record the doings of the Roman people." As the result, we get from Livy very defective accounts even of the Italic peoples most closely connected with Rome. Of the past history and the internal condition of the more distant nations she encountered he tells us little or nothing, even when he found such details carefully given by Polybius.

Scarcely less strong than his interest in Rome is his interest in the moral lessons which her history seemed to him so well qualified to teach. This didactic view of history was a prevalent one in antiquity, and it was confirmed no doubt by those rhetorical studies which in Rome as in Greece formed the chief part of education, and which taught men to look on history as little more than a store-house of illustrations and themes for declamation. But it suited also the practical bent of the Roman mind, with its comparative indifference to abstract speculation or purely scientific research. It is in the highest degree natural that Livy should have sought for the secret of the rise of Rome, not in any large historical causes, but in the moral qualities of the people themselves, and that he should have looked upon the contemplation of these as the best remedy for the vices of his own degenerate days. It is possible too that the simplicity and even austerity of manners for which Padua was afterwards celebrated may have characterized its citizens in Livy's time, and that he was thus especially fitted to appreciate the purity, reverence, and loyalty of early Rome. But, whatever the cause, there is no doubt of the fact. He is never tired of insisting on the virtues of past days, or of contrasting them with the vices of the present. He dwells with delight on the unselfish patriotism of the old heroes of the republic. In those times children obeyed their parents, the gods were still sincerely worshipped, poverty was no disgrace, sceptical philosophies and foreign fashions in religion and in daily life were unknown. But this ethical interest is closely bound up with his Roman sympathies. His moral idea is no abstract one, and the virtues he praises are those which in his view made up the truly Roman type of character. "Minime Romani ingenii homo" is the sentence of condemnation he passes (xxii. 58) on a Roman soldier who broke faith with Hannibal. Camillus is praised as "vir ac vere Romanus" (xxii. 14); "to do and to suffer bravely" is Roman (ii. 12). The prominence thus given to the moral aspects of the history tends to obscure in some degree the true relations and real importance of the events narrated, but it does so in Livy to a far less extent than in some other writers. He is much too skilful an artist either to resolve his history into a mere bundle of examples, or to overload it, as Tacitus is sometimes inclined to do, with reflections and axioms. The moral he wishes to enforce is usually either conveyed by the story itself, with the aid perhaps of a single sentence of comment, or put as a speech into the mouth of one of his characters (*e. g.*, xxiii. 49; the devotion of Decius, viii. 10, comp. vii. 40; and the speech of Camillus, v. 54); and what little his narrative thus loses in accuracy it gains in dignity and warmth of feeling. In his portraits of the typical Romans of the old style, such as Q. Fabius Maximus, in his descriptions of the unshaken firmness and calm courage shown by the fathers of the state in the hour of trial, Livy is at his best; and he is so largely in virtue of his genuine appreciation of character as a powerful force in the affairs of men.

This enthusiasm for Rome and for Roman virtues is, moreover, saved from degenerating into gross partiality by the genuine candor of Livy's mind and by his wide sympathies with everything great and good. Seneca has described him as "candidissimus omnium magnorum ingeniorum æstimator" (*Suasor.*, vi. 21). Quintilian (x. 1, 101) places him on a level with Herodotus as a writer "clarissimi candoris," and this candid admiration is not reserved exclusively for Romans. Hasdrubal's devotion and valor at the battle on the Metaurus are described in terms of eloquent praise (xxvii. 49, "there, as became the son of Hamilcar and the brother of Hannibal, he fell fighting"); and even in Hannibal, the lifelong enemy of Rome, he frankly recognizes the great qualities that balanced his faults. Nor though his sympathies are unmistakably with the aristocratic party, does he scruple to censure the pride, cruelty, and selfishness which too often marked their conduct (ii. 54; the speech of Canuleius, iv. 3; of Sextius and Licinius, vi. 36); and, though he feels acutely that the times are out of joint, and has apparently little hope of the future, he still believes in justice and goodness. He is often righteously indignant, but never satirical, and such a pessimism as that of Tacitus and Juvenal is wholly foreign to his nature.

Though he studied and even wrote on philosophy (Senec., *Ep.* 100), Livy is by no means a philosophic historian. We learn indeed from incidental notices that he inclined to Stoicism and disliked the Epicurean system. With the scepticism that despised the gods (x. 40) and denied that they meddled with the affairs of men (xliii. 13) he has no sympathy. The immortal gods are everywhere the same (xiii. 3); they govern the world (xxxvii. 45) and reveal the future to men by signs and wonders (xliii. 13), but only a debased superstition will look for their hand in every petty incident (xxvii. 23, "minimis etiam rebus prava religio inserit deos"), or abandon itself to an indiscriminate belief in the portents and miracles in which popular credulity delights (xxviii. 11, xxi. 62, "multa ea hieme prodigia . . . aut quod evenire solet, motis semel in religionem animis, multa nunciata et temere credita"). The ancient state religion of Rome, with its temples, priests, and auguries, he not only reverences as an integral part of the Roman constitution, with a sympathy which grows as he studies it (xliii. 13, "et mihi vetustas res scribenti, nescio quo pacto antiquus fit animus"), but, like Varro, and in true Stoic fashion, he regards it as a valuable instrument of government (i. 19, 21), indispensable in a well-ordered community. As distinctly Stoical is the doctrine of a fate to which even the gods must yield (ix. 4), which disposes the plans of men (i. 42) and blinds their minds (v. 37), yet leaves their wills free (xxxvii. 45).

But we find no trace in Livy of any systematic application of philosophy to the facts of history. He is as innocent of the leading ideas which shaped the work of Polybius as he is of the cheap theorizing which wearies us in the pages of Dionysius. The events are graphically, if not always accurately, described; but of the larger causes at work in producing them, of their subtle action and reaction upon each other, and of the general conditions amid which the history worked itself out, he takes no thought at all. Nor has Livy much acquaintance with either the theory or the practice of politics. He exhibits, it is true, political sympathies and antipathies. He is on the whole for the nobles and against the commons; and, though the unfavorable colors in which he paints the leaders of the latter are possibly reflected from the authorities he followed, it is evident that he despised and disliked the multitude (xxiv. 25, "aut servit humiliter aut superbe dominatur"). Of monarchy he speaks with a genuine Roman hatred, and we know that in the last days of the republic his sympathies were wholly with those who strove in vain to save it. He betrays too an insight into the evils which were destined finally to undermine the imposing fabric of Roman empire. The decline of the free population, the spread of slavery (vi. 12, vii. 25), the universal craving for wealth (iii. 26), the employment of foreign mercenaries (xxv. 33), the corruption of Roman race and Roman manners by mixture with aliens (xxxix. 3), are all noticed in tones of solemn warning. But his retired life had given him no wide experience of men and things. It is not surprising, therefore, to find that he fails altogether to present a clear and coherent picture of the history and working of the Roman constitution, or that his handling of intricate questions of policy is weak and inadequate.

If from the general aim and spirit of Livy's history we pass to consider his method of workmanship, we are struck at once by the very different measure of success attained by him in the two great departments of an historian's labor. He is a consummate artist, but an unskilled and often careless investigator and critic. The materials which lay ready to his hand may be roughly classed under two heads:—(1) the original evidence of monuments, inscriptions, etc., (2) the written tradition as found in the works of previous authors. It is on the second of these two kinds of evidence that Livy almost exclusively relies. Yet that even for the very early times a certain amount of original evidence still existed is proved by the use which was made of it by Dionysius, who mentions at least three important inscriptions, two dating from the regal period and one from the first years of the republic (iv. 26, iv. 58, x. 32). We know from Livy himself that the breastplate dedicated by Cossus (428 B. C.) was to be seen in his own day in the temple of Jupiter Feretrius, nor is there any reason to suppose that the "libri lintei," quoted by Licinius Macer, were not extant when Livy wrote. For more recent times the materials were plentiful, and a rich field of research lay open to the student in the long series of laws, decrees of the senate, and official registers, reaching back, as it probably did, at least to the commencement of the 3d century B. C. Nevertheless it seems certain that Livy never realized the duty of consulting these relics of the past, even in order to verify the statements of his authorities. Many of them he never mentions; the others (*e. g.*, the libri lintei) he evidently describes at second hand. Antiquarian studies were popular in his day, but the instances are very few in which he has turned their results to account. There is no sign that he had ever read Varro; and he never alludes to Verrius Flaccus. The haziness and inaccuracy of his topography make it clear that he did not attempt to familiarize himself with the actual scenes of events even that took place in Italy. Not only does he confuse Thermon, the capital of Ætolia, with Thermopylæ (xxxiii. 35), but his accounts of the Roman campaigns against Volsci, Æqui, and Samnites swarm with confusions and difficulties; nor are even his descriptions of Hannibal's movements free from an occasional vagueness which betrays the absence of an exact knowledge of localities.

The consequence of this indifference to original research and patient verification might have been less serious had the written tradition on which Livy preferred to rely been more trustworthy. But neither the materials out of which it was composed nor the manner in which it had been put together were such as to make it a safe guide. It was indeed represented by a long line of respectable names. The majority of the Roman annalists were men of high birth and education, with a long experience of affairs, and their defects did not arise from seclusion of life or ignorance of letters. It is rather in the conditions under which they wrote and in the rules and traditions of their craft that the causes of their shortcomings must be sought.

It was not until the 6th century from the foundation of the city that historical writing began in Rome. The father of Roman history, Q. Fabius Pictor, a patrician and a senator, can scarcely have published his annals before the close of the Second Punic War, but these annals covered the whole period from the arrival of Evander in Italy down at least to the battle by Lake Trasimene (217 B. C.). Out of what materials, then, did he put together his account of the earlier history? Recent criticism has succeeded in answering this question with some degree of certainty. A careful examination of the fragments of Fabius (see H. Peter, *Historicorum Romanorum Relliquiæ*, Leipsic, 1870; and Nitzsch, *Röm. Annalistik*, Berlin, 1873) reveals in the first place a marked difference between the kingly period and that which followed the establishment of the republic. The history of the former stretches back into the regions of pure mythology. It is little more than a collection of fables told with scarcely any attempt at criticism, and with no more regard to chronological sequence than was necessary to make the tale run smoothly or to fill up such gaps as that between the flight of Æneas from Troy and the supposed year of the foundation of Rome. But from its very commencement the history of the Republic wears a different aspect. The mass of floating tradition, which had come down from early days, with its tales of border raids and forays, of valiant chiefs, and deeds of patriotism, is now rudely fitted into a framework of a wholly different kind. This framework consists of short notices of important events, wars, prodigies, consecration of temples, etc., all recorded with extreme brevity, precisely dated, and couched in a somewhat archaic style. They were taken probably from one or more of the state registers, such as the annals of the pontiffs, or those kept by the ædiles in the temple of Ceres. This bare official outline of the past history of his city was by Fabius filled in from the rich store of tradition that lay ready to his hand. The manner and spirit in which he effected this combination were no doubt wholly uncritical. Usually he seems to have transferred both annalistic notices and popular traditions to his pages much in the shape in which he found them. But he unquestionably gave undue prominence to the tales of the prowess and glory of the Fabii, and probably also allowed his own strong aristocratic sympathies to color his version of the early political controversies. This fault of partiality was, according to Polybius, a conspicuous blot in Fabius's account of his own times, which was, we are told, full and in the main accurate, and, like the earlier portions, consisted of official annalistic notices, supplemented, however, not from tradition, but from his own experience and from contemporary sources. But even here Polybius charges him with favoring Rome at the expense of Carthage, and with the undue exaltation of the great head of his house, Q. Fabius Cunctator.

Nevertheless the comparative fidelity with which Fabius seems to have reproduced his materials might have made his annals the starting point of a critical history. But unfortunately intelligent criticism was exactly what they never received. It is true that in some respects a decided advance upon Fabius was made by subsequent annalists. M. Porcius Cato (234–149 B. C.) widened the scope of Roman history so as to include that of the chief Italian cities, and made the first serious attempt to settle the chronology. In his history of the Punic wars Cælius Antipater (*circa* 130 B. C.) added fresh material, drawn probably from the works of the Sicilian Greek Silenus, while Licinius Macer (70 B. C.) distinguished himself by the use he made of the ancient "linen books." No doubt, too, the later annalists, at any rate from Cælius Antipater onwards, improved upon Fabius in treatment and style. But in more essential points we can discern no progress. One annalist after another quietly adopted the established tradition, as it had been left by his predecessors, without any serious alterations of its main outlines. Of independent research and critical analysis we find no trace, and the general agreement upon main facts is to be attributed simply to the regularity with which each writer copied the one before him. But, had the later annalists contented themselves with simply reproducing the earlier ones, we should at least have had the old tradition before us in a simple and tolerably genuine form. As it was, while they slavishly clung to its substance, they succeeded as a rule in destroying all traces of its original form and coloring. L. Calpurnius Piso, tribune in 149 B. C. and consul in 133 B. C., prided himself on reducing the old legends to the level of common sense, and importing into them valuable moral lessons for his own generation. By Cælius Antipater the methods of rhetoric were first applied to history, a disastrous precedent enough. He inserted speeches, enlivened his pages with chance tales, and aimed, as Cicero tells us, at not merely narrating facts but also at beautifying them. His successors carried still further the practice of dressing up the rather bald chronicles of earlier writers with all the ornaments of rhetoric. The old traditions were altered, almost beyond the possibility of recognition, by exaggerations, interpolations, and additions. Fresh incidents were inserted, new motives suggested, and speeches composed in order to infuse the required life and freshness into these dry bones of history. At the same time the political bias of the writers, and the political ideas of their day were allowed, in some cases perhaps half unconsciously, to affect their representations of past events. Annalists of the Gracchan age imported into the early struggles of patricians and plebeians the economic controversies of their own day, and painted the first tribunes in the colors of the two Gracchi or of Saturninus. In the next generation they dexterously forced the venerable records of the early republic to pronounce in favor of the ascendency of the senate, as established by Sulla. To political bias was added family pride, for the gratification of which the archives of the great houses, the funeral panegyrics, or the imagination of the writer himself supplied an ample store of doubtful material. Pedigrees were invented, imaginary consulships and fictitious triumphs inserted, and family traditions and family honors were formally incorporated with the history of the state.

Things were not much better even where the annalists were dealing with recent or contemporary events. Here indeed their materials were naturally fuller and more trustworthy, and less room was left for fanciful decoration and capricious alteration of the facts. But their methods are in the main unchanged. What they found written they copied; the gaps they supplied, where personal experience failed, by imagination. No better proof of this can be given than a comparison of the annalist's version of history with that of Polybius. In the fourth and fifth decades of Livy the two appear side by side, and the contrast between them is striking. Polybius, for instance, gives the number of the slain at Cynoscephalæ as 8000; the annalists raise it as high as 40,000 (Livy, xxxiii. 10). In another case (xxxii. 6) Valerius Antias, the chief of sinners in this respect, inserts a decisive Roman victory over the Macedonians, in which 12,000 of the latter were slain and 2200 taken prisoners, an achievement recorded by no other authority. In some parts of these two decades, however, Livy gives us only the annalists' story. Of the campaigns in Cisalpine Gaul, Liguria, and Spain, as described by him on their authority, Nissen well remarks (*Untersuch.*, p. 94), "One would think that the Gauls, Ligurians, and Spaniards were there for the sole purpose of being slaughtered in thousands by the Romans. Year after year they rise in revolt against Rome, lose some 40,000 men in the struggle, and finally submit, only to begin the same game afresh next year."

Such was the written tradition on which Livy mainly relied. We have next to examine the manner in which he used it, and here we are met at the outset by the difficulty of determining with exactness what authorities he is following at any one time; for of the importance of full and accurate references he has no idea, and often for chapters together he gives us no clue at all. More often still he contents himself with such vague phrases as "they say," "the story goes," "some think," or speaks in general terms of "ancient writers" or "my authorities." Even where he mentions a writer by name, it is frequently clear that the writer named is not the one whose lead he is following at the moment, but that he is noticed incidentally as differing from Livy's guide for the time being on some point of detail (compare the references to Piso in the first decade, i. 55, ii. 32, etc.). It is very rarely that Livy explicitly tells us whom he has selected as his chief source (*e. g.*, Fabius, xxii. 7; Polybius, xxxiii. 10). By a careful analysis, however, of those portions of his work which admit of a comparison with the text of his acknowledged authorities (*e. g.*, fourth and fifth decades, see Nissen, *Untersuchungen*, Berlin, 1863), and elsewhere by comparing his version with the known fragments of the various annalists, and with what we are told of their style and method of treatment, we are able to form a general idea of his plan of procedure. As to the first decade, it is generally agreed that in the first and second books at any rate he follows such older and simpler writers as Fabius Pictor and Calpurnius Piso (the only ones whom he there refers to by name), to whom, so far as the first book is concerned, Niebuhr (*Introd. Lect.*, p. 33) would add the poet Ennius. With the close of the second book or the opening of the third we come upon the first traces of the use of later authors. Valerius Antias is first quoted in iii. 5, and signs of his handiwork are visible here and there throughout the rest of the decade (vii. 36, ix. 27, x. 3-5). In the fourth book the principal authority is apparently Licinius Macer, and for the period following the sack of Rome by the Gauls Q. Claudius Quadrigarius, whose annals began at this point in the history. We have besides a single reference (vii. 3) to the antiquarian Cincius, and two (iv. 23, x. 9) to Q. Ælius Tubero, one of the last in the list of annalists. Passing to the third decade, we find ourselves at once confronted by a question which has been long and fully discussed—the relation between Livy and Polybius. Did Livy use Polybius at all, and, if so, to what extent? (See for details Hübner, *Grundriss zu Vorlesungen üb. d. Röm. Litteraturgeschichte*, p. 195.)

It is conceded on all hands that Livy in this decade makes considerable use of other authorities than Polybius (*e. g.*, Fabius, xxii. 7; Cælius Antipater, xxi. 38, 46, 47, xxii. 31, etc.), that he only once mentions Polybius (xxx. 45, "Polybius haudquaquam spernendus auctor"), and that, if he used him, he did so to a much less extent than in the fourth and fifth decades, and in a very different manner. It is also agreed that we can detect in Livy's account of the Hannibalic war two distinct elements, derived originally, the one from a Roman, the other from a non-Roman source. But from these generally accepted premisses two opposite conclusions have been drawn. On the one hand it is maintained (*e. g.*, by Lachmann, C. Peter, H. Peter, *Hist. Rom. Reliq.*) that those parts of Livy's narrative which point to a non-Roman authority (*e. g.*, Hannibal's movements prior to his invasion of Italy) are taken by Livy directly from Polybius, with occasional reference of course to other writers, and with the omission (as in the later decades) of all matters uninteresting to Livy or his Roman readers, and the addition of rhetorical touches and occasional comments. It is urged that Livy, who in the fourth and fifth decades shows himself so sensible of the great merits of Polybius, is not likely to have ignored him in the third, and that his more limited use of him in the latter case is fully accounted for by the closer connection of the history with Rome and Roman affairs, and the comparative excellence of the available Roman authorities, and, lastly, that the points of agreement with Polybius, not only in matter but in expression, can only be explained on the theory that Livy is directly following the great Greek historian. On the other hand it is maintained (especially by Schwegler, Nitzsch, and K. Böttcher) that the extent and nature of Livy's agreement with Polybius in this part of his work point rather to the use by both of a common original authority. It is argued that Livy's mode of using his authorities is tolerably uniform, and that his mode of using Polybius in particular is known with certainty from the later decades. Consequently the theory that he used Polybius in the third decade requires us to assume that in this one instance he departed widely, and without sufficient reason, from his usual course of procedure. Moreover, even in the passages where the agreement with Polybius is most apparent, there are so many discrepancies and divergencies in detail, and so many unaccountable omissions and additions, as to render it inconceivable that he had the text of Polybius before him. But all these are made intelligible if we suppose Livy to have been here following directly or indirectly the same original sources that were used by Polybius. The earliest of these original sources was probably Silenus, with whom may possibly be placed, for books xxi., xxii., Fabius Pictor. The latter Livy certainly used directly for some parts of the decade. The former he almost as certainly knew only at second hand, the intermediate authority being probably Cælius Antipater. This writer, who confined himself to a history of the Second Punic War, in seven books, is expressly referred to by Livy eleven times in the third decade; and in other passages where his name is not mentioned Livy can be shown to have followed him (*e. g.*, xxii. 5, 49, 50, 51; xxiv. 9). In the latter books of the decade his chief authority is possibly Valerius Antias.

In the fourth and fifth decades the question of Livy's authorities presents no great difficulties, and the conclusions arrived at by Nissen in his masterly *Untersuchungen* have met with general acceptance. These may be shortly stated as follows. In the portions of the history which deal with Greece and the East, Livy follows Polybius, and these portions are easily distinguishable from the rest by their superior clearness, accuracy, and fulness. On the other hand, for the history of Italy and western Europe he falls back on Roman annalists, especially, it seems, on Claudius Quadrigarius and Valerius Antias,—a most unfortunate choice,—and from them too he takes the annalistic mould into which his matter is cast.

Livy's general method of using these authorities was certainly not such as would be deemed satisfactory in a modern historian. He is indeed free from the grosser faults of deliberate injustice and falsification, and he resists that temptation to invent to which "the minds of authors are only too much inclined" (xxii. 7). Nor is he unconscious of the necessity for some kind of criticism. He distinguishes between rumor and the precise statements of recognized authorities (*cf.* xxi. 46, v. 21, vii. 6). The latter he reproduced in the main faithfully, but with a certain exercise of discretion. Where they disagreed, he calls attention to the fact, occasionally pronouncing in favor of one version rather than another (ii. 41, xxi. 46), though often on no adequate grounds, or attempting to reconcile and explain discrepancies (vi. 12, 38). Where he detects or suspects the insertion of fabulous matter he has no scruple in saying so (*e. g.*, ii. 7, v. 21, "inseritur huic loco fabula"). Gross exaggerations, such as those in which Valerius Antias indulged, he roundly denounces (xxxvi. 38, "in augendo numero non alius intemperantior"), and with equal plainness of speech he condemns the family vanity which has so constantly corrupted and distorted the truth. "I suppose," he says (viii. 40), "that the record and memorial of these matters hath been depraved and corrupted by these funeral orations of praises, ... while every house and family draweth to it the honor and renown of noble exploits, martial feats, and dignities by any untruth and lie, so it be colorable." The legendary character of the earliest traditions he frankly admits. "Such things as are reported either before or at the foundation of the city, more beautified and set out with poets' fables than grounded upon pure and faithful records, I mean neither to aver nor disprove" (*Præf.*); and of the whole history previous to the sack of Rome by the Gauls (390 B. C.) he writes that it was obscure "both in regard of exceeding antiquity, and also for that in those days there were very few writings and monuments, the only faithful safeguard and true remembrancers of deeds past; and, besides, whatsoever was registered in the commentaries of the priests and in other public or private records, the same for the most part, when the city was burned, perished withal." Further than this, however, Livy's criticism does not go. Where his written authorities are not palpably inconsistent with each other or with probability, he accepts and transcribes their record without any further inquiry, nor does he ever attempt to get behind this record in order to discover the original evidence on which it rested. His acceptance in any particular case of the version given by an annalist by no means implies that he has by careful inquiry satisfied himself of its truth. At the most it only pre-supposes a comparison with other versions, equally second hand, but either less generally accepted or less in harmony with his own views of the situation; and in many cases the reasons he gives for his preference of one account over another are eminently unscientific (*e. g.*, xxvi. 49, "media simillima veris"). Livy's history, then, rests on no foundation of original research or even of careful verification. It is a compilation, and even as such it leaves much to be desired. For we cannot credit Livy with having made such a preliminary survey of his authorities as would enable him to determine their relations to each other, and fuse their various narratives into a consistent whole. It is clear, on the contrary, that his circle of authorities for any one decade was a comparatively small one, that of these he selected one, and transcribed him with the necessary embellishments and other slight modifications until impelled by various reasons to drop him. He then, without warning, takes up another, whom he follows in the same way. The result is a curious mosaic, in which pieces of all colors and dates are found side by side, and in which even the great artistic skill displayed throughout fails to conceal the lack of internal unity. Thus many of Livy's inconsistencies are due to his having pieced together two versions, each of which gave a differently colored account of the same event. Mommsen has clearly shown that this is what has happened in his relation of the legal proceedings against the elder Africanus in book xxxviii. (*Röm. Forschungen*, ii.); and in the story of the first secession, as he tells it, the older version which represented it as due to political and the later which explained it by economical grievances are found side by side. Similarly a change from one authority to another leads him not unfrequently to copy from the latter statements inconsistent with those he took from the former, to forget what he has previously said, or to treat as known a fact which has not been mentioned before (*cf.* ii. 1, xxxiv. 6, and Weissenborn's *Introduction*, p. 37). In other cases where the same event has been placed by different annalists in different years, or where their versions of it varied, it reappears in Livy as two events. Thus the four campaigns against the Volsci (ii. 17, *sq.*) are, as Schwegler (*R. G.*, i. 13) rightly says, simply variations of one single expedition. Other instances of such "doublettes" are the two single combats described in xxiii.

46, and xxv. 18, and the two battles at Baecula in Spain (xxvii. 17 and xxviii. 12). Without doubt too much of the chronological confusion observable throughout Livy is due to the fact that he follows now one now another authority, heedless of their differences on this head. Thus he vacillates between the Catonian and Varronian reckoning of the years of the city, and between the chronologies of Polybius and the Roman annalists.

To these defects in his method must be added the fact that he does not always succeed even in accurately reproducing the authority he is for the time following. In the the case of Polybius, for instance, he allows himself great freedom in omitting what strikes him as irrelevant, or tedious, or uninteresting to his Roman readers, a process in which much valuable matter disappears. In other cases his desire to give a vividness and point to what he doubtless considered the rather bald and dry style of Polybius leads him into absurdities and inaccuracies. Thus by the treaty with Antiochus (188 B. C.) it was provided that the Greek communities of Asia Minor "shall settle their mutual differences by arbitration," and so far Livy correctly transcribes Polybius, but he adds with a rhetorical flourish, "or, if both parties prefer it, by war" (xxxviii. 38). Elsewhere his blunders are apparently due to haste, or ignorance, or sheer carelessness; thus, for instance, when Polybius speaks of the Ætolians assembling at their capital Thermon, Livy (xxxiii. 35) not only substitutes Thermopylæ, but gratuitously informs his readers that here the Pylæan assemblies were held. Thanks partly to carelessness, partly to mistranslation, he makes sad havoc (xxxv. 5 *sq.*) of Polybius's account of the battle of Cynoscephalæ, while in xxxviii. 7 he mistakes θυρεούς ("shields") for θύρας ("doors"), and makes nonsense of the passage accordingly. Finally, Livy cannot be altogether acquitted on the charge of having here and there modified Polybius in the interests of Rome, as when he gives an air of magnanimous moderation to the spoliation of Ambracia (189 B. C.), by adding, after describing the carrying away of all statues, bronzes, and pictures, "nihil præterea tactum violatumve" (xxxviii. 9, comp. xlv. 19; and Nissen, *Unters.*, p. 31).

Serious as these defects in Livy's method appear if viewed in the light of modern criticism, it is probable that they were easily pardoned, if indeed they were ever discovered, by his contemporaries. For it was on the artistic rather than on the critical side of history that stress was almost universally laid in antiquity, and the thing that above all others was expected from the historian was not so much a scientific investigation and accurate exposition of the truth, as its skilful presentation in such a form as would charm and interest the reader. In this sense Cicero, *De Legg.*, i. 2, speaks of history as an "opus oratorium," and Quintilian, x. 1, as "a prose poem" (carmen solutum); and so we find that in the judgment of ancient critics it is by their artistic merits that historians stand or fall. Tried by this standard, Livy deservedly won and held a place in the very first rank. Asinius Pollio sneered at his Patavinity, and the emperor Caligula denounced him as verbose, but with these exceptions the opinion of antiquity was unanimous in pronouncing him a consummate literary workman. The classical purity of his style, the eloquence of his speeches, the skill with which he depicted the play of emotion, and his masterly portraiture of great men, are all in turn warmly commended, and in our own day we question if any ancient historian is either more readable or more widely read. It is true that for us his artistic treatment of history is not without its drawbacks. The more trained historical sense of modern times is continually shocked by the obvious untruth of his coloring, especially in the earlier parts of his history, by the palpable unreality of many of the speeches, and by the naiveté with which he omits everything, however important, which he thinks will weary his readers. But in spite of all this we are forced to acknowledge that, as a master of what we may perhaps call "narrative history," he has no superior in antiquity; for, inferior as he is to Thucydides, to Polybius, and even to Tacitus in philosophic power and breadth of view, he is at least their equal in the skill with which he tells his story. He is indeed the prince of chroniclers, and in this respect not unworthy to be classed even with Herodotus (Quint., x. 1). Nor is anything more remarkable than the way in which Livy's fine taste and sense of proportion, his true poetic feeling and genuine enthusiasm, saved him from the besetting faults of the mode of treatment which he adopted. The most superficial comparison of his account of the earliest days of Rome with that given by Dionysius shows from what depths of tediousness he was preserved by these qualities. Instead of the wearisome prolixity and the misplaced pedantry which make the latter almost unreadable, we find the old tales briefly and simply told. Their primitive beauty is not marred by any attempt to force them into an historical mould, or disguised beneath an accumulation of the insipid inventions of later times. At the same time they are not treated as mere tales for children, for Livy never forgets the dignity that belongs to them as the prelude to the great epic of Rome, and as consecrated by the faith of generations. Perhaps an even stronger proof of the skill which enabled Livy to avoid dangers which were fatal to weaker men is to be found in his speeches. We cannot indeed regard them, with the ancients, as the best part of his history, for the majority of them are obviously unhistorical, and nearly all savor somewhat too much of the rhetorical schools to be perfectly agreeable to modern taste. To appreciate them we must take them for what they are, pieces of declamation, intended either to enliven the course of the narrative, to place vividly before the reader the feelings and aims of the chief actors, or more frequently still to enforce some lesson which the author himself has at heart. The substance no doubt of many of them Livy took from his authorities, but their form is his own, and, in throwing into them all his own eloquence and enthusiasm, he not only acted in conformity with the established traditions of his art, but found a welcome outlet for feelings and ideas which the fall of the republic had deprived of all other means of expression. To us, therefore, they are valuable not only for their eloquence, but still more as giving us our clearest insight into Livy's own sentiments, his lofty sense of the greatness of Rome, his appreciation of Roman courage and firmness, and his reverence for the simple virtues of older times. But, freely as Livy uses this privilege of speech-making, his correct taste keeps his rhetoric within reasonable limits. With a very few exceptions the speeches are dignified in tone, full of life, and have at least a dramatic propriety, while of such incongruous and labored absurdities as the speech which Dionysius puts into the mouth of Romulus, after the rape of the Sabine women, there are no instances in Livy.

But, if our estimate of the merits of his speeches is moderated by doubts as to his right to introduce them at all, no such scruples interfere with our admiration for the skill with which he has drawn the portraits of the great men who figure in his pages. We may indeed doubt whether in all cases they are drawn with perfect accuracy and impartiality, but of their life-like vigor and clearness there can be no question. With Livy this portrait-painting was a labor of love. "To all great men," says Seneca, "he gave their due ungrudgingly," but he is at his best in dealing with those who, like Q. Fabius Maximus, "the Delayer," were in his eyes the most perfect types of the true Roman. Over their pictures he lingers with loving care. Each act of their lives, and every speech that is put into their mouths, adds something to the completeness of the sketch, or brings into stronger relief its characteristic features, and thus the desired impression is produced more indelibly than by pages of critical analysis or panegyric.

The general effect of Livy's narrative is no doubt a little spoilt by the awkward arrangement, adopted from his authorities, which obliges him to group the events by years, and thus to disturb their natural relations and continuity. As the result his history has the appearance of being rather a series of brilliant pictures loosely strung together than a coherent narrative. But it is impossible not to admire the copious variety of thought and language, and the evenly flowing style which carried him safely through the dreariest periods of his history; and still more remarkable is the dramatic power he displays when some great crisis or thrilling episode stirs his blood. The sentences with which he begins his account of the sack of Rome by the Gauls are impressive in their solemn simplicity:—"In the same year one M. Cædicius, a plebeian, gave notice to the tribunes that in the new road where now there standeth a chapel, above the temple of Vesta, there was in the still time of the night a voice heard, louder than any man's, commanding that the magistrates should be told that the Gauls were coming" (vi. 32). With genuine tragic irony he describes how, as the hour of their fate drew nigh, the minds of the Romans were blinded (vi. 37), and how they forgot their ancient cunning in counsel and their courage in the fight, till "full unhappily and in an ill hour" they were scattered to the winds by their foes. Equally vivid is his picture of the self-devotion of the senators who refused to save themselves by flight—"then the elders that had triumphed aforetime, and been consuls, openly gave out and said that they would live and die together with them." . . . But we have not space to follow the story to its triumphant close, when the banished Camillus arrived to save the country which had driven him into exile. Nor can we do more than refer to the description of the forced march of the consul Claudius in the Second Punic War, of the battle by the river Metaurus, and the death of Hasdrubal.

Livy, however, is not always at his best. For the full exercise of his powers he seems to require either the stimulus supplied by the absorbing interest of the particular events he is describing, or the absence of any authority so full and so little to be disregarded as to fetter his freedom. Certain it is that in his accounts of the kingly period, and of the Hannibalic war, he is seen to much better advantage than in the fourth and fifth decades. We may naturally suppose too that his energies flagged as the work progressed; and in the extant fragments of the ninety-first book other critics besides Niebuhr have detected the signs of failing strength.

In style and language Livy represents the best period of Latin prose writing. He has passed far beyond the bald and meagre diction of the early chroniclers. In his hands Latin acquired a flexibility and a richness of vocabulary unknown to it before. If he writes with less finish and a less perfect rhythm than his favorite model Cicero, he excels him in the varied structure of his periods, and their adaptation to the subject-matter. It is true that here and there the "creamy richness" of his style becomes verbosity, and that he occasionally draws too freely on his inexhaustible store of epithets, metaphors, and turns of speech; but these faults, which did not escape the censure even of friendly critics like Quintilian, are comparatively rare in the extant parts of his work. From the tendency to use a poetic diction in prose, which was so conspicuous a fault in the writers of the silver age, Livy is not wholly free. In his earlier books especially there are numerous phrases and sentences which have an unmistakably poetic ring, recalling sometimes Ennius and more often his contemporary Virgil (see for instance Teuffel, p. 482, n. 14). But in Livy this poetic element is kept within bounds, and serves only to give warmth and vividness to the narrative. Similarly, though the influence of rhetoric upon his language, as well as upon his general treatment, is clearly perceptible, he has not the perverted love of antithesis, paradox, and labored word-painting which offends us in Tacitus; and, in spite of the Venetian richness of his coloring, and the copious flow of his words, he is on the whole wonderfully natural and simple.

These merits, not less than the high tone and easy grace of his narrative and the eloquence of his speeches, gave Livy a hold on Roman readers such as only Cicero and Virgil besides him ever obtained. His history formed the groundwork of nearly all that was afterwards written on the subject. Plutarch, writers on rhetoric like the elder Seneca, moralists like Valerius Maximus, went to Livy for their stock examples. Florus and Eutropius abridged him; Orosius extracted from him his proofs of the sinful blindness of the pagan world; and in every school Livy was firmly established as a text-book for the Roman youth.

By far the most complete account of the various editions of Livy, and of all that has been written upon him, will be found in Emil Hübner's *Grundriss zu Vorlesungen über die Römische Literaturgeschichte*, 4th ed., Berlin, 1878. The most successful translation of his history is that by Philemon Holland, London, 1600. (H. F. P.)

LIZARD. The name Lizard (Lat., *lacerta*) originally referred only to the small European species of four-legged reptiles, but is now applied to a whole order (*Lacertilia*), which is represented by extremely numerous species in all temperate and tropical parts of the globe. Lizards may be described as reptiles with a more or less elongate body terminating in a tail, and with the skin either folded into scales (as in snakes) or granular and tubercular; legs are generally present—usually four, rarely two in number—but sometimes they are reduced to rudiments or entirely hidden below the skin; the jaws are toothed, and the two mandibles firmly united in front by an osseous suture. Eyelids are generally present. The vent is a transverse slit, and not longitudinal as in Crocodilians. Other structural characteristics, especially of the skeleton, separate lizards from the other orders of reptiles; but will be better understood if described in relation to the other members of that class. See REPTILES.

At a low estimate the number of described species of lizards may be given as about one thousand seven hundred.[1] They are extremely scarce north of 60° N. lat.; and in the southern hemisphere the southern point of Patagonia forms the furthest limit of their range. As we approach the tropics, the variety of forms and the number of individuals increase steadily, the most specialized and the most developed forms (the monitors and leguans) being restricted to the tropical regions where lizards abound. They have adapted themselves to almost every physical condition, except the extreme cold of high latitudes or altitudes. Those inhabiting temperate latitudes hibernate. The majority live on broken ground, rocks with or without vegetation; others are arboreal; to a few (certain monitors) the neighborhood of water is a necessity; whilst others are true desert animals, in color scarcely distinguishable from their surroundings. Some, like many geckos, live near or in houses, being enabled by a peculiar apparatus of their toes to run along perpendicular and even overhanging surfaces. No lizard enters the sea, with the exception of one species, the leguan of the Galapagos (*Amblyrhynchus*), which feeds on sea-weed. Some, like the majority of the geckos, are nocturnal.

The motions of most lizards are executed with great but not enduring rapidity. With the exception of the chamæleon, all drag their body over the ground, the limbs being wide apart, turned outwards, and relatively to the bulk of the body generally weak. But the limbs show with regard to development great variation, and an uninterrupted transition from the most perfect condition of two pairs with five separate clawed toes to their total disappearance; yet even limbless lizards retain rudiments of the osseous framework below the skin. The motions of these limbless lizards are very similar to those of snakes, which they resemble in their elongate body passing into a long cylindrical and tapering tail.

In a great many lizards (*Lacertidæ*, skinks, geckos) the muscles of the several vertebral segments of the tail are so loosely connected, and the axis of the vertebræ is so weak, that the tail breaks off with the greatest

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[1] The two latest general works on lizards are those by Duméril and Bibron (*Erpétologie générale*, with atlas, tom. i.-ix., Paris, 1834-54, 8vo), and by J. E. Gray (*Catalogue of Lizards in the Collection of the British Museum*, London, 1845, 8vo). Both are now antiquated, and a new edition of either is much required.

facility. The part severed retains its muscular irritability for a short time, wriggling as if it were a living creature. A lizard thus mutilated does not seem to be much affected by its loss, and in a short time the part is reproduced; but, whilst the muscles and also the integuments may be perfectly regenerated, the osseous part always remains replaced by a cartilaginous rod, without vertebral segmentation. This faculty is of great advantage to the lizards endowed with it; they are either species in which the tail has no special function, such as to assist in a particular kind of locomotion or to serve as a weapon of defence, or they are small species which lack other means of escape from their numerous enemies. The geckos are even able to throw off their tail spontaneously, and are said to do this frequently when pursued by some other animal, which is satisfied with capturing the wriggling member, whilst the owner saves its life by a rapid flight.

The majority of lizards are carnivorous, the larger feeding on small mammals, birds, fishes, and eggs, the smaller on insects, worms, and other invertebrates. Not a few, however, are herbivorous, as the larger leguans, and many agamas. This difference in diet is quite independent of modifications of dentition. Generally the teeth are simply conical, pointed, more rarely blunt, or notched at the top or sides. Always anchylosed with the bone, they are inserted either on the inner side of the margin of the jaws (*pleurodontes*), or on the edge of the bones (*acrodontes*). The form of the tongue exhibits many modifications which have been used for the division of the order into families, as will be seen from the systematic list given below.

All lizards are oviparous, the eggs being of an oval shape, and covered with a hard or leathery calcareous shell. The number of eggs laid is, in comparison with other reptiles, small, perhaps never exceeding forty, and some, like the anolis and geckos, deposit only one or two at a time, but probably the act of oviposition is repeated in these lizards at frequent intervals. The parents do not take care of their progeny, and leave the eggs to hatch where they were deposited. In a few lizards, however, the eggs are retained in the oviduct until the embryo is fully developed; these species, then, bring forth living young, and are called *ovoviviparous*.

No lizard is venomous, with, perhaps, a single exception (*Heloderma*) to be mentioned hereafter.

The order of lizards may be divided into the following suborders and families:—

First suborder.—Cionocrania.

Vertebræ procœlian; an orbital ring with a temporal bar more or less complete; columella present; parietal bone single.

Family 1. *Monitoridæ.*—Scales of the belly oblong, quadrangular, in cross-bands, on the back and tail rhombic, very small or granular. Tongue very long, exsertile, ending in two long filaments, sheathed at the base. Head with small polygonal shields. The largest lizards, inhabiting the African, Indian, and Australian regions.

Genera: *Psammosaurus*, *Odatria*, *Varanus* (*Monitor*), *Hydrosaurus*.

Family 2. *Tejidæ.*—Scales small, granular, sometimes with larger tubercles; those of the belly oblong, quadrangular, in cross-bands. Head with large symmetrical scutes. Tongue long, scaly, bifid at the end. Dentition acrodont. No fold of the skin along the sides. Tropical and subtropical America.

Genera: *Tejus*, *Callopistes*, *Ameiva*, *Cnemidophorus*, *Dicrodon*, *Acrantus*, *Centropyx*, *Crocodilurus*, *Ada*, *Custa*.

Family 3. *Lacertidæ.*—Scutellation as in the preceding family. Tongue long, exsertile, bifid at the end, without sheath at the base. Dentition pleurodont. Old World, especially from the Europo-Asiatic, African, and Indian regions.

Genera: *Lacerta*, *Tropidosaura*, *Tachydromus*, *Ichnotropis*, *Acanthodactylus*, *Psammodromus*, *Scapteira*, *Eremias*, *Mesalina*, *Cabrita*, *Ophiops*, *Chondrophiops*, *Tracheloptychus*.

Family 4. *Xanthusiidæ*—Distinguished from the preceding family by a broader non-exsertile tongue. California, Central America, and Cuba.

Genera: *Xanthusia*, *Lepidophyma*, *Cricosaura*.

Family 5. *Trachydermi.*—Scales arranged in transverse rows, frequently swollen or tubercular. Tongue ending in two short points. Dentition pleurodont. No femoral pores. Central America, extending into the subtropical parts of North America.

Genera: *Heloderma*, *Gerrhonotus*.

Family 6. *Zonuridæ.*—Scales arranged in transverse rows, quadrangular, those of the back generally keeled; a fold of the skin runs along the side of the body, separating the upper from the lower parts. Head with large symmetrical shields. Tympanum distinct. African region; *Pseudopus* from the Europo-Asiatic, and *Ophisaurus* from the North American region.

Genera: *Cordylus*, *Zonurus*, *Platysaurus*, *Gerrhosaurus*, *Pleurostrichus*, *Saurophis*, *Caitia*, *Pseudopus*, *Ophisaurus*, *Hyalosaurus*.

Family 7. *Chalcididæ.*—Scales arranged in transverse bands, quadrangular; scarcely a trace of a lateral fold in front. Head with large symmetrical shields. Tongue scaly, bifid in front. Tympanum hidden. Body long, with rudimentary limbs. Tropical America.

Genera: *Brachypus*, *Microdactylus*, *Chalcis*, *Ophiognomon*, *Bachia*, *Propus*, *Heterodactylus*.

Family 8. *Cercosauridæ.*—Scales rhombic or quadrangular, generally arranged in transverse series. No lateral fold, or only a trace of it. Head with large symmetrical shields. Tongue scaly, bifid in front. Tympanum distinct. Body moderately elongate, with four developed limbs. Males with femoral pores. Tropical America.

Genera: *Cercosaura*, *Pantodactylus*, *Chalcidolepis*, *Iphisa*, *Perodactylus*, *Placosoma*, *Holaspis*, *Lepidosoma*, *Ecpleopus*, *Euspondylus*, *Cricosaura*, *Proctoporus*, *Urosaura*, *Emphrassotis*, *Lepidophyma*. *Loxopholis*, *Tretioscincus*.

Family 9. *Chamæsauridæ.*—Body slender, with rudimentary limbs. Scales arranged in transverse series, equal all round the body, provided with a sharp keel, the keels forming longitudinal ridges; no lateral fold. Tympanum distinct. Tongue with a very shallow notch in front. South Africa.

Genus: *Chamæsaura*.

Family 10. *Gymnophthalmidæ.*—The entire body is covered with rounded imbricate quincuncial scales; head with symmetrical shields. No eyelids. Nostrils lateral, in a single shield. Body long, with the limbs small or rudimentary. Irregularly distributed over the tropical regions.

·Genera: *Gymnophthalmus*, *Epaphelus*, *Ablepharus*, *Blepharosteres*, *Cryptoblepharus*, *Morethia*, *Menetia*, *Miculia*, *Lerista*, *Blepharactisis*.

Family 11. *Pygopodidæ.*—Scutellation as in the preceding family, but the nostrils are situated above the upper edge of the first labial shield. No eyelids. Body long, with a pair of rudimentary hind limbs only. Australia.

Genera: *Pygopus*, *Delma*.

Family 12. *Aprasiidæ.*—Scutellation as in the preceding families, the nostrils in a suture between the nasal and first labial shields. No eyelids. Limbs none. Australia.

Genus: *Aprasia*.

Family 13. *Lialidæ.*—Scales imbricate, quincuncially arranged; head with imbricate scale-like shields. No eyelids. Body long, with a pair of rudimentary hind limbs only. Australia.

Genus: *Lialis*.

Family 14. *Scincidæ.*—The entire body is covered with rounded imbricate scales, quincuncially arranged; head with symmetrical shields. Eyelids developed. Nostrils behind the rostral, in a separate shield, or between two or three small shields. Tongue short, with a notch in front. Ground-lizards.—This family has so wide a distribution that its range almost coincides with that of the order generally.

The following genera are composed of numerous species, and extend over several geographical regions: *Hinulia* (Indian and Australian regions), *Eumeces*, including *Mocoa* and *Riopa*, *Lygosoma* and *Chelomeles* (Indian and Australian regions), *Plestiodon* (Europo-Asiatic, North American, and Indian regions), *Mabouia* and *Tiliqua* (*Euprepes*), generally distributed in the tropical and subtropical regions, *Heteropus* (Indian and Australian regions), *Sphenops* and *Gongylus* (Europo-Asiatic and African regions.)

Indian genera: *Lipinia*, *Amphixestus*, *Lygosaurus*, *Cophoscincus*, *Ristella*, *Podophis*, *Chiamela*, *Senira*, *Brachymeles*, *Hagria*, *Tropidophorus*, *Norbea*, *Dasia*, *Sphenocephalus*, *Sepophis*.

Australian genera: *Hemiergis*, *Tetradactylus*, *Omolepida*, *Siaphos*, *Anomalopus*, *Rhodona*, *Ophioscincus*, *Soridia*, *Lioscincus*, *Tribolonotus*, *Trachydosaurus*, *Corucia*, *Cyclodus*, *Silubosaurus*, *Egernia*, *Tropidolepisma*, *Tropidoscincus*, *Nannoscincus*, *Ophioseps*.

Tropical American genera: *Ophiodes*, *Celestus*, *Camilia*, *Diploglossus*, *Sauresia*, *Panolopus*.

African genera: *Liolepisma*, *Dumerilia*, *Pygomeles*, *Eumecia*, *Scelotes*, *Thyrus*, *Amphiglossus*, *Sepsina*, *Sepomorphus*, *Herpetosaura*, *Sepacontias*.

Europo-Asiatic genera: *Scincus*, *Anouis* *Ophiomorus*, *Zygnopsis*, *Hemipodion*, *Seps*, *Heteromoredes*.

North American genus: *Anniella*.

Family 15. *Acontiidæ.*—Scutellation similar to that of the skinks, but the rostral shield is enlarged, cup-shaped, the nostril being in the rostral, with a long slit between it and the hinder margin of the rostral. Eyes distinct, with a lower eyelid. Limbs rudimentary or absent. Africa, Madagascar, and Ceylon.

Genera: *Nessia, Evesia, Acontias, Aparallactus.*

Family 16. *Typhlinidæ.*—Differing from the preceding family by having the eyes hidden under the skin. Africa, East Indian Archipelago, New Guinea.

Genera: *Typhlosaurus, Feylinia, Dibamus.*

Family 17. *Iguanidæ.*—Scales of the back and sides imbricate, generally in transverse, oblique rows, those of the belly similar; head with numerous, irregular small scutes. Tongue short, scarcely notched in front, not exsertile. Dentition pleurodont; teeth frequently compressed towards the point. Toes 5–5. The whole of this large family are found in the New World, with the exception of two genera, one (*Brachylophus*) inhabiting the Fiji Islands, the other (*Hoplurus*) Madagascar.

The genera may be divided into two groups,—one comprising arboreal forms with compressed slender body, slender legs, and long tail, the other forms, which live on the ground, with a broader, more depressed body, stouter legs, and shorter tail. Both groups pass into each other.

Arboreal genera: *Polychrus, Urotrophus, Ecphymotes, Læmanctus, Iguana, Aloponotus, Brachylophus, Metopoceros, Trachycephalus, Oreocephalus, Cyclura, Ctenosaura, Enyaliosaurus, Basiliscus, Corythæolus, Corythophanes, Chamæleopsis, Ophryoessa, Ophryoessoides, Enyalius, Chamæleolis, Xephosurus, Dactyloa, Xiphocercus, Acantholis, Norops, Anolis, Draniscodon, Plica.*

Terrestrial genera: *Tropidolepis* (*Sceloporus*), *Liodera, Liolæmus, Pygoderus, Proctotretus, Liocephalus, Helocephalus, Scartiscus, Stenocercus, Trachycyclus, Holbrookia, Uta, Aneuporus, Taraguira, Tropidurus, Microphactus, Anisophractus, Hoplurus, Hoplocercus, Strobilurus, Liosaurus, Diplolæmus, Sauromalus, Cachryx, Uranocentron, Crotaphytus, Phymaturus, Centrura, Callisaurus, Uma, Tropidogaster, Phrynosoma.*

Family 18. *Agamidæ.*—Differing from the preceding family by their acrodont dentition. The tropical regions of the Old World and Central Asia.

Arboreal Indian genera: *Draco, Sitana, Lyriocephalus, Arpephorus, Ceratophora, Copholis, Otocryptis, Gonyocephalus, Japalura, Dilophyrus, Oriotiaris, Tiaris, Acanthosaura, Calotes, Bronchocœla, Salea, Lophocalotes, Hypselurus, Gonyocephalus, Lophura, Physignathus.*

Terrestrial Australian genera: *Chelosania, Gindalia, Chlamydosaurus, Lophognathus, Diporophora, Grammatophora, Tympanocryptis, Moloch.*

Terrestrial African, Indian, and Asiatic genera: *Stellio, Agama, Charasia, Trapelus, Brachysaura, Phrynocephalus, Megalochilus, Centrotrachelus, Uromastyx, Liolepis, Chalarodon.*

Second Suborder.—Chamæleonoidea.

Vertebræ procœlian; a bar crossing from the parietal to the mastoid; temporal bar complete. No columella. Parietal bone single.

Family 1. *Chamæleontidæ.*—Body granular. Toes 5–5, formed into two grasping opposable groups. Tongue very long, worm-shaped, very extensile. Exclusively arboreal. Africa and Madagascar, one species extending into Europe and India.

Genera: *Chamæleon, Rhampholeon.*

Third Suborder.—Nyctisaura.

Vertebræ amphicœlian; orbital ring and temporal bars not developed. A columella. Parietal bone paired.

Family 1. *Geckotidæ.*—Upper parts granular, rarely with scales; lower parts covered with imbricate scales. Tongue thick, short, slightly notched in front. Eyes large, without (very rarely with) eyelids. Body depressed. Toes frequently with a more or less developed adhesive apparatus. Tropical and subtropical regions.

Genera with a wide range: *Hemidactylus* (*Peripia*), *Phyllodactylus* (not extending into the Indian region), *Diplodactylus* (Tropical America, Australia, and Africa), *Thecadactylus* (Tropical America and Australia), *Platydactylus* (Africa and Australia), *Heteronota* (Indian and Australian regions), *Phelsuma* (Indian and African regions).

Tropical American genera: *Caudiverbera, Aristelliger, Sphærodactylus, Homonota, Goniodactylus.* Some of these genera go beyond the limits of the tropics southwards or northwards.

New Zealand genus: *Naultinus.*

Australian genera: *Œdura, Rhynchœdura, Strophura, Stenodactylopsis, Correlophus, Ceratolophus, Gehyra, Nephrurus, Phyllurus.*

Indian genera: *Spathodactylus, Callodactylus, Ptyodactylus, Nycteridium, Pentadactylus, Gecko, Luperosaurus, Ptychozoon, Eublepharis, Geckoella, Cyrtodactylus, Gymnodactylus, Teratolepis.*

African genera: *Paradura, Ebenavia, Rhoptropus, Uroplates, Theconyx, Tarentola, Pachydactylus, Ptilodactylus, Pristiurus, Stenodactylus, Chondrodactylus, Geckolepis, Spatalura.*

Europo-Asiatic genera: *Bunopus, Ceramodactylus, Teratoscincus, Agamura.* These inhabit only the southern parts of the region in Asia; representatives of some African or Indian genera (viz., *Ptyodactylus, Tarentola, Gymnodactylus,* and *Stenodactylus*) likewise extend into this region.

This list, from which many subgenera have been excluded, will give an idea of the wide distribution of the order of lizards, and of the great variety of forms which it comprises. Indeed, in both respects, it far surpasses the other orders of reptiles. The scope of the present article does not permit us to enter into further taxonomic details, but a few notes may be added on some lizards, to which special interest is attached, or of which most frequent mention is made in general literature.

The first family, that of *Monitoridæ*, comprises very large lizards, the largest exceeding a length of 6 feet. Some are terrestrial, others semi-aquatic, the former having a rounded the latter a compressed tail with a sharp, saw-like upper edge, which assists them greatly in swimming, and at the same time forms a formidable weapon with which these powerful animals can inflict deep wounds on the incautious captor. They range all over Africa, the Indian region, and Australia; their prey consists of other vertebrate animals, small mammals, birds, frogs, fishes, and eggs. The young are prettily spotted with white and black ocelli, the old ones having a plainer coloration. The Monitor of the Nile (*Monitor niloticus*, fig. 1) is an aquatic species found in the neighborhood of all large rivers of tropical Africa. The Arabs know it well under the name *Waran* (whence the generic name *Varanus* is derived), and it frequently appears also among the engravings and hieroglyphs of ancient Egypt. Some respect was and is still paid to it, as it is said to prey largely on the eggs of crocodiles. Another Monitor, the *Waran el ard* of the Arabs (*Psammosaurus scincus*), also inhabits North Africa, but is strictly terrestrial, and has a rounded tail.

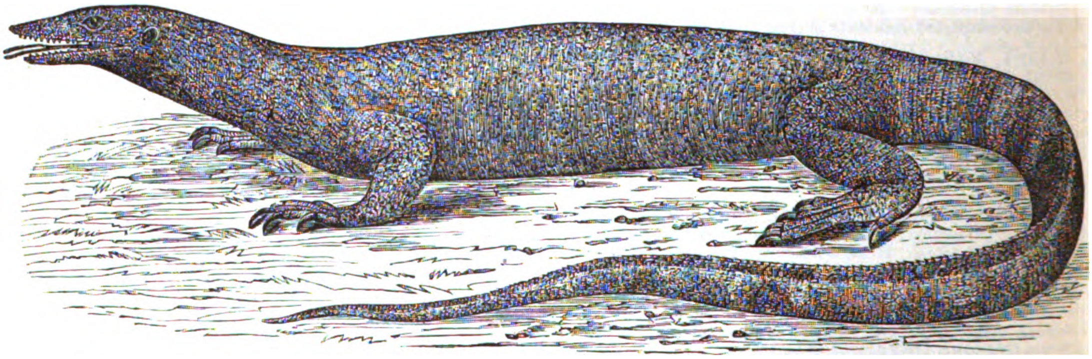

FIG. 1.—Monitor of the Nile (*Monitor niloticus*).

Most of the European lizards with four well-developed limbs belong to the genus *Lacerta*. They are of small size, and insectivorous. Their tongue is deeply cleft at the end, and is frequently exserted when the animal is in a state of excitement from fear or anger. As in all the lizards of the family *Lacertidæ*, their tail is easily broken, and as readily reproduced, the reproduced portion often assuming a monstrous or double shape, so that the animal appears to be provided with two tails. Only three species occur in Great Britain (see fig. 2). The Common Lizard (*Lacerta vivipara*) frequents heaths and banks in England and Scotland, and is locally met with also in Ireland; it is ovoviviparous. Much scarcer is the second species, the Sand Lizard (*Lacerta agilis*), which is confined to some localities in the south of England, the New Forest and its vicinity; it does not appear to attain on English soil to the same size as on the Continent, where it abounds, growing sometimes to a length of 9 inches. Singularly, a snake (*Coronella lævis*), also common on the Continent, and feeding principally on this lizard, has followed it across the British Channel, apparently existing in those localities only in which the sand-lizard has settled. This lizard is oviparous. The males differ by their brighter green ground color from the females, which are brown, spotted with black. The third British species, the Green Lizard (*Lacerta viridis*), does not occur in England proper; it has found a congenial home in the island of Guernsey, but is there much less developed as regards size and beauty than in the countries south of the Alps and Pyrenées. This species is larger than the two preceding; it is green, with minute blackish spots. In Germany and France one other species only (*Lacerta muralis*) appears; but in the south of Europe the species of *Lacerta* are much more numerous, the largest and finest being *L. ocellata*, which grows to a length of 18 or 20 inches, and is brilliantly green, ornamented with blue eye-like spots on the sides. Even the small island-rocks of the Mediterranean, sometimes only a few hundred yards in diameter, are occupied by peculiar races of lizards, which of late years have attracted much attention from the fact that they, like other reptiles, have assumed under such isolated conditions a more or less dark, almost black, coloration.

Heloderma horridum is a Mexican lizard, which in its native country has the reputation of being a most poisonous reptile. Its anterior teeth are, indeed, provided with a deep groove, as in many poisonous snakes, and the submaxillary gland is enormously developed. Sumichrast has recently proved by actual experiment on mammals the fatal effects of the bite of this lizard; and J. Stein, a traveller in Mexico, who was bitten in the finger, suffered from symptoms similar to those resulting from the bite of a poisonous snake. It thus appears that the fear in which it is held by the natives is not due merely to its hideous appearance, as was formerly believed. Tubercles of a dirty brown and yellow color, with which its body is covered, give it the appearance of a leprous skin. It is about 20 inches long, and is known by the name of "Escorpion."

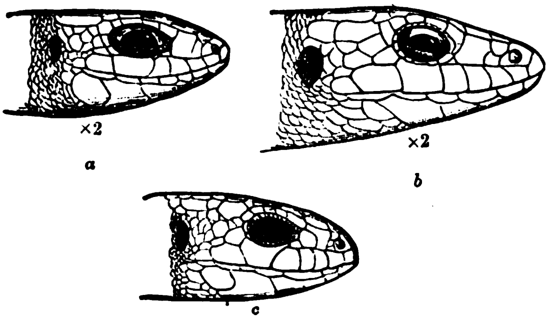

Fig. 2.—Heads of British Lizards. *a*, *Lacerta vivipara*; *b*, *L. agilis*; *c*, *L. viridis*.

The Glass-Snake (*Pseudopus pallasii*) or *Sheltopusik* (Russ.) is common in Dalmatia, Hungary, southern Russia, and the western parts of Central Asia. Externally it resembles a snake, the fore limbs being entirely absent, and the hind limbs reduced to small rudiments. It attains to a length of 2 or 3 feet, and feeds on insects, worms, mice, and small birds. In captivity it becomes perfectly tame. North America is inhabited by a very similar glass-snake (*Ophisaurus*), and North Africa by a third (*Hyalosaurus*). Limbless lizards are especially common in Australia, but their scutellation is so different from that of the glass-snakes of the northern hemisphere that they are placed in distinct families, which have been noticed in the systematic list (*Pygopodidæ*, *Aprasiidæ*, *Lialidæ*).

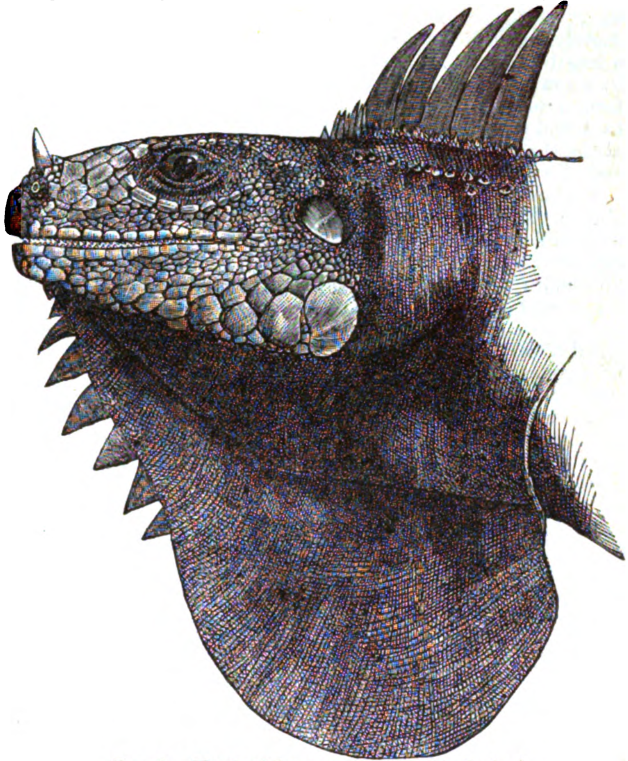

Fig. 3.—Head of Leguan (*Iguana rhinolophus*).

The family of skinks also includes many genera with rudimentary limbs or without any, the Slow-Worm or Blind-Worm (*Anguis fragilis*) being the one most generally known. It is distributed over the greater part of Europe, and rarely exceeds a length of 15 inches. Its eyes, although small, are perfectly developed and provided with eyelids. It is ovoviviparous; the young, in the first year of their life, differ considerably from the old in their coloration, the back being of a milk-white color, with a black line down the middle. In the south of Europe it gradually disappears, and its place is taken by the similarly shaped *Seps*, a genus distinguished from *Anguis* by the presence of four very small rudiments of limbs, which have no function.

The Skink, which has given the name to the whole family, is a small lizard (*Scincus officinalis*) of 6 or 8 inches in length, common in arid districts of North Africa and Syria. A peculiarly wedge-shaped snout, and toes provided with strong fringes, enable this animal to burrow rapidly in and under the sand of the desert. In former times large quantities of it were imported in a dry state into Europe for officinal purposes, the drug having the reputation of being efficacious in diseases of the skin and lungs; and even now it may be found in apothecaries' shops in the south of Europe, country people regarding it as a powerful aphrodisiac for cattle.

Of the family *Iguanidæ* we refer to three genera only:—*Iguana*, *Anolis*, and *Phrynosoma*. Herpetologists distinguish several species of *Iguana* or Leguans, which, however, do not appear to differ in their habits. They are found in the forest regions of tropical America only, in the neighborhood of water, into which when frightened they jump from the overhanging branches of trees, to escape capture by swimming and diving. Feeding exclusively on leaves or fruits, they are themselves highly esteemed as food, and their eggs also are eagerly searched for by the natives. Iguanas grow to a length of from 2 to 5 feet, and are readily recognized by a row of long compressed and pointed scales which form a more or less high crest along the middle of the back and tail, and by a compressed and pendent dewlap at the throat. These large lizards are strictly arboreal, and of a brilliant coloration, in which green prevails.

The smallest lizards of this family belong to the genus *Anolis*, extremely numerous as regards species and individuals on bushes and trees of tropical America, and especially of the West Indies. They offer many points of analogy to the humming birds in their distribution, colors, and even disposition. Gosse (*A Naturalist's Sojourn in Jamaica*, pp. 75 *sq.*) has given a vivid and faithful description of their manners. Hundreds may be seen on a bright day, disporting themselves on the trees and fences, leaping from branch to branch, fearlessly entering houses, chasing each other, or engaging in combat with some rival. Like the iguanas, they (at least the males) are provided with a large, expansible dewlap at the throat, which is brilliantly colored, and which they display on the slightest provocation. This appendage is merely a fold of the skin, ornamental and sexual, like the wattles of the throat of a gallinaceous bird; it has no cavity in its interior, and has no communication with the mouth or with the respiratory organs; it is supported by the posterior horns of the hyoid bone, and can be erected and spread at the will of the animal. The presence of such dewlaps in lizards is always a sign of an excitable temper. The anolis possess the power of changing their colors in a most extraordinary degree, the brilliant iridescent hues of their body passing almost in an instant into a dull sooty brown in an irritated or alarmed animal. They are much fed upon by birds and snakes, and have, like all small much-persecuted lizards, a fragile tail, easily reproduced. They bring forth only one large egg at a time, but probably breed several times during the season.

The third iguanoid, *Phrynosoma*, is a terrestrial form. Several species are known, inhabiting the plains of south-western America and Mexico. Since the opening of the Pacific Railway, living specimens are frequently sent to Europe, and sold under the name of "California toads." Although they belong to the same family, a greater contrast than that between the nimble, slender, and long-tailed *Anolis* and the toad-like *Phrynosoma* can hardly be imagined. The body is short, broad, and depressed, ending in a short tail, covered with rough tubercles or spines; the short head is armed behind with long bony spikes; the colors are a motley of brown, black, and yellow. Their defence against birds lies chiefly in their outward appearance, as, whilst they rest quiet, they are difficult to distinguish from a stone overgrown with lichen; nor have we ever found their remains in the stomach of snakes, their spines proving a sufficient protection against these equally formidable enemies. They are said to move with rapidity in a wild state, but in confinement, especially when the animal believes itself observed, their movements are extremely sluggish and their manners uninteresting. It seems to be a common belief in California that they have the power of squirting a blood-red fluid from the corner of the eye to some distance; but nothing has been found, on anatomical examination, to establish the correctness of this assertion. They attain a length of from 6 to 8 inches.

Of the *Agamidæ*, which represent the iguanas in the Old World, and which have been differentiated into a still greater number of distinct generic forms, several genera deserve more than a merely nominal notice. The perhaps most highly specialized form are the Dragons (*Draco*), a genus of small lizards from the East Indies, more common in the archipelago than on the continent, but absent in Ceylon. The character by which they are at once recognized is the peculiar additional apparatus for locomotion, formed by the much-prolonged five or six hind ribs, which are connected by a broad expansible fold of the skin, the whole forming a subsemicircular wing on each side of the body. The snakes are the only order of vertebrates in which the ribs serve as organs of locomotion, but, whilst in that order all the ribs are charged with a function for which no other special organ exists, in the dragons only a part of the ribs are modified for the purpose of assisting four well-developed limbs. The dragons are tree-lizards; they take long flying leaps from branch to branch, supported in the air by their expanded parachutes, which are laid backwards at the sides of the animal while it is sitting or merely running. If the hind or fore limbs of a dragon were cut off, it would be helpless, and deprived of locomotion, but it could continue to move with velocity after the loss of its wings. Like the anolis, whose analogues they are in the Old World, they are provided with long highly ornamented dewlaps. These appendages are found in both sexes, one in the middle and one on each side of the throat, but they are much more developed in the mature male. The tail is very long and slender, not fragile; we have never seen a dragon in which this member was mutilated; it seems to be necessary for their peculiar locomotion, and probably its loss soon proves fatal to the animal. Cantor says that the transcendent beauty of their colors baffles description. As the lizard lies in the shade along the trunk of a tree, its colors at a distance appear as a mixture of brown and gray, and render it scarcely distinguishable from

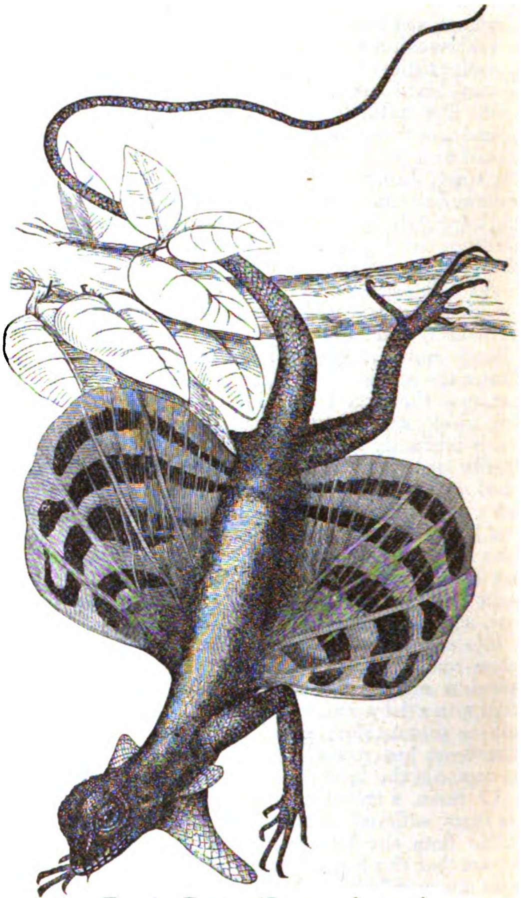

FIG. 4.—Dragon (*Draco tæniopterus*).

the bark. Thus it remains with no signs of life except the restless eyes watching passing insects, which, suddenly expanding its wings, it seizes with a sometimes considerable unerring leap. All the species attain a length of 7 or 8 inches, of which the tail takes at least one half. They deposit three or four eggs at a time.

Calotes is another genus of agamoids peculiar to the East Indies; it comprises numerous species well known in India by the name of "blood-suckers," a designation the origin of which cannot satisfactorily be traced. They are tree-lizards, extremely variable in their colors, which change, not only with the season, but also at the will of the animal. The males, and in some species also the females, possess a crest of compressed scales along the back.

Of the Australian agamas no other genus is so numerously represented and widely distributed as *Grammatophora*, the species of which grow to a length of from 8 to 18 inches. Their scales are generally rough and spinous; but otherwise they possess no strikingly distinguishing peculiarity, unless the loose skin of their throat, which is transversely folded and capable of inflation, be regarded as such. On the other hand, two other Australian agamoids have attained some celebrity by their grotesque appearance, due to the extraordinary development of their integuments. One (fig. 5) is the Frilled Lizard (*Chlamydosaurus*), which is restricted to Queensland and the north coast, and grows to a length of 2 feet, including the long tapering tail. It is provided with a frill-like fold of the skin round the neck, which, when erected, resembles a broad collar, not unlike the gigantic lace-collars of Queen Elizabeth's time. The late Mr. Krefft has made the observation that this lizard when startled, rises with the forelegs off the ground, and squats and jumps in kangaroo fashion, thus reminding us of the peculiar locomotion ascribed to certain gigantic extinct reptiles. The other lizard is one which most appropriately has been called *Moloch horridus*. It is covered with large and small spine-bearing tubercles; the head is small, and the tail short. It is sluggish in its movements, and so harmless that its armature and (to a casual observer) repulsive appearance are its sole means of defence. It grows only to a length of 10 inches, and is not uncommon in the flats of South and West Australia.

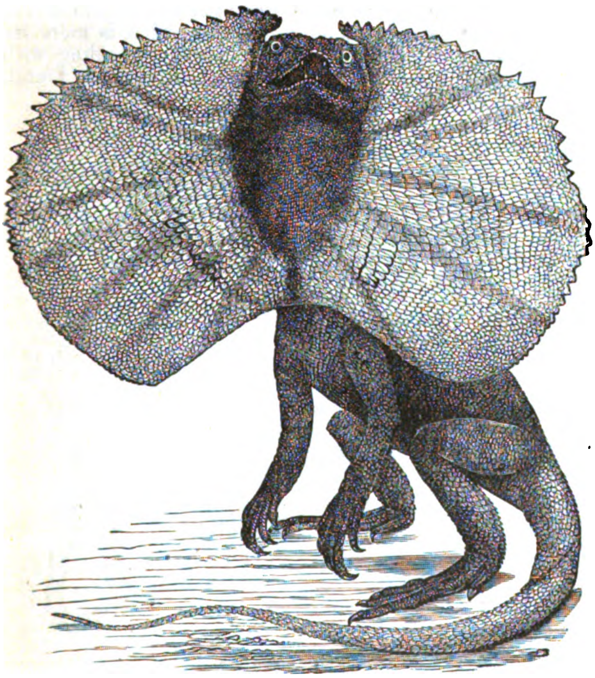

FIG. 5.—Frilled Lizard (*Chlamydosaurus*).

The majority of the ground-agamas, and the most common species of the plains, deserts, or rocky districts of Africa and Asia, belong to the genera *Stellio* and *Agama*. They resemble much the *Grammatophora* of the Australian region, their scales being mixed with larger prominent spines, which in some species are particularly developed on the tail, and disposed in whorls. Nearly all travellers in the north of Africa mention the *Ḥardhón* of the Arabs (*Stellio cordylinus*), which is extremely common, and has drawn upon itself the hatred of the Mohammedans by its habit of nodding its head, which they interpret as a mockery of their own movements whilst engaged in prayer. *Uromastyx* is one of the largest and most developed genera of ground-agamas, and likewise found in Africa and Asia. The body is uniformly covered with granular scales, whilst the short, strong tail is armed with powerful spines disposed in whorls. The Indian species (*U. harderickii*) feeds on herbs only; the African species probably take mixed food.

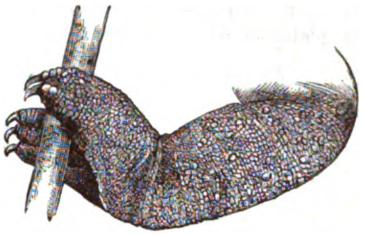

FIG. 6.—Forefoot of *Chamæleon o'shaughenesii*.

The Chamæleons are almost peculiar to the African region, and most numerous in Madagascar, where out of the thirty-six species known not less than seventeen occur. Only one species (*C. vulgaris*) extends into India and Ceylon. No other member of the order of lizards shows such a degree of specialization as the chamæleons. The tongue, eyes, limbs, tail, skin, lungs, are modified in a most extraordinary manner to serve special functions in the peculiar economy of these animals. They lead an exclusively arboreal life; each of their feet is converted into a grasping hand, by means of which, assisted by a long prehensile tail, they hold so fast to a branch on which they are sitting that they can only with difficulty be dislodged. Their movements are slow on the ground, and still more so in the water, where they are nearly helpless. As in ant-eaters, woodpeckers, or frogs, their tongue is the organ with which they catch their prey; it is exceedingly long, worm-like, with a club-shaped viscous end; they shoot it out of the mouth with incredible rapidity towards insects, which remain attached to it, and are thus caught. The globular eyes are covered with a circular lid pierced by a small central hole, and are so prominent that more than one-half of the ball stands out of the head. Not only can they be moved in any direction, but each has an action independent of the other; one eye may be looking forwards, whilst an object behind the animal is examined with the other. The lungs of the chamæleons are very capacious, and are inflated when the animal is angry or frightened. The faculty of changing color, which they have in common with many other lizards, is partly dependent on the degree in which the lungs are filled with air, and different layers of chromatophores are pressed towards the outer surface of the skin. Some species are only a few inches long, whilst others attain to a length of 18 and 20 inches. The majority are oviparous, a few ovoviviparous.

Almost all the lizards belonging to the family of *Geckos* may be recognized at first sight; the head is broad and depressed, the eyes large, the body depressed; the tail is thick at the base, tapering, generally somewhat deformed, as a specimen is rarely met with in which this member is not reproduced. The limbs are stout, rather short, with at least four of the toes well developed. Geckos are found in almost every part of the globe between and near the tropics, frequenting houses, rocks, and trees; and some of the species are so numerous around and within human dwellings as to be most familiar objects to the inhabitants. Many are able to run up and along the surface of a wall or of any other perpendicular object; for this purpose the lower surface of their toes is provided with a series of movable plates or disks,[1] by the aid of which they adhere to the surface over which they pass. In forest-species this apparatus is generally less developed, or entirely absent, claws being of greater use for walking up the rough bark of a tree. Geckos, with few exceptions, are nocturnal and, consequently, large-eyed animals, the pupil being generally contracted in a vertical direction, shaped like two rhombs placed with the angles towards each other. They are of small size, the largest species not exceeding 10 or 14 inches in length. They are carnivorous, destroying moths and all kinds of insects, and even the younger and weaker members of their own species. They have been seen devouring the skin which they cast off, and their own wriggling tail. They are of a fierce disposition, frequently fighting among themselves; but house-geckos readily become habituated to the presence of man; accustomed to be fed at a certain time with rice, these little lizards will punctually make their appearance, and fearlessly take the proffered food. Another peculiarity of geckos is that they, or at least some genera, are endowed with a voice. The large *Gecko guttatus* and *G. monarchus* of the East Indies utter a shrill cry, sounding like "tokee" or "tok." The common species found in houses in the south of Europe are a species of *Hemidactylus* (*H. verruculatus*) and *Tarentola*, the terrentola of the Italians. All geckos seem to be oviparous.

(A. C. G.)

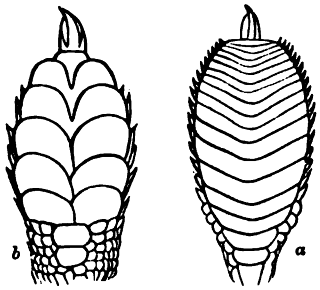

FIG. 7.—Lower Surface of the Toe of (*a*) *Gecko*, (*b*) *Hemidactylus*—enlarged.

LLAMA, sometimes spelt *Lama*, a word by which the Peruvians designated one of a small group of closely allied animals, which, before the Spanish conquest of America, were the only domesticated hoofed mammals of the country, being kept, not only for their value as beasts of burden, but also for their flesh, hides, and wool,—in fact, supplying in the domestic economy of the people the place of the horse, the ox, the goat, and the sheep of the Old World. The word is now sometimes restricted to one particular species or variety of the group, and sometimes used in a generic sense to cover the whole. Although they were often compared by early writers to sheep, and spoken of as such, their affinity to the camel was very soon perceived, and they were included in the genus *Camelus* in the *Systema Naturæ* of Linnæus. They were, however, separated by Cuvier in 1800 under the name of *Lama*, changed by Illiger in 1811 to *Auchenia* (in allusion to the great length of neck, αὐχήν), a term afterwards adopted by Cuvier, and almost universally accepted by systematic zoologists, although there has been of late a disposition to revive the earlier name.

The animals of the genus *Auchenia* or *Lama* are, with the two species of true camels (to which the generic term *Camelus* is now restricted), the sole existing representatives of a very distinct section of the "artiodactyle" or even-toed ungulates, called *Tylopoda*, or "boss-footed," from the peculiar bosses or cushions placed on the under surface of their feet, and on which they tread. This section thus consists of a single family, the *Camelidæ*, the other sections of the same great division being the *Suina* or pigs, the *Tragulina* or chevrotains, and the *Pecora* or true ruminants, to each of which the *Tylopoda* have more or less affinity, standing in some respects in a central position between them, borrowing as it were some characters from each, but in others showing great special modifications not found in any of the other sections.

Until within the last few years the existence of two genera having so very much in common as the camels and the llamas, and yet so completely isolated geographically, had not received any satisfactory explanation, for the old idea that they in some way "represented" each other in the two hemispheres of the world was a mere fancy without philosophical basis. The discoveries made mostly within the past ten years of a vast and previously unsuspected extinct fauna of the American continent of the Tertiary period, as interpreted by the able palæontologists Leidy, Cope, and Marsh, has thrown a flood of light upon the early history of this family, and upon its relations to other mammals. It is now known that llamas at one time were not confined to the part of the continent south of the Isthmus of Panama, as at the present day, for their remains have been abundantly found in the Pleistocene deposits of the region of the Rocky Mountains, and in Central America, some attaining a much larger size than those now existing. There have also been found in the same regions many camel-like animals exhibiting different generic modifications, and what is more interesting, a gradual series of changes, coinciding with the antiquity of the deposits in which they are found, have been traced from the thoroughly differentiated species of the modern epoch down through the Pliocene to the early Miocene beds, where, their characters having become by degrees more generalized, they have lost all that especially distinguishes them as *Camelidæ*, and are merged into forms common to the ancestral type of

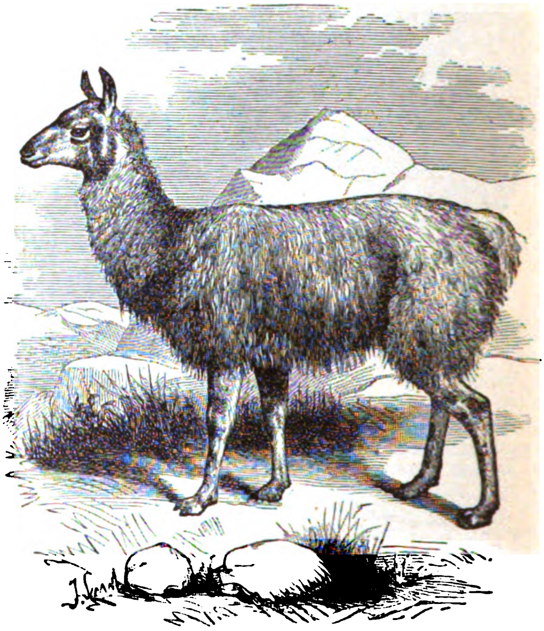

FIG. 1.—Llama (from an animal living in the Gardens of the Zoological Society of London).

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[1] The mechanism resembles in some the adhesive organ of *Echeneis* or sucking-fish, in others that of the legs of a fly.

all the other sections of the Artiodactyles. Hitherto none of these annectant forms have been found in any of the fossiliferous strata of the Old World; it may therefore be fairly surmised (according to the evidence at present before us) that America was the original home of the *Tylopoda*, and that the true camels have passed over into the Old World, probably by way of the north of Asia, where we have every reason to believe there was formerly a free communication between the continents, and then, gradually driven southward, perhaps by changes of climate, having become isolated, have undergone some further special modifications; while those members of the family that remained in their original birthplace have become, through causes not clearly understood, restricted solely to the southern or most distant part of the continent. There are few groups of mammals of which the palæontological history has been so satisfactorily demonstrated as the one of which we are treating.[1]

The special characters which the llamas and camels have in common, and the combination of which distinguishes them from the rest of the Artiodactyles, are as follows. The premaxillæ have the full number of incisor teeth in the young state, and the outermost is persistent through life, an isolated laniariform tooth. The canines are present in both jaws, and those of the mandible are differentiated from the long, procumbent, and spatulate incisors, being suberect and pointed. The crowns of the true molars belong to the crescentic or "selenodont" type, and are very long or "hypsodont;" but one or more of the anterior premolars is usually detached from the series, and of simple pointed form. The hinder part of the body is much contracted, and the femur long and vertically placed, so that the knee-joint is lower in position, and the thigh altogether more detached from the abdomen than in most quadrupedal mammals. The limbs are long, but with only two digits (the third and fourth) developed on each, no traces of any of the others being present. The trapezoid and magnum of the carpus, and the cuboid and navicular of the tarsus are distinct. The two metapodal bones of each limb are confluent for the greater part of their length, though separated for a considerable distance at the lower end. Their distal articular surfaces, instead of being pulley-like, with deep ridges and grooves, as in other Artiodactyles, are simple, rounded, and smooth. The proximal phalanges are expanded at their distal ends, and the wide, depressed middle phalanges are embedded in a broad cutaneous pad, forming the sole of the foot, on which the animal rests in walking instead of on the hoofs. The ungual phalanges are very small and nodular, not flattened on their inner or opposed surfaces, and not completely encased in hoofs, but bearing nails on their upper surface only. The cervical region is long and flexuous, and the vertebræ of which it is composed are remarkable for the position of the canal for the transmission of the vertebral artery, which does not perforate the transverse process, but passes obliquely through the anterior part of the pedicle of the arch (a condition only found in two other genera of mammals, *Macrauchenia* and *Myrmecophaga*). There are no horns or antlers. Though these animals ruminate, the stomach differs considerably in the details of its construction from that of the *Pecora*. The interior of the rumen or paunch has no villi on its surface, and there is no distint psalterium or maniplies. Both first and second compartments are remarkable for the presence of a number of pouches or cells in their walls, with muscular septa, and a sphincter-like arrangement of their orifices, by which they can be shut off from the rest of the cavity, and into which the fluid portion only of the contents of the stomach is allowed to enter.[2] The placenta is diffuse as in the *Suina* and *Tragulina*, not cotyledonary as in the *Pecora*. Finally, they differ not only from other ungulates, but from all other mammals, in the fact that the red corpuscles of the blood, instead of being circular in outline, are oval as in the inferior vertebrated classes.

The following characters apply especially to the llamas. Dentition of adults:—incisors $\frac{1}{3}$, canines $\frac{1}{1}$, premolars $\frac{2}{2}$, molars $\frac{3}{3}$; total 32. In the upper jaw there is a compressed, sharp, pointed laniariform incisor near the hinder edge of the premaxilla, followed in the male at least by a moderate-sized, pointed, curved true canine in the anterior part of the maxilla. The isolated canine-like premolar which follows in the camels is not present. The teeth of the molar series which are in contact with each other consist of two very small premolars (the first almost rudimentary) and three broad molars, constructed generally like those of *Camelus*. In the lower jaw, the three incisors are long, spatulate, and procumbent; the outer ones are the smallest. Next to these is a curved, suberect canine, followed after an interval by an isolated minute and often deciduous simple conical premolar; then a contiguous series of one premolar and three molars, which differ from those of *Camelus* in having a small accessory column at the anterior outer edge. The skull generally resembles that of *Camelus*, the relatively larger brain-cavity and orbits and less developed cranial ridges being due to its smaller size. The nasal bones are shorter and broader, and are joined by the premaxillæ. Vertebræ:—cervical 7, dorsal 12, lumbar 7, sacral 4, caudal 15 to 20. Ears rather long and pointed. No dorsal hump. Feet narrow, the toes being more separated than in the camels, each having a distinct plantar pad. Tail short. Hairy covering long and woolly. Size smaller and general form lighter than in the camels. At present and within historic times they are entirely confined to the western side and southernmost parts of South America, though fossil remains have been found in the caves of Brazil, in the pampas of the Argentine republic, and, as before mentioned, in Central and North America.

In essential structural characters, as well as in general appearance and habits, all the animals of this genus very closely resemble each other, so that the question as to whether they should be considered as belonging to one, two, or more species has been one which has led to a large amount of controversy among naturalists. The question has been much complicated by the circumstance of the great majority of individuals which have come under observation being either in a completely or partially domesticated state, and descended from ancestors which from time immemorial have been in like condition, one which always tends to produce a certain amount of variation from the original type. It has, however, lost much of its importance since the doctrine of the distinct origin of species has been generally abandoned. The four forms commonly distinguished by the inhabitants of South America are recognized by some naturalists as distinct species, and have had specific designations attached to them, though usually with expressions of doubt, and with great difficulties in defining their distinctive characteristics. These are—(1) the llama, *Auchenia glama* (Linn.), or *Lama peruana* (Tiedemann); (2) the alpaca, *A. pacos* (Linn.); (3) the guanaco or huanaco, *A. huanacus* (Molina); and (4) the vicugna, *A. vicugna* (Molina), or *A. vicunna* (Cuv.). The first and second are only known in the domestic state, and are variable in size and color, being often white, black, or piebald.

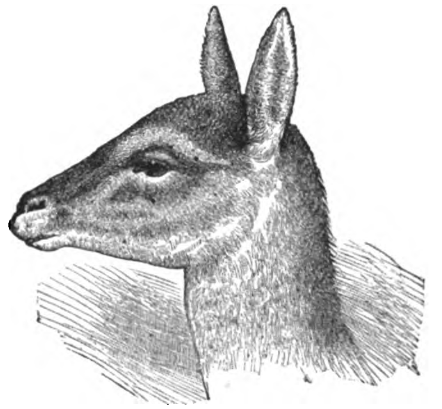

FIG. 2.—Head of Vicugna (from an animal living in the Gardens of the Zoological Society of London).

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[1] See especially E. D. Cope, in Wheeler's *Report of the Survey West of the 100th Meridian*, iv. pt. 2, pp. 325–46, 1877.

[2] The stomach of the camel inhabiting the Arabian desert is commonly looked upon as a striking example of specialized structure, adapted or modified in direct accordance with a highly specialized mode of life; it is therefore very remarkable to find an organ exactly similar, except in some unessential details, in the llamas of the Peruvian Andes and the guanacos of the Pampas. No hypothesis except that of a common origin will satisfactorily account for this, and, granting that this view is correct, it becomes extremely interesting to find for how long a time two genera may be isolated and yet retain such close similarities in parts which in other groups appear readily subject to adaptive modifications.

The third and fourth are wild, and of a nearly uniform light-brown color, passing into white below. They certainly differ from each other, the vicugna being smaller, more slender in its proportions, and having a shorter head than the guanaco. It may therefore, according to the usual view of species, be considered distinct. It lives in herds on the bleak and elevated parts of the mountain range bordering the region of perpetual snow, amidst rocks and precipices, occurring in various suitable localities throughout Peru, in the southern part of Ecuador, and as far south as the middle of Bolivia. Its manners very much resemble those of the chamois of the European Alps; and it is as vigilant, wild, and timid. The wool is extremely delicate and soft, and highly valued for the purposes of weaving, but the quantity which each animal produces is not great.

The guanaco has an extensive geographical range, from the high lands of the Andean region of Ecuador and Peru to the open plains of Patagonia, and even the wooded islands of Tierra del Fuego. It constitutes the principal food of the Patagonian Indians, and its skin is invaluable to them, as furnishing the material out of which their long robes are constructed. It is about the size of a European red deer, and is an elegant animal, being possessed of a long, slender, gracefully curved neck and fine legs. Dr. Cunningham,[1] speaking from observation on wild animals, says:—

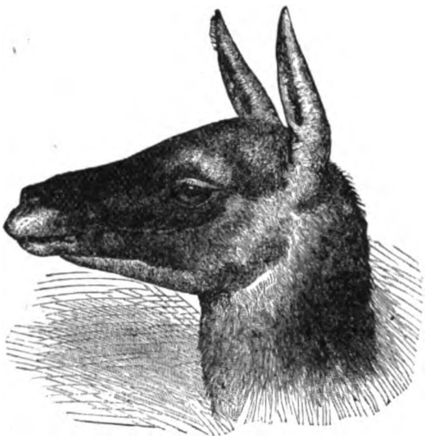

FIG. 3.—Head of Guanaco (from an animal living in the Gardens of the Zoological Society of London).

> "It is not easy to describe its general appearance, which combines some of the characters of a camel, a deer, and a goat. The body, deep at the breast but very small at the loins, is covered with long, soft, very fine hair, which on the upper parts is of a kind of fawn color, and beneath varies from a very pale yellow to the most beautiful snow-white. The head is provided with large ears, in general carried well back, and is covered with short grayish hair, which is darkest on the forehead. Occasionally the face is nearly black. As a rule, it lives in flocks of from half a dozen to several hundreds, but solitary individuals are now and then to be met with. They are very difficult to approach sufficiently near to admit of an easy shot, as they are extremely wary, but on being disturbed, canter off at a pace which soon puts a safe distance between them and the sportsman, even though he should be mounted. Despite their timidity, however, they are possessed of great curiosity, and will sometimes advance within a comparatively short distance of an unknown object, at which they will gaze fixedly till they take alarm, when they effect a speedy retreat. Their cry is very peculiar, being something between the belling of a deer and the neigh of a horse. It would be difficult to overestimate their numbers upon the Patagonian plains; for in whatever direction we walked we always came upon numbers of portions of their skeletons and detached bones."

Darwin, who has given a most interesting account of the habits of the guanaco in his *Naturalist's Voyage*, says that they readily take to the water, and were seen several times at Port Valdes swimming from island to island.

The llama is only known as a domestic animal, and is chiefly met with in the southern part of Peru. Burmeister, the latest and a very competent writer on the subject,[2] says that he is perfectly satisfied that it is the descendant of the wild guanaco, an opinion opposed to that of Tschudi. It generally attains a larger size than the guanaco, and is usually white or spotted with brown or black, and sometimes altogether black. The earliest and often quoted account of this animal by Augustin de Zarate, treasurer-general of Peru in 1544, will bear repeating as an excellent summary of the general character and uses to which it was put by the Peruvians at the time of the Spanish conquest. He speaks of the llama as a sheep, observing, however, that it is camel-like in shape, though destitute of a hump:—

> "In places where there is no snow, the natives want water, and to supply this they fill the skins of sheep with water and make other living sheep carry them, for, it must be remarked, these sheep of Peru are large enough to serve as beasts of burden. They can carry about one hundred pounds or more, and the Spaniards used to ride them, and they would go four or five leagues a day. When they are weary they lie down upon the ground, and as there are no means of making them get up, either by beating or assisting them, the load must of necessity be taken off. When there is a man on one of them, if the beast is tired and urged to go on, he turns his head round, and discharges his saliva, which has an unpleasant odor, into the rider's face. These animals are of great use and profit to their masters, for their wool is very good and fine, particularly that of the species called pacas, which have very long fleeces; and the expense of their food is trifling, as a handful of maize suffices them, and they can go four or five days without water. Their flesh is as good as that of the fat sheep of Castile. There are now public shambles for the sale of their flesh in all parts of Peru, which was not the case when the Spaniards came first; for when one Indian had killed a sheep his neighbors came and took what they wanted, and then another Indian killed a sheep in his turn."

The disagreeable habit here noticed of spitting in the face of persons whose presence is obnoxious is common to all the group, as may be daily witnessed in specimens in confinement in the menageries of Europe. One of the principal labors to which the llamas were subjected at the time of the Spanish conquest was that of bringing down ore from the mines in the mountains. Gregory de Bolivar estimated that in his day as many as three hundred thousand were employed in the transport of the produce of the mines of Potosi alone, but since the introduction of horses, mules, and donkeys the importance of the llama as a beast of burden has greatly diminished.

The alpaca is believed by most naturalists to be a variety of the vicugna; others have, however, identified it with the guanaco, and some consider it as a distinct species. It is usually found in a domesticated or semi-domesticated state, being kept in large flocks which graze on the level heights of the Andes of southern Peru and northern Bolivia at an elevation of from 14,000 to 16,000 feet above the sea-level, throughout the year. It is not used as a beast of burden like the llama, but is valued only for its wool, of which the Indian blankets and ponchas are made. Its color is usually dark brown or black. The characteristics of its wool, and the history of its introduction into British manufacturing industry, are described in the article ALPACA. (W. H. F.)

LLANDAFF, a city of Glamorgan, South Wales. See CARDIFF, within which parliamentary borough it is almost entirely included.

LLANDUDNO, a watering-place in Carnarvonshire, North Wales, situated on the Irish Sea, and at the mouth of the Conway, in a finely sheltered bay, 50 miles west of Chester by rail. It lies between Great Orme's Head and Little Orme's Head, two lofty promontories which rise precipitously from the sea to the height of several hundred feet. Round Great Orme's Head a public drive has been made, from which very picturesque views are obtained. The rock is greatly frequented by many varieties of sea birds, and is also the habitat of many rare plants. The old parish church of St. Tudno, situated on a cliff overlooking the sea, has been replaced by a later structure (St. George's), and the Church of Holy Trinity in the First Pointed style was erected in 1865. The chief attractions of the town are its picturesque and sheltered situation, and the fine facilities it affords for sea bathing. In the neighboring copper-mines various mineralogical specimens of interest have been found. On the summit of the head there are the remains of old circular buildings, some portions of an old fortress, and a rocking stone. The population of the urban sanitary district in 1871 was 2762, and in 1881 it was 4838, but these figures do not represent its summer population, which is nearly twice as great.

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[1] *Natural History of the Strait of Magellan*, 1871.

[2] *Description Physique de la République Argentine*, vol. iii. p. 456, 1879.

LLANELLY, a market-town, parliamentary borough, and seaport town of Carmarthenshire, South Wales, is situated on a creek of Carmarthen Bay, on the river Lougher, and on several railway lines, 11 miles west of Swansea, and 225 west-north-west of London. It is a prosperous manufacturing town. The church of St. Elli or Llanelly is in the Early English style, with a square embattled tower. The other principal buildings are the town-hall and the athenæum. The town possesses extensive docks. It imports large quantities of copper ore, and carries on an export trade in its special manufactures. For the last five years the exports have averaged above £150,000 annually, and the imports £50,000. There are copper, silver, lead, and tin works, iron foundries, manufactures of pottery, chemical works, brick and tile works, flour-mills, and breweries; and in the vicinity there are extensive collieries. Llanelly is included in the Carmarthen district of parliamentary boroughs. The population of the urban sanitary district in 1871 was 14,973, which in 1881 had increased to 19,655.

LLANGOLLEN, a picturesque market-town of Denbighshire, North Wales, and a favorite summer resort, is beautifully situated in a fine vale surrounded by lofty mountains, on the right bank of the Dee, and on a branch line of the Great Western Railway, 9 miles south-west of Wrexham, and 22 south-west of Chester. The river is crossed by a peculiarly constructed bridge of five arches built in 1345. The church, dedicated to St. Collen, is a plain but ancient structure, partly in the Early English style. Opposite the town, on the summit of a conical hill, are the remains of a very ancient fortress, the Castell Dinas Brân. The beautiful abbey of Valle Crucis, in a neighboring dell, is one of the finest ecclesiastical ruins in Wales. Near it there is an ancient British monument, the "Pillar of Eliseg." The principal secular buildings of the town are the town-hall and the court-house. The industries include the manufacture of linen and wool, and in the vicinity there are collieries, lime-works, and iron-works. The population of the urban sanitary district in 1871 was 2798, and in 1881 it was 3124.

LLORENTE, JUAN ANTONIO (1756–1823), the historian of the Spanish Inquisition, was born March 30, 1756, at Rincon de Soto, near Calahorra, Aragon, studied at Tarragona and Saragossa, received (by dispensation) priest's orders in 1779, and became vicar-general to the bishop of Calahorra in 1782. In 1785 he became commissary of the Holy Office at Logroño, and in 1789 its general secretary at Madrid. In 1805 he obtained a canonry at Toledo, and in 1806–8 his *Noticias Historicas sobre las tres Provincias Vascondadas* appeared. In the crisis of 1808 Llorente identified himself with the Bonapartists, and from 1809 onwards he was engaged in superintending the execution of the decree of suppression of the monastic orders, and in examining the archives of the Inquisition for his *History*, a work which appeared in 1817–18 at Paris, where its author had been residing since the return of Ferdinand VII. to Madrid in 1814, under the title *Histoire critique de l'Inquisition d'Espagne, depuis l'époque de son établissement par Ferdinand V. jusqu'au règne de Ferdinand VII., tirée des pièces originales du Conseil de la Suprême et de celles des tribunaux subalternes du Saint Office.* Translated within a few years into German, English, Dutch, Italian, and Spanish, it attracted much attention throughout Europe, and involved its author in considerable persecution and hardship, which, on the publication of his *Portraits politiques des Papes* in 1822, culminated in a peremptory order (December, 1822) to quit France. His death, caused, or at least hastened, by the fatigues of the hasty journey to Spain, took place at Madrid on February 5, 1823. Both the personal character and the literary trustworthiness of Llorente have been very bitterly assailed; but, although he was very imperfectly equipped as an exact historian, there is no reason to doubt that he made an honest use of documents (now no longer extant) relating to the Inquisition, to which he had access at Madrid. An English (abridged) translation of the *History* appeared in 1826. A full list of the numerous writings of Llorente is given in the *Biographie Générale.*

LLOYD'S, an association of merchants, shipowners, underwriters, and ship and insurance brokers, having its headquarters in a suite of rooms in the north-east corner of the Royal Exchange, London. Originally a mere gathering of merchants for business or gossip in a coffee-house kept by one Edward Lloyd in Tower Street, London, the earliest notice of which occurs in the *London Gazette* of 18th February, 1688, this institution has gradually become one of the greatest and most perfect organizations in the world in connection with commerce. The establishment existed in Tower Street up to 1692, in which year it was removed by the enterprising proprietor to Lombard Street, in the very centre of that portion of the old city of London most frequented by merchants of the highest class. Shortly after this event Mr. Lloyd gave another proof of his enterprise and intelligence by the establishment of a weekly newspaper furnishing commercial and shipping news, in those days an undertaking of no small difficulty. This paper took the name of *Lloyd's News*, and, although its life was not a prolonged one, it was destined to be the precursor of the now ubiquitous *Lloyd's List*, the oldest existing paper, the *London Gazette* excepted, of the present day. In Lombard Street the business transacted at Lloyd's coffee-house steadily grew in extent and importance, but it does not appear that throughout the greater part of the 18th century the merchants and underwriters frequenting the rooms were bound together by any rules, or acted under any organization. By and by, however, the rapid increase of marine insurance business made a change of system and improved accommodation absolutely necessary, and accordingly, after finding a temporary resting-place in Pope's Head Alley, the underwriters and brokers finally settled down in the Royal Exchange in March, 1774. One of the first improvements in the mode of effecting marine insurance springing out of this new state of things was the introduction of a printed form of policy. Hitherto various forms had been in use; and, to avoid the numerous disputes consequent on a practice so loose and unsatisfactory, the committee of Lloyd's proposed a general form, which was finally adopted by the members on the 12th of January, 1779, and which remains in use, with only a few slight alterations, to this day. The two most important events in the history of Lloyd's during the present century are the reorganization of the association in 1811, and the passage of an Act in 1871 granting to Lloyd's all the rights and privileges of a corporation sanctioned by parliament. According to this Act of Incorporation, the three main objects for which the society exists are—first, the carrying out of the business of marine insurance; secondly, the protection of the interests of the members of the association; and thirdly, the collection publication, and diffusion of intelligence and information with respect to shipping.

In the promotion of the last-named object, obviously the foundation upon which the entire superstructure rests, an intelligence department has been gradually developed which for wideness of range and efficient working has no parallel among private enterprises in any country.

The rooms at Lloyd's are available only to subscribers and members. The former pay an annual subscription of five guineas without entrance fee, but have no voice in the management of the institution. The latter consist of non-underwriting members, who pay an entrance fee of twelve guineas, and of underwriting members, who pay a fee of one hundred pounds. Underwriting members are also required to deposit securities to the value of £5000 to £10,000, according to circumstances, as a guarantee for their engagements. The management of the establishment is delegated by the members to certain of their number selected as a "committee for managing the affairs of Lloyd's." With this body lies the appointment of all the officials and agents of the institution, the daily routine of duty being entrusted to a secretary and a large staff of clerks and other assistants. The mode employed in effecting an insurance at Lloyd's is very simple. The business is done entirely by brokers, who write upon a slip of paper the name of the ship and shipmaster, the nature of the voyage, the subject to be insured, and the amount at which it is valued. If the risk is accepted, each underwriter subscribes his name and the amount he agrees to take or underwrite, the insurance being effected as soon as the total value is made up. The sum paid by the insured to the underwriters is denominated the premium, a tax upon the profits of the merchant which the progress of science, of the art of shipbuilding, and of navigation has in these days reduced to a very moderate figure.

(W. P. H.)

LOACH. The loaches (*Cobitidina*) are small fishes of the Carp family (*Cyprinidæ*), with a generally cylindrical body, with very small or without any scales, with six or more barbels round the mouth, with a short dorsal and anal fin, and with the pharyngeal teeth in a single series. The air-bladder is double, as in other carps, the two divisions lying side by side, or one behind the other; but it is always entirely or partially enclosed in a bony capsule formed by the anterior vertebræ. The largest of the ninety species known grow to a length of 10 or 12 inches, but the majority are of much smaller dimensions. They are found in Europe and Asia only. The typical species are partial to fast-running streams with stony bottoms; they abound in the waters draining the central Alps of Asia, and extend far towards the north of the Europo-Asiatic region. The tropical forms from the south of the Himalayas are not less common, and some of them have assumed a more compressed form of the body with a bright coloration. In Great Britain two species occur, viz., the common loach (*Nemachilus barbatulus*), and the more local *Cobitis tænia*, which is distinguished by a small spine below the eye. The former is esteemed as food in parts of the Continent where it occurs in sufficient abundance. See ICHTHYOLOGY.

LOANDA, or in full São Paulo de Loanda, the capital of the Portuguese settlements in Western Africa, and the principal municipality of the Loanda district, one of the three into which Angola is divided, is situated on the mainland in 8° 48′ S. lat. and 13° 7′ E. long. The beautiful bay, protected from the surf by the long narrow island of pure sand from which the town takes its name, is backed by a line of low sandy cliff which at its southern end sweeps out with a sharp curve and terminates in the bold point crowned by Fort San Miguel. A good part of the town lies on the shore, but the more important buildings—the Government offices, the governor's residence, the palace of the bishop of Angola, and the admirable hospital—are situated on the higher grounds. Most of the European houses are large stone buildings of one story with red tile roofs. The streets, formerly full of loose fine sand, have in many cases been paved. The great defect of the situation is the want of water, which had to be brought for the most part in little boats from the Bengo and the Dande; but the Portuguese government signed a contract in November, 1877, by which a canal 43 miles long was to be constructed, at a cost of 6,000,000 francs, from Tandabondo (a point 37 miles from the mouth of the Bengo) to the city. Loanda is a busy place; the shops are well supplied with European goods, and large native markets are held in various parts of the town. While the slave trade to Brazil was still in full prosperity, the traffic of the port was of no small account; and after a period of great depression it is now developing in more legitimate directions. There is a regular service of steamers from Lisbon and Liverpool, and in 1877 746 vessels entered and 693 cleared. The population is from 10,000 to 12,000 (Lux gives 18,000 to 20,000), about a third being whites. From 1641 to 1648 Loanda was occupied by the Dutch.

See J. J. Monteiro, *Angola and the River Congo*, London, 1875; and Lux, *Von Loanda nach Kimbundu*, Vienna, 1880.

LOANGO, in the wider signification of the name, is a region on the west coast of southern Africa, which extends from the mouth of the Congo (Zaire) river in 6° S. lat. northwards through about two degrees, with no very definite limit in this direction, unless we adopt the Numbi river which falls into Chilunga Bay in 4° 9′ S. lat., and was formerly considered the northern boundary of the Loango kingdom. In a narrower sense it is the country bounded on the S. by the Luemma, and on the N. by the Kuilu,—the district between the Luemma and the Chiloango being known as Chiloango or Little Loango, that between the Chiloango and the Congo as Kakongo and Angoy, and that to the north of the Kuilu as Chilunga. The whole country between 6° and 4° may be described as the lowland portion of the seaward versant of the Serra do Crystal or Serra Complida, a range running almost parallel with the coast, from which its spurs and underfalls are distant only 30 or 40 miles. It has an irregularly undulating or hilly surface, slowly rising in somewhat indefinite terraces, and is traversed from north-east to south-west by a number of considerable streams flowing in well-marked valleys. The coast-line in some stretches is low and swampy, while in others, as along Loango and Kabinda Bays, it presents a series of cliffs 40 to 50 feet high. Behind the region of alluvial deposits which prevails for some distance inland there is a broken belt of Tertiary rocks; but these soon give place to laterite, and beyond the laterite lie the micaschists, talcs, and gneiss of which the mountains are composed. Of the Loango rivers the best explored is the Kuilu or Quillu. At its mouth, in 4° 29′ S. lat., it is a noble stream 1100 feet wide, but the bar has hitherto proved an insuperable obstacle to the entrance of sea-going ships; near the Mayombe factory, which may be reached in fifteen hours from the coast, it begins to take the character of a mountain stream. Its principal affluent is the Nanga. Farther south are the Songolo and the Luemma. Of greater importance as a navigable route towards the interior is the Chiloango or Loango Luse (sometimes erroneously called the Kakongo), which disembogues in 5° 12′ S. lat. and 12° 5′ E. long., and is formed about 15 miles inland by the junction of the Loango and the Lukula, of which the one separates Loango proper from the Osobo country and the other the Osobo country from Kakongo.

Though a large proportion of the Loango coast region is occupied by primeval forest, with trees rising to a height of 150 and 200 feet, there is considerable variety of scenery—open lagoons, mangrove swamps, scattered clusters of trees, park-like reaches, dense walls of tangled underwood along the rivers, prairies of tall grass through which no pathway can be driven, and patches of cultivation. Among the more characteristic forms of vegetation are baobabs, silk-cotton trees, screw-pines, and palms—especially *Hyphæne guineensis* (a palm-fan), *Raphia* (the wine-palm), and *Elæis guineensis* (the oil-palm). Anonaceous plants (notably *Anona senegalensis*) and the *pallabanda*, an olive-myrtle-like tree, are common in the prairies; the papyrus shoots up to a height of 20 feet along the rivers (particularly the Luemma); the banks are fringed by the cottony *Hibiscus tiliaceus*, ipomæas, and fragrant jasmines; and the thickets are bound together in one inextricable mass by lianas of many kinds. Among the fruit trees are the mango and the papaw; the orange has been successfully introduced at Vista and Kabinda; and the lemon continues to flourish well up the country. Negro-pepper (a variety of capsicum) and ginger grow wild; the natives, in addition to manioc (their staple sustenance) and bananas, cultivate ground-nuts and tobacco; and the planters have European vegetables in their gardens.

The crocodile, the hippopotamus, and several kinds of apes—including the chimpanzee and the rare gorilla—are the most noteworthy larger animals; the birds are various and beautiful—gray parrots, shrikes, fly-catchers, rhinoceros birds, weaver birds (often in large colonies on the palm-trees), ice birds, from the *Cecyle Sharpii* to the dwarfish *Alcedo cristata*, butterfly-finches, and helmet-birds (*Turacus giganteus*), not to mention doves, snipes, and other more familiar types. Snakes are extremely common—*Caucus rhombeatus*, *Atractaspis irregularis*, *Dendraspis Jamesonii*, *Dasypeltis palmarum*, etc., but they give comparatively little trouble. The curious climbing-fish, which frequents the mangroves, the *Pteropterus* or lung-fish, which lies in the mud in a state of lethargy during the dry season, the strange and poisonous *Tetrodon guttifer*, and the herring-like *Pellona africana*, often caught in great shoals—are the more remarkable of the fishes. Oysters are got in abundance from the lagoons, and the Portuguese fatten the huge *Cardisoma armatum* or heart-crab for table. Fireflies and unfortunately also mosquitoes and sandflies are among the most familiar forms of insect life; the bird spider among the rarer. A kind of ant builds very striking pent-house or umbrella-shaped nests rising on the tree trunks one above the other like the roofs of a Chinese pagoda.

Well-built and tall (average height of the men 5·5 feet, of the women 5·2), strongly dolichocephalous and very thick of skull, never black, but of various shades of warm brown with the faintest suggestion of purple, the Bafiote (as the natives of the Loango coast call themselves) are on the whole very favorable specimens of the Negro stock to which they belong. Their black curly hair never becomes white with age, and gray only in the case of very old people. Baldness is quite unknown, and many of the men wear beards. Physical deformity is extremely rare. Like the west-coast negroes in general the Bafiote have a ghastly and grotesque belief in fetiches and witchcraft; and their gangas or priests employ the cassa (nkassa) ordeal with such recklessness that for every grown-up person who dies a natural death three or four, it is estimated, perish by this judgment of the invisible powers. A custom which readily catches the eye of the foreigner is that of setting their marriageable maidens forth to view in a little bower specially erected in front of the parents' dwelling—their skins stained red with a peculiar powder. Near Chinchoxo there is a curious tribe, the Mavumbu or Umwambu, known to Europeans as Black Jews on account of their strikingly Semitic features. The coast people proper or Bavilli look down on their more inland neighbors as less civilized; and these in their turn pay the same compliment to those beyond,—the Bayombe and Bayaka, who occupy the mountainous woodland on the borders of Loango, being reckoned as genuine savages.

The people are scattered throughout the country in small villages; Nkondo, probably the largest, contains only 350 to 400 huts, though it is the seat of one of the most influential "princes." There is no town or village of Loango,—the place of that name on Loango Bay being a mere group of factories. Buri, Boari, or Boali, was the name of the former capital; Loangiri or Loangele (visited in 1873 by Bastian) was the burial-place of the ancient kings; and Lubu, which is still neutral in war, is that of the "princes." At one time included in the great Congo kingdom, Loango became independent about the close of the 16th century, and was still of considerable importance in the days of Abbé Proyart (1750), though Kakongo and other districts were practically independent. At present there is no central authority in the country; the petty local chiefs are local chiefs and nothing more; but the members of the blood royal are still honored with special privileges, a large number of nominal titles remain in use, and a common tradition of greatness gives a sort of cohesion to the political conglomerate.

The slave-trade was longer maintained in Loango than anywhere else on the West African seaboard; and since its extirpation palm oil and india-rubber have been the main objects of commerce. Perfect freedom of trade prevails; and there are Dutch, Portuguese, German, French, and English factories on the coast and up the rivers. The Portuguese have made considerable efforts to secure territorial supremacy; but they have hitherto failed, partly owing to direct French opposition, partly to the state of the country.

The following are the principal stations of European trade:—Banana at the mouth of the Congo, the central post of the Rotterdam African Trading Company, whose comptoirs are scattered along a vast extent of the west coast; Muanda, with one of the best of the native villages; Vista; Kabinda, the natives of which are known as far south as Mossamedes for their enterprise and skill as carpenters, tailors, etc.; Landana, the seat of Dutch, French, and Portuguese factories, and of a French mission from the Gaboon; and Chincho or Tchinchotcho (5° 9' 14'' S. lat., 12° 3' 45'' E. long.) the post occupied by the German Exploring Expedition in 1873–76.

See, besides Merolla and Battel (Pinkerton, vol. ii.), Proyart, *Histoire de Loango*, Paris, 1766 (also in Pinkerton); Degrandpré, *Reise nach der westlichen Küste von Afrika*, Weimar, 1801; Bastian, *Die deutsche Expedition an der Loango-Küste*, Jena, 1874–75; and *Die Loango-Expedition*, by Dr. Paul Güssfeldt (1879), Julius Falkenstein (1879), and Pechuel-Loesche (1882)

LOBELIA, L., the typical genus of the tribe *Lobelieæ*, of the order *Campanulaceæ*, named after Matthias de Lobel,[1] a native of Lille, botanist and physician to James I. It numbers about two hundred species, natives of nearly all the temperate and warmer regions of the world, excepting central and eastern Europe as well as western Asia. For the sections into which the genus is divided, see *Genera Plantarum*, by Bentham and Hooker, vol. ii. p. 551; and for species, De C., *Prod.*, vii. p. 357. Two species are British, *L. Dortmanna*, L., named after Dortmann, a Dutch druggist, which occurs in gravelly mountain lakes; and *L. urens*, L., which is only found on heaths, etc., near Axminster (see Baxter's *Brit. Gen.*, No. 79). The genus is distinguished from *Campanula* by the irregular corolla and completely united anthers, and by the excessive acridity of the milky juice. The species earliest described and figured appears to be *L. cardinalis*, L., under the name *Trachelium americanum sive cardinalis planta*, "the rich crimson cardinal's flower;" Parkinson (*Paradisus*, 1629, p. 356) says, "it groweth nere the riuer of Canada, where the French plantation in America is seated;" De Candolle records it from New England to Carolina (*Prod.*, vii. 382). This species, as well as several others, are in cultivation as ornamental garden plants, *e. g.*, the dwarf blue, *E. Erinus*, L., from the Cape, which, with its varieties, forms a familiar bedding plant. *L. splendens*, Willd., and *L. fulgens*, Willd., growing from 2 to 4 feet high, from Mexico, have scarlet flowers; while *L. amœna*, Mich., from North America, as well as *L. syphilitica*, L., and its hybrids, from Virginia, have blue flowers. The last-named was introduced in 1665, according to Paxton (*Bot. Dict.*, p. 340), but is not mentioned by Parkinson. Certain species of lobelia are used medicinally, the chief being *L. inflata*, L., a native of north-eastern America, called "Indian tobacco," as its effects are very similar to those of tobacco; for its localities, etc., see Pickering, *Chron. Hist. of Pl.*, p. 1015. It is expectorant and diaphoretic in small doses, but in full medicinal doses is nauseating and emetic. It is used for spasmodic asthma, and as an adjunct to diuretics. See Bentley and Trimen's *Med. Pl.*, No. 162; *Pharmacographia*, p. 357; and Pereira's *Mat. Med.*, vol. ii. pt. ii. p. 8. For active principles, see *Pharm. Journ.*, vol. x. pp. 270, 456. Another medicinal species is *L. syphilitica*, L., the blue cardinal, of which the root is used by the North American Indians for the purpose implied in the specific name. The value, however, is said to have no foundation in fact (Pearson, *Obs. on var. Art. of Mat. Med.*, p. 70), but see *Amer. Dispens.*, p. 494. A third species is *L. decurrens*, Cav., from near Arequipa in Peru, where the Indians use it as an emetic (*Pharm. Journ.* [1], vol. xiii. p. 14).

LOBO, IERONIMO (1593–1678), a Jesuit missionary, was born in Lisbon in 1593, and entered the Order of Jesus at the age of sixteen. In 1621 he was ordered to repair as a missionary to India, and in 1622 he arrived at Goa. With the intention of proceeding to Abyssinia as a missionary, he left India in 1624, but after disembarking on the coast of Mombas, and attempting to reach his destination by land, through the Galla country, was forced to return. Repeating the attempt in the ensuing year, in concert with Mendez, the newly-appointed patriarch of Ethiopia, and eight missionaries, Lobo landed on the coast of the Red Sea, and settled down in Abyssinia as superintendent of the missions in the state of Tigre, travelling about a good deal over the country, and thus obtaining much valuable information on its geography and people. He remained at his post for some years, until death deprived the Catholics of their protector, the emperor Segued. Forced by persecution to leave the kingdom, in 1634 Lobo fell, along with his companions, into the hands of the Turks at Massowah, and was sent by them to India to procure a ransom for his imprisoned fellow-missionaries. This object he gained, and at the same time he endeavored, though without avail, to persuade the Portuguese viceroy to send an armament against Abyssinia. Intent upon accomplishing this cherished project, he embarked for Portugal, and after he had been shipwrecked on the coast of Natal, and captured by pirates, arrived at Lisbon. Neither at this city, however, nor at Madrid and Rome, was any countenance given to Lobo's plan for Christianizing Abyssinia by the aid of arms. He accordingly returned to India in 1640, and was elected rector, and afterwards provincial, of the Jesuits at Goa. After some years he returned to his native city, and died there January 29, 1678.

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[1] [A Fleming (1538-1616), who did his best work in London and Denmark.—AM. ED.]

Lobo wrote an account of his travels in Portuguese, which appears never to have been printed, but is deposited in the monastery of St. Roque, Lisbon. Balthezar Telles made large use of the information therein in his *Historia Geral da Etiopia Alta* (Coimbra, 1660), which is often erroneously attributed to Lobo (see Machado's *Bibliotheca Lusitana*). Lobo's own narrative was translated from a MS. copy into French, under the title of *Voyage Historique de Abissinie*, by the Abbé Legrand, Paris, 1728. In 1669 a translation by Sir Peter Wyche of several passages from a MS. account of Lobo's travels was published by the Royal Society, and this was translated into Thenevot's *Relation des Voyages* in 1673. An English abridgment of Legrand's edition by Dr. Johnson was published in 1735, and reprinted in 1789. In a *Mémoire justicatif en rehabilitation des Pierre Paes et Jerome Lobo*, Dr. C. T. Beke maintains the accuracy of Lobo's statements as to the source of the Abai branch of the Nile against Bruce.

LOBSTER. See CRUSTACEA, and FISHERIES, vol. ix. p. 231.

LOCK—not being a canal lock—means the fastening of a door, or box, or drawer, which requires a key, or else some secret contrivance or manipulation, to open it. It is generally fixed to the door, but it may also be loose, and then it is called a padlock, which is internally like other locks, but externally has a half link or *bow* turning on a hinge at one end, while the other, after being put through a chain or staple on the door, enters the lock and is fastened by the bolt therein.

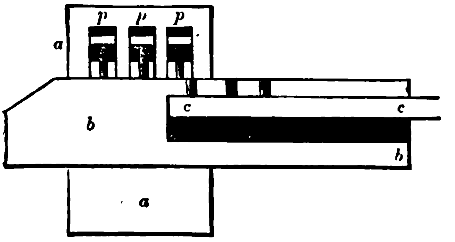

Fig. 1.

The bolt may be moved by the key, or may close by a spring, but requires a key to open it, as in the case of handcuffs, which are a pair of padlocks of this kind united by a short chain. A common door lock also comprises a spring latch which opens by a handle, and sometimes a small bolt held by friction either shut or open, which is moved by a smaller handle inside the room only; but neither of these is the lock proper, any more than a hook or a button, or a common lifting latch. Therefore, omitting them, a lock is as defined above.

The earliest lock of which the construction is known is the Egyptian, which was used four thousand years ago. In fig. 1, *aa* is the body of the lock, *bb* the bolt, and *cc* the key. The three pins, *p*, *p*, *p* drop into three holes in the bolt when it is pushed in, and so hold it fast; and they are raised again by putting in the key through the large hole in the bolt and raising it a little, so that the pins in the key push the locking pins up out of the way of the bolt. The security of this is very small, as it is easy enough to find the places of the pins by pushing in a bit of wood covered with clay or tallow, on which the holes will mark themselves; and the depth can easily be got by trial.

Mr. Chubb, the well-known lock-maker, used to show a wooden Chinese lock very superior to the Egyptian, and, in fact, founded on exactly the same principle as the Bramah lock, which long enjoyed the reputation of being the most secure lock ever invented; for it has sliders or tumblers of different lengths, and cannot be opened unless they are all raised to the proper heights, and no higher. Until about a century ago no lock so good as this was known in England. The locks then in use (fig. 2) were nothing better than a mere bolt, held in its place, either shut or open, by a spring *b*, which pressed it down, and so held it at either one end or the other of the convex notch *aa;* and the only impediment to opening it was the wards which the key had to pass before it could turn in the keyhole. But it was always possible to find the shape of the wards by merely putting in a blank key covered with wax, and pressing it against them; and when this had been done, it was by no means necessary to cut out the key into the complicated form of the wards (such as fig. 3), because no part of that key does any work except the edge *bc* farthest from the pipe *a;* and so a key of the form fig. 4 will do just as well; and a small collection of skeleton keys, as they are called, of a few different patterns, were all the stock in trade that a lock-picker required.

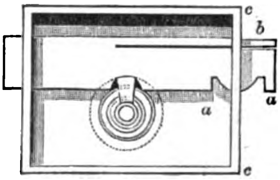

Fig. 2.

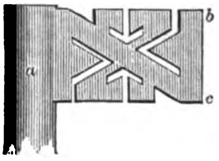

Fig. 3.

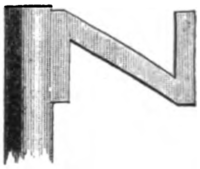

Fig. 4.

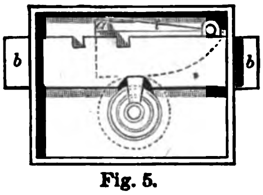

Fig. 5.

The common single-tumbler lock (fig. 5) was rather better than this, as it requires two operations instead of one to open it. The tumbler *at* turns on a pivot at *t*, and has a square pin at *a*, which drops into a notch in the bolt *bb*, when it is either quite open or quite shut, and the tumbler must be lifted by the key before the bolt can be moved again. But this also is very easy, unless the lock is so made that the tumbler will go into another notch in the bolt if it is lifted too high, as in the lock

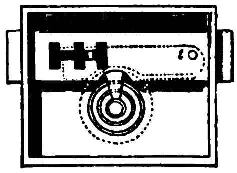

Fig. 6.

we shall now describe, which was the foundation of all the modern improvements in lock-making.

Barron's Lock.—This was the first lock with several tumblers. It was patented in 1778. Fig. 6 is a front view, and fig. 7 a horizontal section. First consider it with reference to one tumbler *at* only. Unless the square pin *a* is lifted by the key to the proper height, and no higher, the bolt cannot move, and that alone adds very considerably to the difficulty of picking, except by a method not discovered for many years after. But Barron added another tumbler, and unless both were raised at once to the proper height, and no higher, the lock could not be opened. The face, or working edge, of the key of a many-tumblered lock assumes this form (fig. 8), the steps corresponding to the different heights to which the tumblers have to be raised, and one of them acting on the bolt, and they may have a much wider range of difference than in this figure. The key here drawn is also one with the wards of such a shape that no skeleton except itself can pass them. The form, however, can be got in the usual way by a wax impression; and as it weakens the key very much, and is expensive to cut, it is not often used.

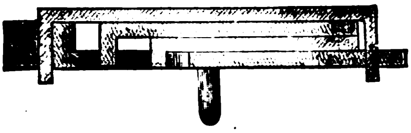

Fig. 7.

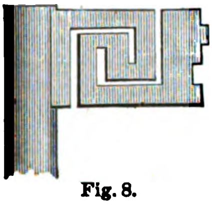

Fig. 8.

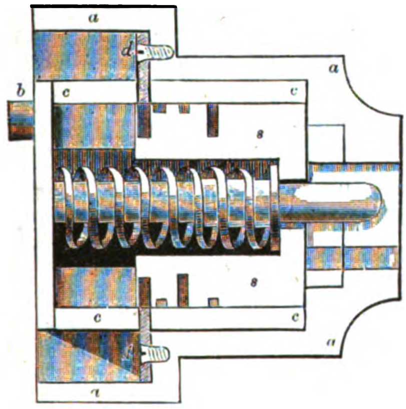

Fig. 9.

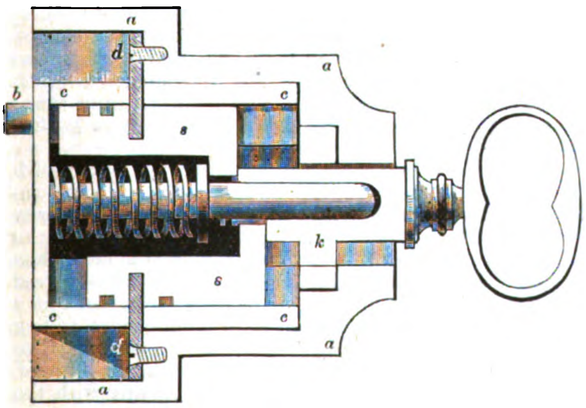

Fig. 10.

Bramah's Lock.—The next lock of any importance was the celebrated one patented ten years after Barron's, by Joseph Bramah (see BRAMAH). In figs. 9 and 10 *aaaa* is the outer barrel of the lock, which is screwed to, or cast with, the plate; *ccc* is a cylinder, or inner barrel, turning within the other. It is shown separately at fig. 11; and fig. 12 is a cross section of it, the black ring being the keyhole, and the light spot in the middle the drill-pin, which goes into the key. The short pin *b* in figs. 9, 10, 11 is set in the end of the cylinder, near its edge; and, when the cylinder turns round, that pin shoots or draws the bolt, by acting in a slit of the form shown in fig. 13. The security of the lock depends upon a number of slides, *s*, *s*, of which the shape is shown in fig. 14, and the cross section in fig. 12. They are made of plates of steel doubled, and sprung open a little, so as to make them move with a little friction in the slits of the cylinder or revolving barrel in which they lie, and are pressed up against the cap of the lock by a spiral spring. They are shown so pressed up in fig. 9, and pressed down by the key in fig. 10. There is a deep groove cut round the barrel, and in each of the sliders there is a deep notch which can be pushed down to that place in the barrel by a key slit to the proper depth; and it is evident that when all the sliders are pushed down to that position the barrel will present the appearance of having no sliders on it. A steel plate (fig. 15), made in two pieces in order to get it on, embraces the barrel at the place where the groove is, having notches in it corresponding to the sliders, and is fixed to the body of the lock by two screws marked *d*, *d* in figs. 9, 10, and 15. When the sliders are pushed up by the spring they fill the notches in the plate, and prevent the barrel from turning; but when they are pushed down by the key the notches in the sliders all lie in the plane of the plate, and so the barrel can turn with the key, and the pin *b* in the end of it drives the bolt as before described.

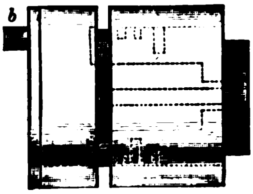

Fig. 11.

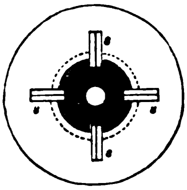

Fig. 12.

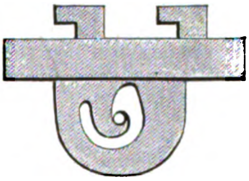

Fig. 13.

The key has a bit, *k*, sticking out from the pipe, the use of which is to fix the depth to which it is to be pushed in, and then, as the bit slips under the cap of the lock, it keeps the key at the same depth while it is being turned.

This was the construction of the lock for a good many years, and Bramah pronounced it in that state "not to be within the range of art to produce a key, or other instrument, by which a lock on this principle can be opened." It was found, however, long before the defeat of the improved challenge Bramah lock by Mr. Hobbs in 1851, that the inventor had made the common mistake of pronouncing that to be impossible which he only did not see how to do himself. As it has been generally supposed that what is called the tentative method of lock-picking was unknown in England before it came over from America in the year of the Exhibition of 1851, we must remind our readers that it was described in the 7th edition of this work fifty years ago, though the lock-picking fraternity were not of sufficiently literary habits to make themselves acquainted with it. Mr. Hobbs, it is true, carried the process further than had been supposed possible before; but all the Barron and Chubb and other many-tumblered locks, which were supposed impregnable, might long ago have been opened by anybody who had paid attention to the method by which the Bramah locks were known to have been picked some seventy years ago, before the introduction of the false notches designed in 1817 by Mr. Russell, then one of Mr. Bramah's workmen. If you apply backward pressure to the bolt of a tumbler lock when locked, or twisting pressure to the barrel of a Bramah lock, first pressing down the spiral spring, there will be a greater pressure felt against some of the tumblers or sliders than against others, in consequence of inevitable inequalities of workmanship; and if you keep the pressure up, and gently move any of the tumblers or sliders on which the pressure is felt, you will at last get it to some point where it feels loose. That may or may not be the exact place to which the key ought to lift it; but as soon as you feel it loose leave it alone, it will not fall again, as the friction is sufficient to prevent it; and, if necessary, you may fix it there by a proper instrument, or measure the depth and keep the measure till you begin again. Then try another tumbler which feels tight, and raise it till it also feels loose. And if you go on in that way, always leaving the loose tumblers alone, and raising the one which feels tight, they will at last all be got into the position of complete freedom, *i. e.*, to the place where the stump of the bolt can pass them. The operation is just the same in principle in the Bramah lock and in tumbler locks; only, as all the sliders are acted on by one spring in the Bramah as now made, you need only just push down that spring, and hold it there, and then the sliders may be moved freely either way by means of a hook or a small pair of self-acting forceps to pull them up if they accidentally get pushed too far. At first each slider had a separate spring.

But if the sliders have some false notches in them not so deep as the true ones (see fig. 14), and the corners of the notches in the plate *dd* are cut out a little (as in fig. 15), then you might by trial get all the sliders into such a position that the barrel could turn a very little, but no more; and when it is turned that little, you cannot push the sliders in any further, and so (as was long supposed) the tentative process is defeated; and undoubtedly it is made much more troublesome, but it only requires more time and patience. You can still feel that the pressure is greater against some one or more of the tumblers or sliders than against others, and wherever that is the case, you know that it must be a false notch, and not the true one, for a true one gives no pressure at all. Proceeding in this way, Mr. Hobbs opened the challenge lock with eighteen sliders, or guards, which had hung in Messrs. Bramah's window for many years, in nineteen hours, and would have done it sooner, but that one of his instruments broke in the lock. He afterwards repeated the operation three times within the hour, in the presence of the arbitrators; and a more recent one with eight sliders he opened in four minutes, by means of an instrument which is equivalent to a Bramah key with adjustable slits, which are set to the sliders as the operation of feeling them and getting their depths goes on. It is, moreover, to be remembered that thieves do not always confine themselves to the conditions of a challenge, in which force and injury to the lock are of course prohibited; and, if a lock can be easily opened by tearing out its entrails, it is of very little use to say that it would have defied all the arts of polite lock-picking. In this respect the Bramah lock is singularly deficient; for if the exposed cap or nozzle of the keyhole is cut off, as it easily may be, or if the hole is widened out by a centre-bit, the sliders can all be pulled out, and there is an end of the lock.

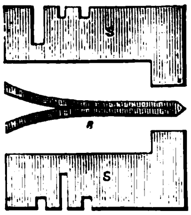

Fig. 14.

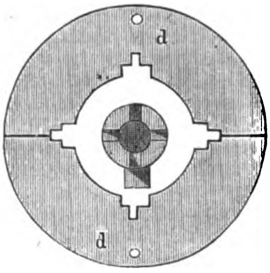

Fig. 15.

Inside and Outside Locks.—Locks for drawers, closets, iron chests, and the like are only required to lock on one side, and their keys are therefore generally made with a pipe, which slips on to a pin in the lock called the drill-pin, and turns on it. Doors which have to be locked sometimes on one side and sometimes on the other cannot have their keys made in this way; the key is solid, and its plug or stem, being thicker than the flat part or web, acts as an axis fitting into the upper part of the keyhole, though that hole does not completely enclose it. All keys for these inside and outside locks must be symmetrical or alike on each side of a line through their middle, in order to fit the lock either way, which limits the variety of the tumblers in the case of many-tumblered locks. A Bramah lock, to open on both sides, must be made double, with one set of sliders to push in from one side of the door, and the other set from the other side; and, consequently, they are very seldom used for this purpose. It may be convenient to observe that when we use the term Bramah lock we mean a lock of that construction; for, the patent having long ago expired, such locks may be made by anybody, only Bramah's name must not be used. Messrs. Mordan's locks are the same as Bramah's, except that they make the number of sliders odd, while Messrs. Bramah make it even.

Letter Locks.—At one time it used to be supposed that locks which could only be opened by setting a number of rings or disks to a particular combination of letters could not possibly be opened by anybody who was not in possession of the secret; and hence they were also called puzzle-locks. At first they were made with a fixed combination, which could not be changed. Afterwards the rings were made double, the inner one having the notch in it which the bolt had to pass, and the outer one capable of being fitted on to the inner in any position, by unscrewing some part of the lock, so that you might set them to any combination desired. This was the first instance of a changeable lock, of which we shall have more to say further on. But it was afterwards found that these puzzle-locks have just the same vulnerable point as all our locks had until lately, viz., that the pressure of the bolt can be felt on some of the rings more than on the others; and Mr. Hobbs says emphatically, in the *Rudimentary Treatise on Locks*, "wherever that is the case, that lock can be picked." Apart from this defect, these locks have very much gone out of use on account of their being troublesome to handle, and perhaps also from the risk of forgetting the combination to which the lock was set last, if it has been left for some time; and therefore we do not think it necessary to go farther into the details of their construction.

Chubb's Locks.—Of the multitude of locks which have been made on the many-tumbler principle invented by Barron, none enjoyed so much celebrity before Hobbs's as Chubb's. This was partly due to superior workmanship and use of more tumblers than usual, and perhaps still more to the inventor having had the good fortune to hit upon the name "detector" for a certain part of the machinery, which, besides adding to the security against any mode of picking then known, also captivated the public with the idea of discovering if anybody had been tampering with the lock, though the operator might depart in ignorance that he had left any trace of his attempt behind him. It is remarkable that the detector was not even then a new invention; for a lock exactly the same in principle, but slightly different in arrangement, had been previously made by a Mr. Ruxton, and is described in Price's treatise on *Locks and Keys*, etc., 1856. In the same way false notches were used in Strutt's tumbler lock above thirty years before they were reinvented, by Chubb and others, with the idea of defeating the tentative method of picking by them. In all lever or tumbler locks there is a square pin B, called the stump, riveted to the bolt, which has to clear the passage in the tumblers called the gating. The original form of Chubb's detector is shown in fig. 16 by the lever DT, which turns on a pin in the middle, and is acted upon at its end T by a spring S, which will evidently allow some play to the lever on either side of the corner X, but the moment it is pushed past that point the spring will carry it further in the same direction, like what is called in clock-work a jumper. In its proper position that end always remains above the turning point; but, if any one of the tumblers is raised too high, the other end D of the detector, which reaches over all the tumblers, is lifted so far that the end T is sent down below the corner, and the tooth T then falls into a notch in the bolt, and so prevents it from being drawn back, even though all the tumblers are raised properly by the right key, which at once reveals that somebody has been trying to pick the lock. The way to open it then is to turn the key the other way, as if to overlock the bolt; you observe a short piece of gating near the end of the tumblers, to allow the bolt to advance just far enough to push the tooth of the detector up again by means of its inclination there, and then the lock can be opened as usual. In some more recent locks the tumbler is made in another form. The back tumbler, or the one which has to be raised highest, has a pin *d* reaching over all the others, and if any of them are overlifted that back tumbler is also, and then a square corner *k* in it gets past the end of the detector spring *ks*, and is held up. It is set right by overlocking the bolt as before, the bolt itself raising the end *k* of the spring, and letting the tumbler fall. This form of detector is, however, inferior to the other, as it informs the picker what he has done, by the back tumbler itself being held up, which he can feel directly.

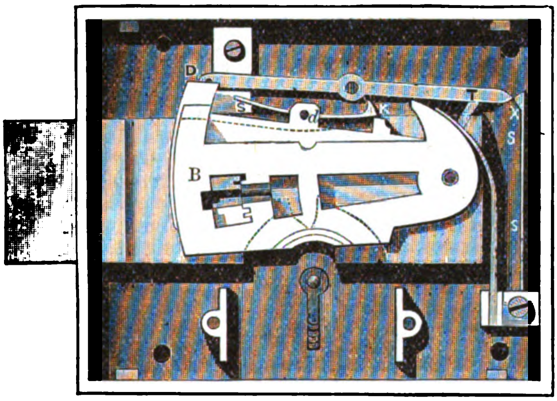

Fig. 16.

But since Mr. Hobbs's mode of picking locks became known all these detectors have become useless. Some persons have even gone so far as to say that the detector may be made a guide to picking. Whether this be so or not, the detector does not act unless some of the tumblers are raised too high, which they never are by a skilful operator on this plan, nor does it act (even if thrown by accident) against picking backwards, or feeling the way to shoot the bolt a little further, as if to free the detector; and in this way the measure of the key can be taken without any hindrance from the detector. Before 1851 tumbler locks were seldom made with false notches, except Strutt's, in which the tumblers were in the form of quadrants, with a very large angular motion, and a number of short or false notches and one deep one. But after that year Chubb and other makers of tumbler locks adopted false notches, together with revolving curtains, which cover the straight part of the keyhole as soon as the key is turned, and barrels going down from the back of the curtain to prevent a false key or pick from turning without turning the curtain; other obstacles were added, of which the object is in all cases to prevent the maintaining of pressure of the stump upon the tumblers at the same time that the tumblers themselves are moved, or, as Mr. Hobbs called it, tickled, by some other instrument. These provisions undoubtedly make the locks more difficult to pick, but it is by no means safe to assume that a lock will never be picked merely because it would take a first-rate hand a long time to do it or gradually make his key.

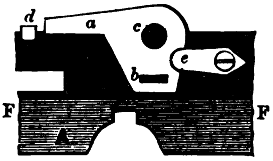

Fig. 17.

Hobbs's Lock.—The invention which most directly meets the defect of all previous locks is Mr. Hobbs's "movable stump," which is not riveted into the bolt as usual, but is set on the end *b* of a bent lever *abc* (fig. 17) which lies in a hollow of the bolt A behind it, turning on a pivot in the bolt itself, and kept steady by a small friction-spring *e*. The stump comes through a hole in the bolt large enough to let it have a little play; and the long end *a* of the lever stands just above the edge of a square pin *d*, which is fixed in the back plate of the lock. When the lock is locked, if you push the bolt back, you produce no sensible pressure on the tumblers, but only just enough to turn this protector lever, as Mr. Hobbs calls it, on its pivot *c*, and so bring down its end *a* in front of the square pin, and then the bolt can no more be pushed back than when held by Chubb's detector. The protector is set free again by merely pushing the bolt forward with the key, without reference to the tumblers. It was found, however, that in this state the protector could be prevented from acting by a method used by the inventor himself for another purpose, viz., pushing a piece of watch-spring through the keyhole, and up behind the bolt, so as to reach the protector at *a*, and keep it up while you push the bolt back, or, again, by pushing up the watch-spring between any two of the tumblers, and holding the end *b* of the protector with it, so as to press the stump against the tumblers. Both these devices, however, are prevented now by letting in a feather FF in a groove between the bolt and the back of the lock, which no watch-spring can pass, and also bringing a piece of the feather forward through the front gating of the tumblers just under the stump. In this form the lock is safe against any mode of picking at present known, unless the keyhole happens to be large enough to admit the inspecting method, which is this. A person intending to pick the lock goes beforehand and smokes the bellies, or lower edges of the tumblers, through the keyhole. When the key comes, it wipes off the black on each tumbler, according to the length of the bit which raises it; and then, when the picker returns, he throws a strong light into the keyhole, and, by means of a narrow reflector put into it, reads off, as it were, the length of bit required to raise each tumbler to the proper height. This operation may sound impossible; but it is an established method of lock-picking in America. It requires a largish keyhole, however, and it may be prevented by any kind of revolving cylinder which will conceal the view of the tumblers while the keyhole is open. The inspecting method might also be frustrated by making the acting part of the bellies of all the tumblers no longer than would be reached by the shortest bit in the key. In that case, the long bits would not begin to act at their points, but on their sides, and would leave no measure of their length upon the tumblers.

A multitude of other many-tumbler locks acted on by springs, and with various kinds of detectors and revolving curtains, all more or less upon the same principles, may be seen described in Price's book above mentioned, but we are not aware that any of them have ever come into general use, or are superior to Chubb's or equal to Hobbs's protector locks. There is another group of locks which involve fanciful and thick ugly keys, and for that or other reasons have not got much beyond patents and exhibitions. "Revolving curtains" have been proved to be less serious impediments to picking than they would seem, inasmuch as they must leave room for an instrument no thicker than the key itself to turn. The only kind of curtain that is not open to this objection must be one that absolutely prevents any touching of the bolt while any instrument at all is within the lock, and projects at all outside. Mr. Hobbs accomplished that by the odd-looking contrivance of a key consisting only of its web, or flat or acting part, which is pushed into the lock, and then carried round by a fixed handle in another place, which closes the keyhole until it has come round again and delivered the key-web ready to be taken out by a proper hook. But this was too troublesome for common use. The same object is effected in another way by Sir E. Beckett's lock, which we shall presently describe.

Tucker's Locks.—There have been several locks on the disk principle invented in succession by Mr. Tucker of Fleet Street, London, the first two of which had revolving disks; and in the last and more simple one, patented in 1855, though the disks no longer revolve, they slide between fixed plates without springs, and do not turn on a pin like common tumblers, and will stand indifferently anywhere. It will be sufficient to describe the last of these inventions, as Mr. Tucker himself states it to possess all the elements of security of the former ones, with the advantages of being much cheaper, because more simple in construction. In fig. 18 TT is one of the sliders, which are separated by thin fixed plates, and slide upon the guide-pins at TT, and have also friction-springs X pressing on them to keep them steady. S is the bolt stump, which can only enter I, the gating of the tumblers, when they are pushed the proper distance towards the left, which the key will do as soon as it turns towards the left, in the usual way of unlocking. But something else still prevents the bolt from falling, and that is the flat curtain C, which turns with the key, and has also a barrel B, as in several of the other locks we have spoken of. This curtain prevents the stump from being pressed against the tumblers, being just big enough to keep it from touching them until it has turned nearly three-quarters round, when the pin S, which stands up on the stump, can enter the opening D in the curtain (shown by a dotted line in the drawing, to prevent confusion). But by the time the curtain has got so far round, any instrument in the keyhole would be prevented by the barrel from reaching the tumblers so as to push them back and feel the pressure of the stump; at least so the inventor asserts, and we do not venture to contradict him; but it must be remembered that no revolving curtain and barrel have yet been able to prevent the instruments of the American lock-pickers from reaching and moving the tumblers at the same time that the barrel is being pressed the other way in order to keep up pressure on the bolt.

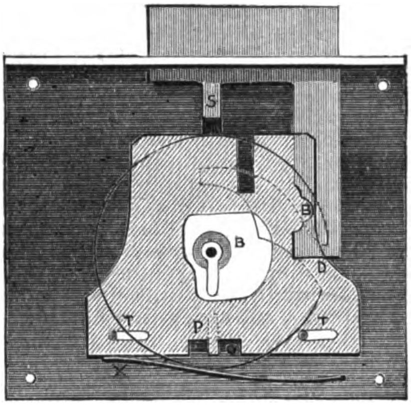

Fig. 18.

We have not yet explained how the bolt in this lock is drawn back when the curtain has got into the proper position for it. It is not done by the last bit in the key acting directly on the bolt as usual, but by a bit P fixed on the curtain itself, which acts upon the notch B in the bolt, as the key usually does. And this same bit P performs another function in locking, viz., shooting all the tumblers into the position here shown by striking against a pin which is set in the bottom one, and comes up to the curtain, and so carries all the others with it by means of the square notch which is cut in all of them, except the one which has the pin in it. It must be observed that the curtain does not lie close upon the tumblers, but there is the thickness of the bolt, or of the bit P, between them. A spring locks into the curtain and prevents it from being turned, except when this spring is pressed down by putting a key into the keyhole. One object of making the curtain, and not the key, to lock and unlock the bolt is that you guard against the risk of what is called short-locking, *i. e.*, sending the bolt in any common tumbler-lock not quite far enough for the tumblers to drop. There are means by which a person intending afterwards to pick a lock might cause it to lock short, if he had previous access to it, or possession of the key, at least as locks are generally made, and then, of course, he has only to pull the bolt back, the tumblers having never fallen. Moreover, this arrangement in Tucker's lock allows it to be locked by any key that will turn in the keyhole, though it cannot be unlocked by any but the true key, or one which will move all the tumblers to the right place for the stump to enter them. Mr. Tucker has also applied the curtain in his padlocks in such a way that the shackle has a tail reaching inwards and resting against the curtain at all times, except when it is in the proper position for opening, *i. e.*, when this tail is opposite to a segment cut out of the curtain corresponding to the opening D in the lock just now described, but much larger. The object of this is to obtain greater strength than usual to resist all attempts to force the shackle open. The cheapness of these locks is due to the circumstance that all the principal parts can be stamped out of sheet brass, the curtain alone being cast with the barrel and bit P on it, and its face turned, which is a cheaper operation than filing. In this respect it approaches to Mr. Hobbs's style of lock-making; only he has carried the stamping and machine-finishing system much further; indeed, it is hardly exaggerating to say that he has abolished the use of the file, and left nothing to hand labor except the mere fitting of the pieces together, and putting the tumblers in the right position to have the gating cut according to the key.

Nettlefold's Bolt.—We have already alluded to padlocks, and we shall do so no farther, because they are generally of exactly the same internal construction as other locks of the same maker. And, for the same reason, it is unnecessary to describe the various modifications of the fastening part of locks to adapt them to peculiar uses or positions; but there is one which does seem to be worth a short notice, viz., an invention of Mr. Nettlefold, patented in 1839, for making the bolt hook into the striking plate, against which it locks. Fig. 19 will explain the nature of the contrivance at once. We have inserted no tumblers, because it may be used with one kind of lock as well as another. It is convenient for writing-desks, sliding cupboards, and even for drawers, which can often be prized open by merely putting in a screw-

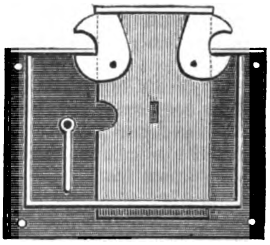
Fig. 19.

driver above the lock, and forcing up the piece over it just enough to let the bolt, which is generally short, pass. There are other ways of doing the same thing, such as making the bolt itself hooked, and giving it two motions, first vertical, to shoot it out, and then horizontal, to hook it into the striking plate; and some Bramah locks are made with a kind of annular bolt, which forms a rim to the cylinder, with a segment cut off in one place to let the striking plate come down, which is then taken hold of by the other part of the ring as it revolves. Bramah locks of portfolios, and articles of that kind, are usually made in this way, which is very cheap and simple.

Master-Keys.—It is often convenient to have a set of locks so arranged that the key of one will open none of the others, and yet the owner of the whole may have one master-key that will open them all. In the old locks with fixed wards this was done by making the wards of a slightly different form, and yet such that one skeleton will pass them all, just as the skeleton-key in fig. 4 will serve for the warded key of fig. 3, and a multitude of others. In locks with sliders or tumblers, the way is to make one tumbler in each lock with a wider gating, so as not to require lifting so high as it does in the other locks of the set; then the key of that lock will raise that tumbler in that lock high enough to clear the stump, and yet the master-key, which has a longer bit in that place, will not raise it too high, because the gating is wide enough for both; but the special key of that lock will not open any other of the set which has not the same tumbler widened in the gating. Mr. Chubb, many years ago, made a set of locks for the Westminster Bridewell, with keys for the different grades of officers. The owner of the head key can stop out any of the under keys; and if any attempt is made to pick any lock, and the detector is thrown, it cannot be released by any of the subordinate keys, though they can open the lock in its normal state, and consequently the governor must be acquainted with it. There are a variety of other forms of many-tumblered locks, but none of them involve any novelty in principle, and they are all capable of being dealt with in the same way; and therefore we shall at once pass on to another class of locks, viz., those which shut of themselves, and are called—

Spring or Latch Locks.—These locks we chiefly notice because they require a particular provision to make them in the smallest degree secure, and are, nevertheless, often left without it, by way of saving a shilling or two in their price, and multitudes of street-door robberies are committed in consequence. The former of these two names is generally used for a lock which shuts of itself on a box or drawer, or articles of that kind; and the latter for street or room-door locks which shut of themselves, and open with a handle on the inside, but only with a key on the outside. In the simplest and cheapest form of these locks there is no pretence of any security except a few fixed wards, which the key has to pass; and, as before explained, that is no security at all against anybody with the smallest dexterity, and with a serious intention of opening the lock. Next to them, or rather below them, pretending to be what they are not, come the locks which lock a certain distance themselves by means of a spring, but can be locked further by the key, and have tumblers, but no fixed wards (which a good tumbler-lock does not require). But though this kind of lock cannot be opened when it is thus double locked, except by the key, or some efficient mode of picking, yet when they are only self-locked the tumblers are of no more use than if they did not exist, and the lock can be opened by any bit of bent wire that will go into the keyhole. It should be remarked, however, that the Bramah lock is just as secure as usual when used for a spring or latch lock, because the key cannot turn at all without pushing in the sliders properly. But in this, as in all latch-locks, it is very unsafe to have a handle which pulls back, as it can easily be reached by a wire put through a hole in the door; the handle should always be made to turn, like a common room-door handle.

There are two ways in which spring-locks with tumblers are made as safe as the same lock with an ordinary bolt. One is to make a click or catch fall into the bolt when it is drawn back, and not to make the tumblers to fall when the bolt is drawn back; in the shutting of the door this catch is pushed back by some knob projecting for the purpose, and then the tumblers fall and hold it fast. Prison locks are made in that way. But this will not do for a latch-lock which is intended to open by a handle on one side of the door. For that purpose the proper plan is that which is now adopted in all good latch and spring locks, not to let the key act directly on the bolt, which has no stump, but on the false bolt which lies on the top of the real one, and has the stump fixed in it. When the real bolt is shut by the spring it carries the false one with it, and that is then locked by the tumblers. But the real bolt can be pushed back by the door shutting, or pulled back by the handle, without moving the false bolt, though it cannot be reached through the keyhole. In buying a lock, the test of this is to see whether the stump moves as you push or pull the bolt back. If it does, the lock is good for nothing, unless it is on some other peculiar construction.

Latches and Latch Locks.—The latter of these, so called by Mr. Chubb, is substantially on the principle just now described, and so is Hobbs's and Hart's latch lock, which also has the protector stump, and therefore is as unpickable as their other locks provided neither the handle nor the bolt can be got at. Chubb's latch (not his latch-lock) consists only of four tumblers, which come out and form the bolt, and fit between a sort of mouth in the striking-plate on the door post, and have all to be lifted to the same height by the key; but that can easily be picked by the tentative method, though it might delay a common street thief for an inconvenient time.

Spring Curtain.—All latch locks for street doors are liable to stick fast through dirt getting between the tumblers, especially in a smoky town. They will keep clean much longer if the keyhole is protected by Sir E. Beckett's self-acting spring curtain, which can be added to any lock which is worth it. It consists only of a small thin steel plate, sliding on the key-pin, and another pin just below the keyhole to guide it, with a slight spring behind, for which there is room in any latch lock with a sliding locking plate over the bolt. They are not patented, and the cost is quite insignificant, and it is odd they are not more commonly insisted on by purchasers.

Safe Locks with Small Keys.—In all the locks we have yet mentioned the bolt is acted on by the key, even though the key may not touch it; the key must therefore be strong enough to move the bolt besides lifting the tumblers, or whatever is substituted for them, and this makes the key for a large lock too large and heavy to be conveniently carried in the pocket, and a bunch of such keys impossible. To get over this difficulty, most of the makers of iron safes have adopted the plan (we do not know by whom invented) of shooting a large bolt, or a number of bolts, by means of a handle, and then a small lock with a small key locks into one of them, and thus fastens them all. The security then depends upon the impregnability of the small lock against fraudulent picking or forcible evisceration. There are certain thieves' instruments by which a force sufficient to tear open the inside of a lock can be inserted through a keyhole of the common size. This, however, is now defeated by cutting out a piece of the back plate, and then screwing it on again with only a few small screws; and so that alone gives way under any bursting pressure, whether from the instrument called the jack-in-the-box, or from gunpowder, which is another of the thieves' methods for cutting the knot which they cannot untie. If the small lock, therefore, cannot be picked, or forced, this mode of locking the bolts of a large door is quite safe, and you have the advantage of a very powerful lock with nothing to carry in your pocket larger than a small desk key.

Sir E. Beckett's Lock.—A lock was invented by Sir Edmund Beckett (formerly Denison) in 1852, but not patented, which combines the advantages of large and strong works with a keyhole so narrow that no instrument strong enough to injure the lock could be got in, nor a reflector to observe the bellies of the tumblers; and the bolt is not only shot by turning the handle, but locked besides, without using any key at all. This lock enjoys the distinction of being the only one of English invention which was pronounced secure against any known method of picking by Messrs Hobbs and Tomlinson, in the treatise before referred to.

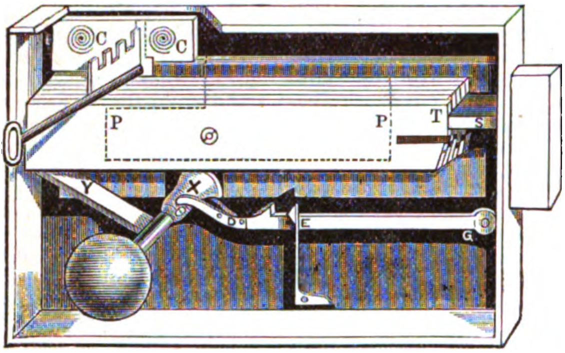

Fig. 20.

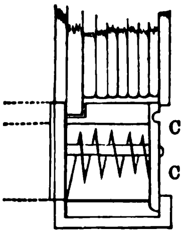

Fig. 21.

In figure 20 are shown the tumblers T, turning on a pin at or near the middle of their length, so as to be nearly balanced, though in small locks this is unnecessary. Between every two adjacent tumblers, and between the bolt and the tumbler next to it, there is a thin steel plate, which occupies the position shown by the dotted lines PP. These plates have one edge lying against the upper side of the lock, so that they cannot turn at all on the tumbler-pin, which goes through them quite loosely. One or two of the plates should be bent a little to make them act as friction springs on the tumblers when the cap of the lock is on, so that they will stand indifferently in any position. In the figure they are drawn all pressed down, so as to prevent the stump S from entering the gating, and this has been done by the long tail Y of the handle, which, it is easy to see, will raise the left end of the tumblers, and depress the right, after the fan-tailed piece X of the handle has shot the bolt. After the tumblers have been raised to the proper height by turning the key half round (where it may be stopped by the plates P, P), the stump can enter the gatings, and the bolt can be drawn back by the handle, the tail Y then doing nothing. So far as we have yet gone, the lock would possess no greater security than any other many-tumblered lock; but there is a steel curtain CC, which does not revolve as usual, but slides on two pins sets in the back of the lock, and is pressed up against the front plate by two spiral springs, so as to close the keyhole completely, except when it is pressed in. From the back of the curtain there goes a kind of square plug (shown in section at fig. 21), which can be pushed through a hole in the back plate, and has a notch in it just in the plane of the bolt, and the bolt itself has a corner there; in this way, when the curtain is up, the bolt can be drawn back through the notch in the curtain plug; but when the plug is pushed in ever so little the bolt cannot be drawn back, because its corner cannot pass the curtain plug, and in this position the stump cannot be made to touch the tumblers, except one of them, which is made a little longer than the rest (as shown at T in fig. 20), in order to keep the bolt steady. It is evident then that as soon as the curtain is pushed in, to admit any instrument whatever, the bolt is held fast, and it becomes impossible to put any pressure of the stump upon the tumblers; in other words, the tentative mode of picking is impossible. In small locks the curtain has no plug, but merely works against the edge of a second stump of the bolt, which can only pass when the curtain is up, and it slides on the drill-pin and another pin below it.

The security of the lock is farther increased by the addition (DEG) of what may be called a detector, as it does detect if the bolt has not been shot far enough by the person who locked it, and, what is of more consequence, prevents it from being opened in that state. It turns on a hinge or pin at G, and is held up or down by a jumper-spring at E, as in Chubb's first detector. In fig. 20 it is shown as held down, or out of the way of the bolt; but, as the handle turns back again and draws back the bolt, the pin below X raises the detector a little, and then the spring is ready to throw its tooth into the notch in the bolt as soon as it is shot only about half-way. In that state the bolt cannot be drawn back without turning the handle far enough for the fan-tail X to send the detector down again below the corner of the spring, and by doing that you will also have locked all the tumblers, and so made the lock fast until the key comes to open it. And it is to be observed that the curtain cannot be pushed in until the bolt is fully shot, so that no exploration of the lock can take place while it is open, or even partially open. By adding a spring catch under the curtain, to be freed by one of the tumblers when it is fully locked, it may be arranged, if required, that the curtain could not be pushed in, not only until the bolt is shot, but until the tumblers are locked also.

The following, therefore, are the advantages of this lock. 1. A very large lock, with all its parts strong, only requires a very small key, not weighing above a quarter of an ounce. 2. No key is required to lock it, and you cannot leave the key in the lock (a fruitful source of mischief), and yet it is free from the inconvenience of spring locks, which sometimes shut themselves when not intended, and moreover, when large, require large and strong keys to open them. 3. It cannot get out of order from the usual causes of the tumblers sticking together, or tumbler-springs breaking, because there are none, and the tumblers do not touch each other, but the friction plates between them. 4. The keyhole being always quite closed by the curtain, except while the key is in, the lock is protected from dirt and from the effects of a damp or smoky atmosphere, which injures other locks. 5. The smallness of the keyhole prevents the insertion of any instrument strong enough to force the lock, and also prevents inspection. 6. It is pronounced by the highest authority to be secure against any known mode of picking. 7. It requires no delicacy of construction or high finish in any of the parts, and the moving parts are few—in fact, the whole of them together are fewer than the number of springs alone in the great American lock of Day & Newell. 8. It is free from the incumbrance of a patent, the inventor being one of those who agree with the opinion of the jury on philosophical instruments in the exhibition of 1851, and with many of the first engineers and most scientific men, that "patents are a great obstruction to the progress of science," and waste, on the whole, more money than they gain for real inventors.

Changeable Key Locks.

Any lock with many tumblers may be changed by taking it off and transposing any two or more of the tumblers; but it will then want a different key, and the process is too troublesome to be resorted to except when there is reason to apprehend that the original key has fallen into bad hands, or had a copy taken of it. A lock which can be locked by a great number of keys, but can only be opened by the one which locked it last, is evidently an immense addition to security. Those keys may either be all distinct, or there may be a great number of different webs, or stepped parts, fitting to a common handle; or each bit or step may be separate, and all screwed together into the key frame as shown in fig. 22.

In a lock with n tumblers, each raisable to m distinct heights, if you have only n loose bits of the m different

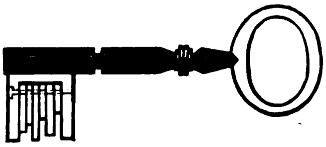

Fig. 22.

heights you may compose $1 \times 2 \times 3 \ldots n$ keys, which for nine tumblers $= 362,880$. But if you also have m bits for each place in the web, the possible number of different keys is very much greater, viz., m^n; for every possible length of bit in each place may be used with every possible length in every other place. If m is 7 and n 9, as they are in the locks we are going to describe next, each lock may have very nearly sixty million different keys, or key-webs capable of fitting into one shank or handle; and the chances are so many against a lock-picker hitting on the right one.

The first changeable key lock known in England was Day & Newell's "Parautoptic" (inspection-defying) lock, which was brought from America by Mr. Hobbs at the time of the 1851 Exhibition, and has been largely used since for banks and other safes. It was fully described in the last edition of this work, and in the books above referred to; but in this place we will describe instead a much simpler form of it, since introduced by Mr. Hart of the firm of Hobbs, Hart & Co. The principle of all changeable key locks is that instead of a single stump fixed to the bolt, there are as many stumps as tumblers, and each one is the projecting part S of a slider PPS which can ride up and down on two pins PP in the bolt, and will stay at any height where it is left when the bolt B is shot. Fig. 23 shows the lock open and the slider stumps lying in the jaws or gating of the tumblers ready to be raised to any height. In fig. 24 the bolt has been shot, and the sliders carried forward with it. Just before they leave the tumblers they are received by the two small teeth C, C on the frame of the lock, holding each slider at whatever height it may then be; those teeth go right down to the thin part of the bolt or as deep as the sum of all the tumblers and sliders. In this figure the topmost slider is received at its third notch, and each of those below it at some other notch. The tumblers having fallen behind all the stumps, the sliders cannot move until the tumblers are all raised again to the various heights at which they left them, which is possible only by the key that locked the lock. These locks have Hobbs's protector behind the bolt; and the bit which moves the bolt is behind a revolving curtain (the darkest circle), which is kept steady by one of the tumblers resting on its flattened top. The bellies of the tumblers are shortened, to obviate a certain trick by which one of Newell's locks was picked, but which it is not necessary now to explain. So far as we can judge, this lock has more than all the advantages of that, as it is much less complicated and liable to get out of order from any cause except that to which all locks with spring tumblers are liable, viz., from two tumblers getting stuck together by dirt, so that one of them rises too high with its neighbor. Oiling tumblers is accordingly fatal to them, though it is necessary in other parts of a lock.

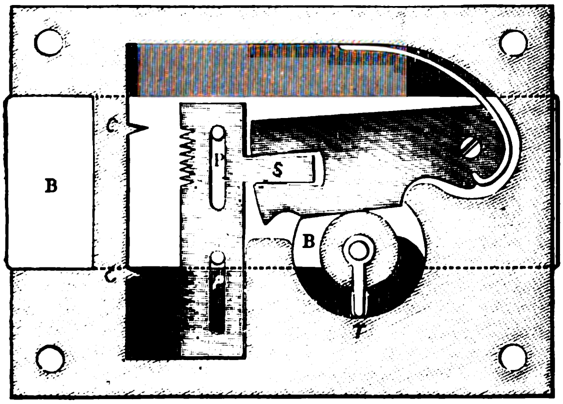

Fig. 23.

The keys of these locks are practically made not of distinct bits screwed into a key frame as in fig. 22, which is the plan used in the Day & Newell lock, and makes a heavy thing to carry, but separate webs are made, each complete in itself, and fitting into a thickish key pipe which need not be carried about. You may leave it near the safe, and lock up therein, or keep somewhere else, all the bits except the one you use for the day, and carry that in your waistcoat pocket. For such a lock as that described you may have as many of the sixty million bits as you like, and may get new ones from time to time. Or you may have separate bits, as in the parautoptic lock, but in that case you must take good care of the key whenever the lock is shut.

The risk of tumblers sticking together in a changeable lock, or any other, may be obviated by not using springs but putting thin plates between the tumblers, as in Sir E. Beckett's lock, giving the tumblers tails coming down on the right of the keyhole in figs. 23, 24, and making the revolving curtain act on all the tails just before the key comes out, by means of an intermediate lever, or else by a small handle which might at the same time bring an escutcheon or external curtain over the keyhole.

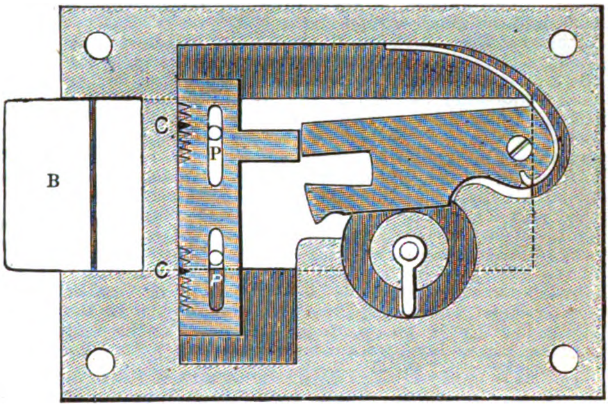

Fig. 24.

Yale Lock.

This American lock is remarkable for the smallness of its key, which is shown from *k* to *a* in fig. 25, full size, and is a thin flat piece of steel weighing only ·1 of an ounce. The narrowness of the keyhole would be an impediment to introducing a picking instrument together with any other intended at the same time to give a twisting pressure to the small barrel *abc*, which has to turn, as in the Bramah lock, in order to move the bolt, which is not shown in these figures. That may be done either as in Bramah locks or by a tongue or bit attached to the end *ab* of the barrel as in several other locks. The barrel is prevented from being turned, except by the proper key, thus. The (apparently) five plugs with spiral springs over them in fig. 25 are really all divided at the cross line *bc*, being all now lifted to the proper height by the key. Consequently the barrel *abc* can turn round, as there is no plug either projecting from it or projecting into it. But when the key is out, all the plugs are pushed down by the springs, and

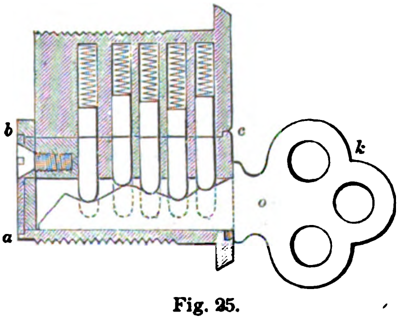

Fig. 25.

so the upper ones descend into the barrel and hold it fast. And again, if any of the steps of a false key are too high, some of the lower plugs will be pushed up beyond the barrel into the holes above them, and so the barrel cannot turn. The bevelled end of the key near *a* enables it to be pushed in under the plugs, though with some friction and resistance. It does not appear, however, to be any more secure than the Bramah lock, except by virtue of the smallness of its keyhole. Nor is the flatness and thinness of the key of any particular value on a bunch of keys, though very convenient for a single latch key to be carried in the waistcoat pocket, as extreme security is not requisite for latch locks.

Yale Time Lock.

The same company have an entirely different kind of lock from all the preceding ones; it consists of a watch in a case enclosed within the safe door, and has a dial with pins marked for every hour, something like a "tell-tale clock." Any number of these pins can be pulled out a little, and the watch will let a weighted lever fall against the bolts of the safe during all those hours, and hold it up during all the other hours, or *vice versa*. For security the case contains two such watches, so that one may do the work if the other happens to fail. Thus no key is used (except the watch key for winding), but the safe can be opened by a handle moving its bolts at such hours as the watch is set for, and at no other.

It should be added that Mr. Hobbs introduced into England in 1851 the American system of manufacturing every part of a lock by machinery, so that all similar locks of a given size are exactly alike, except the keys, and the gating in the tumblers, which is cut when they are lifted by the key; and even those are done by machinery adjustable to secure what may be called an infinite number of variations. The same system has been adopted in the Government rifle manufactories, and for clocks and watches; and no hand-work can compete with it. (E. B.)

LOCKE, JOHN (1632–1704). Some idea of the man and his surroundings is more needed for the interpretation of what Locke has written than in the case of most philosophers. His youth was spent amidst the war of principles of which England was the scene in the middle of the 17th century. In later life he mixed much with the chief actors in the political drama that followed the Restoration. In his advanced years he was the intellectual representative of tendencies which at the Revolution settlement inaugurated the tranquil material progress and tolerant but more prosaic spirit of the 18th century in England. It is instructive to see how the foundations of belief and the constitution of knowledge are investigated by an English gentleman, who was no recluse mediæval monk or pedantic modern professor, but a man of the world, practically conversant with affairs, in tone calm and rational, and now justly regarded as the typical English philosopher.

Locke was born in the county of Somerset, on the 29th of August, 1632, six years after the death of Bacon, and three months before the birth of Spinoza. His father was a small landowner and attorney at Pensford, near the northern boundary of the county, to which neighborhood the family had migrated from Dorsetshire early in the century. The elder Locke, a strict but genial Puritan, by whom the son was carefully educated at home, was engaged in the military service of the popular party when the son was a boy, Bristol being one of the centres of the war. "From the time that I knew anything," Locke wrote in 1660, "I found myself in a storm which has continued to this time." For fourteen years his education was going on at home, in the Puritan family. The house at Beluton, on his father's little estate, in which these years were spent, may still be seen on the side of one of the orchard-clad vales of Somerset, half a mile from the market-town of Pensford, and 6 miles from Bristol. The actual place of Locke's birth was at Wrington, 10 miles westward, in a house which still exists, where his mother chanced to be on a visit.

In 1646 he entered Westminster School, then of course under Puritan control, and at the headquarters of the parliamentary movement. The six following years were mostly spent there. He does not seem to have liked Westminster, and its memories perhaps produced the bias against public schools which afterwards almost disturbed his philosophic impartiality in his *Thoughts on Education*.

In 1652 Locke passed from Westminster to Oxford. He there found himself at Christ Church, in charge of John Owen, the newly appointed Puritan dean, and vice-chancellor of the university. Christ Church was more or less Locke's home for thirty years. For eight years after he entered Oxford was ruled by the Independents, who, through Owen and Goodwin, unlike the Presbyterians, were among the first in England to promulgate the principles of genuine religious liberty. Locke's hereditary sympathy with the Puritans was gradually lessened by what he saw of the intolerance of the Presbyterians and the fanaticism of the Independents. He found, he says characteristically, that "what was called general freedom was general bondage, and that the popular assertors of liberty were the greatest engrossers of it too, and not unfitly called its keepers." The influence of the liberal divines of the Church of England became apparent afterwards in the progress of his mental history.

Oxford had suffered as a seat of learning during the civil war. Under Owen the scholastic studies and disputations were maintained with a formality unsuited to Locke's free inquisitive temper. The reaction against them which he expressed showed thus early a strong disposition to rebel against empty verbal reasonings. He was not, according to his own account of himself to Lady Masham, a very hard student at first. He sought the company of pleasant and witty men, with whom he likewise took great delight in corresponding by letter; and in conversation and in these correspondences he spent much of his time. He took his bachelor's degree in 1656, and that of master in 1658, the latter on the same day with Joseph Glanvill, the author of *Scepsis Scientifica*. In December, 1660, he was made tutor of Christ Church, and lectured in Greek, rhetoric, and philosophy in the following year.

At Oxford Locke was within reach of distinctive intellectual influences, then of great strength, and particularly fitted to promote self-education in a strong character. The metaphysical works of Descartes had appeared a few years before he entered Christ Church, and the *Human Nature* and *Leviathan* of Hobbes during his undergraduate years. It does not seem that Locke read extensively, but he was soon drawn to Descartes. The first books, he told Lady Masham, which gave him a relish for philosophical things were those of Descartes. He was delighted in reading them, though he very often differed in opinion from the writer, for he found that what he said was very intelligible. After the Restoration he lived amidst the influences which were then drawing Oxford and England into experimental research. Experiments in physics became the fashion after 1660. The Royal Society was that year founded at Oxford. Wallis and Wilkins, and afterwards Boyle and Wren, at Oxford, and Barrow and Newton at Cambridge, helped to make chemistry, meteorology, and mechanics take the place of verbal disputes. We find him, accordingly, at work in chemistry about 1663, and also in the meteorological observations which always interested him.

The restraints of professional life were not well suited to Locke. There is a surmise that he once contemplated taking orders in the Church of England. His religious disposition attracted him to theological studies. His revulsion from the severe dogmatism of Presbyterians and the unreasoning fanaticism of Independents favored that connection with liberal Anglican churchmen which he maintained in later life. Whichcote was his favorite preacher, and latterly his closest intimacy was with the Cudworth family. But, though he has a place among the lay theologians of England, his dislike to ecclesiastical impediments to free research, as well as his taste for experimental investigations, led him in the end to turn to medicine when he had to think about a profession. This was soon after the Restoration, and before 1666 he seems to have been practising medicine in Oxford. But, though afterwards known among his friends as "Doctor Locke," he never graduated as a physician. His health was uncertain, for he suffered all his life from chronic consumption and asthma, and besides that an event soon occurred which withdrew him from medical practice. To the end, however, he was fond of the science, and also ready on occasion to give friendly advice.

Locke had early shown an inclination to politics as well as to theology and to medicine. In 1665 he diverged from medical study at Oxford to diplomacy, and was engaged for a few months in this sort of business, as secretary to Sir Walter Vane on his embassy to Cleves. It was soon after his return from Germany in the following year that the incident occurred which determined his career in the direction of politics. Lord Ashley, afterwards first earl of Shaftesbury, the most truly historical figure among the statesmen of Charles II.'s reign, had come to Oxford for health. There Locke was accidentally introduced to him. This meeting was the beginning of a lasting friendship, sustained by a common sympathy with liberty—civil, religious, and philosophical. In 1667 Locke removed from Christ Church to Exeter House, Lord Ashley's London residence, to become his private secretary, and in 1673 secretary of the Board of Trade. Although he retained his studentship at Christ Church, and occasionally visited Oxford, and also his patrimony at Beluton, lately inherited from his father, he found a home and shared fortune with the great statesman during the fifteen years which followed his removal to Exeter House.

The manuscripts of Locke which belong to this Oxford period throw welcome light on the growth of his mind in early life. Among them is an essay on the "Roman Commonwealth," which expresses convictions as to religious liberty and the relations of religion to the state which were only strengthened and deepened in the progress of his life. Objections to the sacerdotal conception of Christianity are strongly stated in another paper; short work is made of human claims to infallibility in the interpretation of Scripture in a third; a scheme of utilitarian ethics, wider in its conception than that of Hobbes, is offered in a fourth. But the most significant of those early revelations is an "Essay concerning Toleration," dated in 1666, which anticipates many of the positions maintained nearly thirty years later in his famous *Letters* on that subject.

The Shaftesbury connection helped to save Locke from those idols of the den to which professional life in every form is exposed. It brought him much in contact with public men, with the springs of political action, and with the details of office. The place he held as confidential adviser of the greatest statesman of his age is indeed the most remarkable feature in his middle life. Exeter House afforded every opportunity for society, and of this Locke, according to his disposition, availed himself. He became one of the intimates among others of the illustrious Sydenham. But though he joined the Royal Society he seldom went to its meetings, for his custom all his life was to encourage small reunions of intimate friends. One of these at Exeter House was the occasion of the enterprise which has made his name memorable in history; for it was there that "five or six friends" met one evening in his rooms, about 1671, and discussed "principles of morality and religion" which seemed remote from questions about "human understanding." They "found themselves quickly at a stand by the difficulties that arose on every side. Locke suggested a careful examination of the exact limits of man's power to know the universe as the proper way out of their difficulties. The results of the reflection to which these difficulties thus gave rise, he thought, when he set to work, might be contained on "one sheet of paper." But what was thus "begun by chance was continued by entreaty, written by incoherent parcels, and after long intervals of neglect resumed again as humor and occasions permitted," till at last, at the end of nearly twenty years, it was given to the world as the *Essay on Human Understanding*. This work gave intellectual unity and a purpose to his life as a man of letters and philosophy.

The fall of Shaftesbury in 1675 enabled Locke to escape for four years from the centre of English politics to a retreat in France, where he could unite the study of "human understanding" with attention to health. He spent three years partly at Montpellier and partly in Paris. His journals and commonplace books of this period show the *Essay* in process of construction. The visits to Paris were times of meeting with men of letters and science, among others Guenellon, the well-known Amsterdam physician; Römer, the Danish astronomer; Thoynard, the critic; Thevenot, the traveller; Justel, the jurist; and Bernier, the expositor of Gassendi. There is no mention of Malebranche, whose *Recherche de la Vérité* had appeared three years before, and who was then at the Oratoire, nor of Arnauld, his illustrious rival at the Sorbonne.

Locke returned to London in 1679. A reaction against the court party had for a time restored Shaftesbury to power. Locke resumed his old confidential relations. A period of much interrupted leisure followed. It was a time of plots and counterplots, when England seemed on the brink of another civil war. In the end Shaftesbury was committed to the Tower, tried, and acquitted. More insurrectionary plots followed in the summer of 1682, after which, isolated at home, he escaped to Holland, and died at Amsterdam in January, 1683. In these two years Locke was much at Oxford or at Beluton. The last movements of Shaftesbury did not recommend themselves to the sage caution of his secretary. Yet the officials of government kept their eyes on him. "John Locke lives a very cunning, unintelligible life here," Prideaux reported from Oxford in 1682. "I may confidently affirm," the dean of Christ Church afterwards wrote to Lord Sunderland, "there is not any one in the college who has heard him speak a word against, or so much as censuring, the Government; and, although very frequently, both in public and private, discourses have been purposely introduced to the disparagement of his master, the earl of Shaftesbury, he could never be provoked to take any notice, or discover in word or look the least concern; so that I believe there is not in the world such a master of taciturnity and passion." Some unpublished correspondence with his Somerset friend, Edward Clarke of Chipley, describes his daily life in these troubled years, and refers to intercourse with the Cudworth family, who were intimate with the Clarkes. The commonplace books and letters about the same time allude to toleration in the state and comprehension in the church, and show an indifference to questions on which theological disputers lay stress, hardly consistent with a strict connection with any organized body of Christians, notwithstanding his gravitation towards the Church of England as the most liberal community.

In his fifty-second year, in the gloomy autumn of 1683, Locke retired to Holland in voluntary exile. It was then the asylum of eminent persons who were elsewhere denied civil and religious liberty. Descartes and Spinoza had meditated there; it had been the home of Erasmus and Grotius; it was now the refuge of Bayle. Holland was Locke's sanctuary for more than five years; but it was hardly a voluntary retreat. His (unpublished) letters from thence represent a man of tender feelings, on whom exile sat heavily. Amsterdam was his first Dutch home. For a time he was in danger of arrest at the instance of the English Government. After anxious months of concealment in the houses of friends, he escaped; he was, however, deprived of his studentship at Christ Church, and Oxford was finally closed against him by order of the king. But Holland introduced him to new friends. One of these, ever after an intimate correspondent, was Philip van Limborch, the successor of Episcopius as Remonstrant professor of theology, lucid, learned, and tolerant, the friend of Cudworth, Whichcote, and More. Limborch attached him to Le Clerc, then the youthful representative of letters and philosophy in Limborch's college, who had escaped from Geneva and Calvinism to the milder atmosphere of Holland. The *Bibliothèque Universelle* of Le Clerc, commenced in 1686, soon became the chief organ in Europe of men of letters. Locke was at once united with him in the work, and contributed several articles. It was his first appearance as an author, although he was now more than fifty-four years of age, and afterwards produced so many volumes. This tardiness in authorship is a significant fact in Locke's mental history, in harmony with the tempered wisdom and massive common sense which reign throughout his works. The next fourteen years were those in which the world received the thoughts which observation of affairs and reflection had so long been forming in his mind. They were taking shape for publication while he was in Holland. The *Essay* was finished there, and a French epitome of it appeared in 1688, in Le Clerc's journal. Locke was then at Rotterdam, where he lived for more than a year in the house of a Quaker friend, Benjamin Furley, a wealthy merchant and collector of books. The course of affairs in England at last opened a way for his return to his native country. At Rotterdam, he was the confidant of the political exiles, including Burnet and Mordaunt, afterwards the famous earl of Peterborough, as well as of the prince of Orange. William landed in England in November, 1688; Locke followed in February, 1689, in the same ship with the princess of Orange and Lady Mordaunt.

It was after his return to England that through authorship Locke emerged into European fame. Within a month he had declined the embassy to Brandenburg, and taken instead the modest office of commissioner of appeals with its almost nominal duties. The two years, 1689 and 1690, during which he lived at Dorset Court, in London, were memorable for the publication of his two chief works in social polity, and also of the most popular and widely influential book in modern philosophy, which expresses in a generalized form the principles that lie at the root of all his political and other writings. The first of the three to appear was the defence of religious liberty in the state, in the *Epistola de Tolerantia*, addressed to Limborch. It was published at Gouda in the spring of 1689, and translated into English in autumn by William Popple, a Unitarian merchant in London. The *Two Treatises on Government*, in defence of the sovereignty of the people, followed a month or two after. The *Essay concerning Human Understanding* saw the light in the spring of 1690. He received £30 for the copyright, which was nearly the same as Kant afterwards got for the first edition of his *Kritik der reinen Vernunft*. He had carried the manuscript from Holland, ready for the press except a few last touches. It was the first book in which his name appeared, for the other two were published anonymously.

Locke's asthma and other ailments had increased in the latter part of 1690. The air of London always aggravated them. The course of public affairs also disappointed him, for the settlement at the Revolution in many ways fell short of his ideal. It was then that the home of his old age, the brightest of all his homes, opened to receive him. This was the manor house of Oates in Essex, pleasantly situated midway between Ongar and Harlow, the country seat of Sir Francis Masham. Lady Masham was the accomplished daughter of Cudworth, and Locke had known her before he went to Holland. In the course of the two years after his return, she told Le Clerc, "by some considerably long visits Mr. Locke made trial of the air of this place, which is some 20 miles from London, and he thought that none would be so suitable for him. His company could not but be very desirable for us, and he had all the assurances we could give him of being always welcome; but, to make him easy in living with us, it was necessary he should do so on his own terms, which Sir Francis at last assenting to, he then believed himself at home with us, and resolved, if it pleased God, here to end his days—as he did." It was in the spring of 1691 that this idyllic life at Oates began. There, among the green lanes of rural England, he enjoyed for fourteen years as much domestic peace and literary leisure as was consistent with broken health and sometimes anxious visits to London on public affairs. Oates was in every way his home. In his letters and otherwise we have charming pictures of its inmates and its internal economy, as well as of occasional visits of friends who went there to see him, among others Lord Peterborough and the Lord Shaftesbury who wrote the *Characteristics*, Isaac Newton, William Molyneux, and Anthony Collins.

At Oates he was always busy with his pen. The *Letter on Toleration* had already involved him in controversy. The *Answer* of a certain Jonas Proast of Queen's College, Oxford, had drawn forth in 1690 his *Second Letter on Toleration*. A rejoinder in 1691 was followed by Locke's *Third Letter* in the summer of the following year. And other questions divided his interest with this one. In 1691 those of currency and finance were much in his thoughts; in the year after he addressed a letter to Sir John Somers on the *Consequences of the Lowering of Interest and Raising the Value of Money*. It happened too that when he was in Holland he had written letters to his friend Clarke of Chipley about the education of his children. These letters formed the substance of the little volume that appeared in 1693, entitled *Thoughts on Education*, which still holds its place among the classics in that department. Nor were the "principles of revealed religion" forgotten, which a quarter of a century before were partly the occasion of the *Essay*. The circumstances of the time now made him desire to show how few and simple all the essential points held in common by the religious community of England were, and to bring men if possible to agree to differ as individuals regarding all beyond. The issue was an anonymous essay on the *Reasonableness of Christianity as delivered in the Scriptures*, which appeared in 1695, in which Locke tried to separate the divine essence of Christianity from accidental accretions of dogma, and verbal reasoning of professional theologians, ignorant of the limits within which the conclusions of human beings on such subjects must be confined. This irenicon involved him in controversies that lasted for years. A host of angry polemics assailed the book. A now forgotten John Edwards was conspicuous among them. Locke produced a *Vindication* which added fuel to the fire, and was followed by a *Second Vindication* in 1697. Notes of opposition to the *Essay* too had been heard almost as soon as it appeared. John Norris, the metaphysical rector of Bemerton, an English disciple of Malebranche, criticised it in certain *Cursory Reflections* in 1690. Locke took no notice of this at the time, but his second winter at Oates was partly employed in writing what appeared after his death as an *Examination of Malebranche's Opinion of Seeing all Things in God*, and as *Remarks upon some of Mr. Norris's Books*,—tracts which throw important light upon his own theory, or rather want of theory, as to perception through the senses. When he was examining Malebranche he was also preparing the *Essay* for a second edition, and corresponding with his friend William Molyneux at Dublin about amendments in it. This edition, with a chapter added on "Personal Identity," and numerous alterations in the chapter on "Power," appeared in 1695. It was followed by a third, which was only a reprint, later in the same year. Wynne's well-known abridgment in that year helped to make the book known in Oxford, and Molyneux had years before introduced it in Dublin. In 1695 a return to questions about the currency diverted Locke's attention for a little from metaphysics and theology. Circumstances in that year gave occasion to his tract entitled *Observations on Silver Money* and also to his *Further Considerations on Raising the Value of Money*.

In 1696 Locke was induced to accept a commissionership on the Board of Trade, which made frequent visits to London needful in the four following years, and involved him considerably in the cares of office. Meantime the *Essay on Human Understanding* and the *Reasonableness of Christianity* were both becoming more involved in the wordy warfare between dogmatists and latitudinarians, trinitarians and unitarians, of which England was the scene in the last decade of the 17th century. The controversy with Edwards was followed by another with Stillingfleet, bishop of Worcester, which takes its place among the memorable philosophical controversies of the modern world. It arose in this way. John Toland, an Irishman, in his *Christianity not Mysterious*, had exaggerated some passages in the *Essay*, and then adopted the opinions as his own. In the autumn of 1696, Stillingfleet, who was a learned and argumentative ecclesiastic more than a religious philosopher, in a *Vindication of the Doctrine of the Trinity* wrote some pages on Locke, condemning him especially for eliminating mystery from human knowledge in his account of what is meant by "substance." Locke replied in a *Letter* dated January, 1697. Stillingfleet's rejoinder appeared in May, followed by a *Second Letter* from Locke in August, to which the bishop replied in the following year. Locke's elaborate *Third Letter*, in which the ramifications of the controversy are pursued with a tedious expenditure of acute reasoning and polished irony, was delayed till 1699. The death of Stillingfleet in that year brought this famous trial of strength to an end. (The interesting episode of Molyneux's visit to Oates, followed by his death a few days after his return to Dublin, occurred in 1698, when the Stillingfleet controversy was at its height.) Other critics were now entering the lists against the *Essay*. One of the ablest was John Sergeant, a Catholic priest, in his *Solid Philosophy Asserted Against the Fancies of the Ideists*, in 1697. He was followed by Thomas Burnet and Dean Sherlock. Henry Lee, rector of Tichmarch, produced in 1702 a folio volume of notes on each chapter in the *Essay*, under the title of *Anti-Scepticism;* John Broughton dealt another blow in his *Psychologia* in the following year. About the same time too John Norris returned to the attack, in various passages in his *Theory of the Ideal or Intelligible World*. Locke was defended with vigor by Samuel Bolde, a Dorsetshire clergyman. The *Essay* was all the while spreading over Europe, impelled by the great name of its author as the chief friend and philosophical defender of civil and religious liberty. The fourth edition (the last while Locke was alive) appeared in 1700. It contained two important new chapters on "Association of Ideas" and "Enthusiasm." What was originally meant for a third chapter was prepared but withheld. It appeared among Locke's posthumous writings, under the now well-known title of *Conduct of the Understanding*, in some respects the most characteristic of his works. The French translation of the *Essay* by Pierre Coste, Locke's amanuensis at Oates, was almost simultaneous with the fourth edition. The Latin version by Burridge of Dublin appeared the year after, reprinted in due time at Amsterdam and at Leipsic.

After 1700 Locke was gathering himself up for the end, in the rural repose of family life at Oates. The commission at the Board of Trade was resigned, and the visits to London ceased. Scriptural studies and religious meditation engaged most of his available strength in the four years that remained. The Gospels had been much searched by him when he worked in theology years before. He now turned to the Epistles of St. Paul, and applied the spirit of the *Essay*, and the rules of critical interpretation which apply to other books, to interpret a literature which he still venerated with the submissiveness of the pious Puritans who surrounded his youth. The results of these studies were ready for the printer when he died, and were published about two years afterwards. A few pages on *Miracles*, written in 1702, in connection with Fleetwood's essay, also appeared posthumously. More adverse criticism was now reported to him, and the *Essay* was formally condemned by the authorities at Oxford. "I take what has been done rather as a recommendation of the book," he wrote to his young friend Anthony Collins, a neighboring Essex squire, then a frequent visitor at Oates, and afterwards a leader of free thought, "and when you and I next meet we shall be merry on the subject." One attack only moved him. In 1704 his adversary Jonas Proast unexpectedly revived their old controversy. Locke in consequence began a *Fourth Letter on Toleration*. The few pages in the posthumous volume, ending in an unfinished sentence, seem to have exhausted his remaining strength in the weeks before he died. Thus the theme which had employed him at Oxford more than forty years before, and had been his ruling idea throughout the long interval, was still dominant in the last days of his life. All that summer of 1704 he continued to decline, tenderly nursed by Lady Masham and her step-daughter. On the 28th of October he passed away, as he declared, "in perfect charity with all men, and in sincere communion with the whole church of Christ, by whatever names Christ's followers call themselves." The tomb of Locke may be seen on the south side of the parish church of High Laver, in which he often worshipped, near the tombs of the Mashams, and of Damaris, the widow of Cudworth, bearing a Latin inscription prepared by his own hand. At the distance of a mile are the garden and park where the manor house of Oates once stood, surrounded by a green undulating country, in the lanes of which the slender delicate figure, with the refined reflective countenance made familiar to us by Kneller, was so often seen in the last years of the 17th century.

Locke's history, combined with his writings, has made his intellectual and moral features not less familiar. The reasonableness of taking probability for our ultimate guide in all the really important concerns of life was the essence of his philosophy. The desire to see for himself what is really true in the light only of its reasonable evidence, and that others should do the like, was his ruling passion, if the term can be applied to one so calm and judicial. "I can no more know anything by another man's understanding," he would say, "than I can see by another man's eyes." The knowledge which one man possesses is "a treasure which cannot be lent or made over to another." This repugnance to believe blindly what rested on authority, as distinguished from what was seen to be sustained by self-evident reason or by demonstration or by good probable evidence, runs through his life. He is typically English in his reverence for facts, whether facts of sense or of rational consciousness, in his tendency to turn away from purely abstract speculation and merely verbal reasonings, in his suspicion of mysticism, in his calm reasonableness, and in his ready submission to truth, even when the truth was incapable of being reduced to system, provided only that it served a human purpose. The delight he took in making use of his reason in everything he did, and a wise use of it too, was what his friend Pierre Coste found most prominent in Locke's daily life at Oates. "He went about the most trifling thing always with some good reason. Above all things he loved order, and he had got the way of observing it in everything with wonderful exactness. As he always kept the useful in his eye in all his disquisitions, he esteemed the employments of men only in proportion to the good they were capable of producing; for which cause he had no great value for the critics who waste their lives in composing words and phrases, and in coming to the choice of a various reading in a passage that has after all nothing important in it. He cared yet less for those professed disputants who, being taken up with the desire of coming off with victory, justify themselves behind the ambiguity of a word, to give their adversaries the more trouble. And whenever he had to deal with this sort of folks, if he did not beforehand take a strong resolution of keeping his temper, he quickly fell into a passion, for he was naturally choleric, but his anger never lasted long. If he retained any resentment it was against himself, for having given way to so ridiculous a passion, which, as he used to say, may do a great deal of harm, but never yet did any one the least good." Large, "round-about," even prosaic common sense, with intellectual strength solidly directed by a virtuous purpose, much more than subtle or daring speculation sustained by an idealizing faculty, in which he was deficient, is what we find conspicuous in Locke's conduct, correspondence, and books. A defect in speculative imagination undoubtedly appears when he encounters the vast and complex problem of human knowledge in its organic unity, and when he is obliged to recognize the need for philosophy as an additional inquiry to that within the scope of any one, or all, of the special sciences.

In the inscription on his tomb Locke refers to his printed works as the true representation of what he really was. They are concerned with SOCIAL POLITY, CHRISTIANITY, EDUCATION, and PHILOSOPHY. It may be convenient to arrange them under these four heads, in the order in which they were published, and then to give some account of his opinions under each head.

I. SOCIAL POLITY.—(1) *Epistola de Tolerantia*, 1689, (translated into English in the same year). (2) *Two Treatises on Government*, 1690 (the *Patriarcha* of Filmer, to which the *First Treatise* was a reply, appeared in 1680). (3) *A Second Letter concerning Toleration*, 1690. (4) *Some Considerations on the Consequence of Lowering the Rate of Interest and Raising the Value of Money*, 1691. (5) *A Third Letter for Toleration*, 1692. (6) *Short Observations on a printed paper entitled, "For Encouraging the Coining of Silver Money in England, and after for Keeping it here,"* 1695. (7) *Further Considerations concerning Raising the Value of Money*, 1695 (this was occasioned by a *Report* containing an "Essay for the Amendment of Silver Coins," published that year by William Lowndes, a secretary for the Treasury; Locke anticipates some later views in political economy). (8) *A Fourth Letter for Toleration*, 1706 (posthumous).

II. CHRISTIANITY.—(1) *The Reasonableness of Christianity as delivered in the Scriptures*, 1695. (2) *A Vindication of the Reasonableness of Christianity from Mr. Edwards's Reflections*, 1695. (3) *A Second Vindication of the Reasonableness of Christianity*, 1697. (4) *A Paraphrase and Notes on the Epistles of St. Paul to the Galatians, First and Second Corinthians, Romans, and Ephesians. To which is prefixed an Essay for the understanding of St. Paul's Epistles by consulting St. Paul himself*, 1705–7 (posthumous).

III. EDUCATION.—(1) *Some Thoughts concerning Education*, 1693. (2) *The Conduct of the Understanding*, 1706 (posthumous). (3) *Some Thoughts concerning Reading and Study for a Gentleman*, 1706 (posthumous). (4) *Instructions for the Conduct of a Young Gentleman*, 1706 (posthumous). (5) *Of Study* (written in France in Locke's journal, and published in L. King's *Life of Locke* in 1830).

IV. PHILOSOPHY.—(1) *An Essay concerning Human Understanding*, in four books, 1690. (2) *A Letter to the Bishop of Worcester concerning some passages relating to Mr. Locke's Essay of Human Understanding in a late Discourse of his Lordship's in Vindication of the Trinity*, 1697. (3) *Mr. Locke's Reply to the Bishop of Worcester's Answer to his Letter*, 1697. (4) *Mr. Locke's Reply to the Bishop of Worcester's Answer to his Second Letter*, 1699. (5) *A Discourse of Miracles*, 1706 (posthumous). (6) *An Examination of Father Malebranche's opinion of Seeing all Things in God*, 1706 (posthumous). (7) *Remarks upon Some of Mr. Norris's Books, wherein he asserts Father Malebranche's opinion of Seeing all Things in God*, 1720 (posthumous).

The following are Miscellaneous Tracts:—(1) *A New Method of a Common Place Book*, 1686 (this was Locke's first article in the *Bibliothèque* of Le Clerc; his other contributions to it are uncertain, except the *Epitome of the Essay*, in 1688). (2) *The Fundamental Constitutions of Carolina* (prepared when Locke was Lord Shaftesbury's secretary at Exeter House about 1673; remarkable for its recognition of the principle of toleration, and published in 1706, in the posthumous collection). (3) *Memoirs relating to the Life of Anthony, First Earl of Shaftesbury*, 1706. (4) *Elements of Natural Philosophy*, 1706. (5) *Observations upon the Growth and Culture of Vines and Olives*, 1706. (6) *Rules of a Society which met once a Week, for their improvement in Useful Knowledge, and for the promotion of Truth and Christian Charity*, 1706. (7) *A Letter from a Person of Quality to his Friend in the Country*, published in 1875 (included by Des Maizeaux in his *Collection of Several Pieces of Mr. John Locke's*, 1720), and soon afterwards burned by the common hangman by orders from the House of Lords, was disavowed by Locke himself. It may have been dictated by Shaftesbury.

There are also various writings of Locke first published in the biographies of Lord Haig and of Mr. Fox Bourne.

Locke's numerous *Letters* to Thoynard, Limborch, Le Clerc, Guenellon, Molyneux, Collins, Sir Isaac Newton, the first and the third Lord Shaftesbury, Lords Peterborough and Pembroke, Clarke of Chipley, and others, many of them unpublished, are models in their kind. They express the courtesy and humor which were natural to him, and his varied interests in human life. Those to Molyneux and Limborch in particular throw light on the *Essay*, and his works on Toleration and Christianity.

I. It has been truly said that all Locke's writings, even the *Essay on Human Understanding* itself, were "occasional, and intended directly to counteract the enemies of reason and freedom in his own age." This is obviously true of his works on Social Polity written in an age when the principles of democracy and toleration were struggling with passive obedience and divine right of kings, and when even "the popular assertors of public liberty were the greatest engrossers of it too." The state with Locke was the issue of free contract, and was not a natural organism. That the people, in the exercise of their sovereignty, have the right to govern themselves in the way they judge expedient for the common good, and that the civil government, whatever form it assumes, has no right to interfere with religious beliefs not expressed in actions inconsistent with civil society, is the essence of his political philosophy. He based the ultimate sovereignty of the people on a virtual consent or contract on the part of the people themselves to be so governed. The precise terms of contract, he allowed, might and should be modified by the sovereign people from time to time, in accommodation to ever changing circumstances. He saw that things in this world were in so constant a flux that no society long remained in the same state, and that "the grossest absurdities" must be the issue of "following custom when reason has left the custom." With an English love of compromise in the working of political affairs, he was always disposed towards liberal ecclesiastical concessions for the sake of religious unity and peace, and recommended obedience to the civil magistrate in all indifferent things in worship and government, not otherwise expressly determined by supernatural revelation.

His attack on Sir Robert Filmer in the *First Treatise on Government* was an anachronism, even when it was published; in the democratic principle argued for in the *Second Treatise*, while in advance of the practice of his age, he was anticipated by Aquinas and Bodin, as well as by Grotius and Hooker. His philosophical defence of the social rights of religious beliefs was the most original and important of his contributions to polity, and the most far-reaching in its ultimate assumptions. Locke had a more modest estimate of human resources, natural and supernatural, for forming true judgments in religion, and a less pronounced judgment of the immorality of religious error, than either the Catholic or the Puritan. The toleration which he spent his life in arguing for meant a revolution from the absolute to a relative point of view in the theory of knowledge. It was a protest against those who in theology "peremptorily require demonstration, and demand certainty where probability only is to be had." The practice of universal toleration amidst increasing religious differences was the most important application to the circumstances of his own age of the theory about human knowledge which pervaded his *Essay*. This paradox is now a commonplace, and the superabundant argument and irony in the *Letters on Toleration* fatigue the modern reader. The change of opinion is more due to Locke himself than to any one else. The rights of free thought and liberty of conscience had indeed been pleaded for, on various grounds, throughout the century in which he lived. Chillingworth, Jeremy Taylor, Cudworth, Glanvill, and other philosophical thinkers in the Church of England urged toleration in the state, in conjunction with a wide comprehension in the church, on grounds which implied intellectual limitation and even uncertainty in religious matters. Puritan Independents and Baptists, like Owen, Goodwin, and Richardson, whose idea of ecclesiastical comprehension was dogmatic and narrow, were ready to accept sectarian variety within the state, on the ground that it was possible to have many religions in the land, but only their own form within their sect. The existence of separate Christian nationalities, on the other hand, was the only justification of separate religious societies to the latitudinarian churchmen with whom Locke associated; in each nationality they would have a comprehensive church coextensive with the nation. Locke went far to unite in a higher principle what was best in the broad Anglican and in the Puritan theories, while he recognized the individual liberty which has ever distinguished the national church of England. (*a*) In his reasonings for toleration he insists on the fact that all human theologies must consist more of beliefs determined on presumptions of probability than of knowledge founded on what is either self-evident or demonstrable in the light of reason. A profound sense of the limits of human reason was at the bottom of his arguments for a tolerant comprehension by the state and also by the church. He had no objections to a national establishment of some form of religion, provided it was comprehensive enough, and was really the nation organized to promote goodness, and not to protect the metaphysical subtleties by which professional theologians spoil the original simplicity of Christianity. The recall of the national religion to this primitive simplicity, he hoped, would make toleration of nonconformists unnecessary, as few would then remain to ask for it. (*b*) The speculative, and therefore individually and socially harmless, nature of most persecuted beliefs and forms of worship is another point on which he insists. "No man is hurt because his neighbor is of a different religion from his own, and no civil society is hurt because its members are of different religions from one another." The more various our beliefs are, the more probable it becomes that a complete view of truth may by degrees be reached at last by the human race. In the meantime beliefs in religion concern the individual only and not society. To the atheist alone Locke absolutely refuses toleration, on the ground that the social bonds can have no hold over him, for "the taking away of God dissolves all." If atheism means the denial that reason is the ultimate regulative principle in the universe, then the consistent atheist without doubt "dissolves all," and must reject physical science even, as well as morality, in an absolute nescience, so that he is incapable of citizenship as one who is insane. In Locke's own philosophy, as we shall see, the existence of God is represented as demonstrable, but the distinctive articles of Christianity are founded only on presumptions of probability. He argued too against full toleration to the Church of Rome, at least in the circumstances of the age in which the Toleration Act was passed, on the ground of its allegiance to a foreign sovereign. (*c*) The unfitness of force as a means of sending the light of truth into a human mind is a third argument urged by Locke, founded on the psychology of human understanding. Persecution can only transform a man into a hypocrite; belief must be formed by individual discernment of evidence. Apart from evidence, a man cannot command his own understanding; he cannot determine arbitrarily what opinions he is to hold. Thus all Locke's pleas for a universal toleration resolve at last into a philosophical view of the limits and origin of knowledge.

II. The principles which determined Locke's social polity largely determined his way of looking at Christianity. His "latitudinarianism" was really the result of an extraordinary reverence for truth, and of his perception that in matters of religion knowledge may be sufficient for practice while it falls far short of perfection and demonstration. He insists on referring questions in religion to the reasoning individual, and never loses sight of the essential reasonableness of Christianity as the only ground on which it can rest. Locke accepted the Scripture as infallible with the reverence of a Puritan, but he did not, like so many Puritans, mean only Scripture as interpreted by himself. Confidence in Biblical infallibility was also combined in Locke with a distrust in the pretensions of "enthusiasm," which predisposed him to regard miracles as a criterion needed for distinguishing reasonable religious convictions from mere "inclinations, fancies, and strong assurances." Assent in religion as in everything else he could only justify on the grounds of its evident rationality; "illumination without search, and certainty without proof and without examination," was to him a sign of the absence of the divine spirit. Fanatical confidence that we are right, he would say, is no proof that we are right; when God makes us assent to the truth of a proposition in religion, he either discovers to us its intrinsic rationality by the ordinary means of scientific insight, or offers miraculous signs, of the existence of which we must have sufficiently probable presumption. Reasonableness somehow must at last be our guide. His own faith in Christianity rested on its moral excellence when it is rightly understood in its primitive simplicity, and on the extraordinary signs in nature which he believed to have accompanied its first promulgation. "Even in those books which have the greatest proof of revelation from God, and the attestation of miracles to confirm their being so, the miracles," he says, "are to be judged by the doctrine, and not the doctrine by the miracles." All this sort of argument became commonplace in books about the "evidences" in the 18th century. The *Reasonableness of Christianity* was an attempt to recall religion from verbal reasonings of theological schools, destructive of peace among Christians, to its original simplicity, but it no doubt involved an abatement of its transcendent mystery and ultimate incomprehensibility. The book was probably written to promote a comprehension of the dissenters. All who practically acknowledge the supremacy of Jesus as the Messiah accept all that is essential to the Christianity of Locke, whatever other theological opinions they may individually or collectively add to this only catholic one.

Christian teachers and apologists in the succeeding age, as well as the assailants of Christianity, alike appealed to the *Essay on Human Understanding*, and the catholic tradition of Anglican theology was thus interrupted in the church for more than a hundred years. His own Christian belief, sincere and earnest, was more the outcome of the sort of common sense sagacity which through him moulded the prudential theology of England in the 18th century, than of the nobler elements present in More, Cudworth, and other religious philosophers of the preceding age, or afterwards in Law and Berkeley, Coleridge and Schleiermacher.

III. Locke takes his place in the succession of great writers on the theory and art of Education. His educational writings might be regarded either as an immediate introduction to or as an application of the *Essay on Human Understanding*. In his *Thoughts on Education* imaginative sentiment is never allowed to weigh against prudential utilitarianism; information and mere learning are subordinated to the formation of character and practical wisdom; the part which habit plays in individuals is always kept in view; the dependence of conscious mind, which it is the purpose of education to improve, upon the health of the corporeal organism is steadily inculcated; to make those happy who are undergoing education is a favorite precept; accumulating facts in the memory without using the power to think, and without accustoming the youthful mind to apply reason to the evidence by which individual thoughts must be tested, is always referred to as the cardinal vice in teaching. Wisdom more than learning is what he requires in the teacher. In the knowledge to be communicated he gives the first place to "that which may direct us to heaven," and the second to "the study of prudence, or discreet conduct and management of ourselves in the several occurrences of our lives," which most assists our "quiet prosperous passage through this present life." The infinity of knowable existence in contrast with the narrowness of human understanding and experience is always in his thoughts. This "disproportionateness" is one reason given for due deliberation in the choice of studies, and for declining those which lie out of the way of a really wise man, however much they may have been favored by custom. Among these last he warns especially against "that maze of words and phrases which have been employed only to instruct and amuse people in the art of disputing, and which will be found perhaps, when looked into, to have little or no meaning, . . . words being of no value nor use but as they are the signs of things; when they stand for nothing they are less than ciphers, for instead of augmenting the value of those they are joined with, they lessen it and make it nothing." Knowledge of what the opinions of other men have been is another study which Locke depreciates. "Truth needs no recommendation, and error is not mended by it; in our inquiry after knowledge it little concerns us what other men have thought. . . . It is an idle and useless thing to make it one's business to study what have been other men's sentiments in matters where reason is only to be judge." Realism and individual rationality are two essential educational principles with Locke. In his *Conduct of the Understanding* the pupil is to be led to the point at which "a full view of all that relates to a question" is to be had, and at which alone a rational discernment of the truth is possible. The uneducated mass of mankind, on the contrary, either "seldom reason at all," or else "put passion in the place of reason," or "for want of large, sound roundabout sense" they direct their minds only to one part of the evidence, "converse with but one sort of men, read but one sort of books, and will not come in the hearing of but one sort of notions, and so carve out to themselves a little Goshen in the intellectual world, where light shines, and, as they conclude, day blesses them; but the rest of the vast *expansion* they give up to night and darkness, and avoid coming near it." It is a treatise on the wisdom needed for the management of the individual mind, so that it may overcome the *idola* or common tendencies to error against which Bacon had warned mankind. Hasty judgment, bias, or want of an *a priori* "indifference" to what evidence may require us to conclude, undue regard for authority or love for custom and antiquity, indolence and sceptical despair, are among the states of mind marked by him as most apt to interfere with the formation of our individual thoughts in harmony with the Universal Thought that is latent in nature. The development of vigorous intellect in each person is the aim of this admirable tract.

IV. The *Essay Concerning Human Understanding* contains Locke's Metaphysical Philosophy. It was the first attempt, on a great scale, and in the Baconian spirit, to show the certainty and inadequacy of human knowledge. This enterprise seemed to Locke to hold out the most reasonable hope of a solution of some sort for the perplexities which encompassed every department of inquiry.

The introduction to the *Essay* is the keynote to the whole. The ill fortune of mankind in their endeavors to comprehend themselves and their surroundings is there attributed to their disposition to extend their inquiries into matters beyond the reach of our intelligence, letting their thoughts wander into depths where we can have no footing. "Whereas, were the capacities of our understandings well considered, the extent of our knowledge once discovered, and the horizon found which sets the bounds between the enlightened and the dark parts of things, between what is and what is not comprehensible by us, men would perhaps with less scruple acquiesce in the avowed ignorance of the one, and employ their thoughts and discourse with more advantage and satisfaction on the other." To inquire into "the original, certainty, and extent of human knowledge, together with the grounds and degrees of belief, opinion, and dissent," is Locke's own account of the design of his *Essay*. He expressly excludes from his inquiry "the physical consideration of the mind,"—the natural causes (and, one might add, the transcendental reasons) for our conscious experience being what in his own "plain historical method" he might find it to be. He wanted to be able to make a faithful report, based on what he actually found, as to how far a merely human understanding of the universe can extend, to what extent human beings can share in pure knowledge, and "in what cases they can only judge and guess" on grounds of probability. Although his report might show that the knowledge attainable by the individual must be "narrow," and far short of a "universal or perfect comprehension of whatsoever is," it might also convince us that it is "sufficient," because "suited to our individual state." The "light of reason," the "candle of the Lord" that is set up in us, "shines bright enough for all our purposes. If we will disbelieve everything because we cannot certainly know all things, we shall do much as wisely as he who would not use his legs, but sit still and perish because he had no wings to fly." Locke thus opens his *Essay* in a tone which, with a more homely cheerfulness, reminds one in parts of the sublime conceptions of Pascal, and in others of the wise moderation of Bishop Butler. The outcome is that, if it should turn out on investigation that human understanding cannot solve the metaphysical problem of the universe, we may at least find that at no stage of our individual existence are we the sport of chance or of an evil power,—that there is a way by which we can secure our final wellbeing, even within the inexorable causal connections, conditioned by space and time, with their imperfectly calculable issues, by which we are environed.

The fourth book alone is concerned directly with the professed design of the *Essay*. It has been suggested by Stewart that Locke may have commenced with this book, especially as it contains few references to preceding parts of the *Essay*, so that "it might have been published separately without being less intelligible than it is." The inquiries in the preceding books are of a more abstract and scholastic nature, which probably opened gradually on his mind as he studied his subject more closely. The second and third books both relate to our individual ideas or thoughts. That each person has thoughts, and that without thoughts or consciousnesses there could be no knowledge for him, is Locke's postulate. This, he presumes, "will be easily granted;" for "every one is conscious of ideas in himself, and men's words and actions will satisfy him that they are in others." Questions about knowledge and its extent therefore presuppose questions about ideas or thoughts. But our mere ideas are, as Locke reminds us, "neither true nor false, being nothing but bare appearances in our own minds." Truth and falsehood belong only to the assertions or denials of the mind. The idea of a centaur has no more falsehood in it, when it appears in our minds, than the name centaur has falsehood in it when it is pronounced by our mouths, or written on paper. Truth and falsehood lie always in affirmations or negations, and the mere thoughts of which as individuals we happen to be conscious are not *per se* either true or false. They do not become either real knowledge or error "till the mind affirms or denies something of them."

That none of our knowledge is "innate" is the conclusion argued for in the First Book. But the drift of this famous argument has been overlooked by Locke's critics. It has been criticised as if it was a metaphysical discussion about the existence of transcendental elements in human knowledge, like that at issue in the present day between empiricism and intellectualism. If it were so it would be an example of the fallacy of irrelevant conclusion. For this Locke himself is no doubt partly responsible. It is not easy to determine who or what he had in view in this polemic. Lord Herbert alone is made prominent as the defender of innateness, and Locke was perhaps too little read in the literature of ancient and modern philosophy to do full justice to those who, from Plato downwards, have recognized the intuitions of reason as well as the phenomena of sense in the constitution of knowledge. The positions which he assails would have been disclaimed by the most eminent defenders of the transcendental elements. "Innate," as Lord Shaftesbury says, "is a word Mr. Locke poorly plays on,"—at least if he is to be understood as engaged in an intellectual struggle against Plato or Descartes. "The right word, though less used, is *connatural*. For what has birth, or the progress of the fœtus, to do in this case?" The real question, as Shaftesbury adds, is not about the time when the supposed innate knowledge entered, but "whether the constitution of man be such that, being adult and grown up, the ideas of (rational) order and administration of a God will not infallibly and necessarily spring up in him." But this Locke himself does not deny. "That there are certain propositions," we find him saying, "which, though the soul from the beginning, or when a man is born, does not know, yet, by assistance from the outward senses, and the help of some previous cultivation, it may afterwards come certainly to know the truth of, is no more than what I have affirmed in my first book" (see "Epistle to Reader," in second edition). This further appears from the fact that, although the *Essay* opens with an attack on innateness in human knowledge, yet the self-evidence, in the light of educated reason, of much that we know is asserted elsewhere not less strenuously. Much of our knowledge he reports in the fourth book to be reached by purely rational insight and demonstration. What he really argues against in the first book is that any of it should be supposed to have a claim to protection against a free criticism of its reasonableness. He argues there against the innateness of our knowledge of God and of morality; yet in the fourth book he reports, as a result of his search into our rational consciousness, in the "plain historical method," that the existence of God is a demonstrable rational conclusion, involved in that causal necessity without which there could be no knowledge at all; and he maintains in various places that morality may be found to be as demonstrably necessary as mathematics. The two positions are quite consistent. The demonstrable rational necessity of these and other sorts of knowledge often remains latent, he might say, in the share of reason that is potentially present in individuals, and therefore cannot be called "innate" knowledge; but, for all that, such truths "carry their own evidence along with them" in every mind that is rationally awake. Even in the first book he appeals to what might be called common reason, which he calls "common sense." "He would be thought void of common sense who asked, on the one side, or, on the other, went to give a reason, why 'it is impossible for the same thing to be and not to be.' It carries its own light and evidence with it, and needs no other proof; he that understands the terms assents to it for its own sake, or else nothing else will ever be able to prevail with him to do it" (bk. i. chap. 3, § 4). The truth is neither Locke nor the intellectualists of the 17th century expressed their meaning with enough of precision; if they had, Locke's first book would probably have taken a form more consistent with its true intention. It is really to be read as an energetic argumentative protest against anything in human knowledge being supposed to be independent of rational criticism. Locke believed that in attacking innate principles he was really substituting conscious self-evidence and rational demonstration instead of blind repose on authority, and was thus, as he says himself, not "pulling up the foundations of knowledge," but "laying those foundations surer." Truth is to be found in "the contemplation of things themselves," that is, by actual rational insight on the part of each individual. But when men heard of "some general propositions that could not be doubted as soon as understood," it was a short and easy way to conclude that such propositions are "innate," and that a personal perception of their rational self-evidence is unnecessary. This being once received, "it eased the lazy from the pains of search, and stopped the inquiry of the doubtful concerning all that was once styled innate." Dogmas became protected against rational criticism. "It was no small advantage to those who affected to be masters and teachers to make this the principle of principles—that principles must not be questioned." The mere assumption that they are "innate" was enough "to take men off the use of their own reason and judgment, and to put them upon believing and taking upon trust without further examination. . . . Nor is it a small power it gives a man over another to have the authority to make a man swallow that for an innate principle which may serve his purpose who teacheth them" (bk. i. chap. 4, § 24). Locke's examination of the way in which the rational consciousness of self-evident truths is actually reached refers them to "the being of things themselves duly considered, and to the application of those faculties that are fitted to receive and judge of them when duly employed." Thus the reasoning which runs through the first book is a return, in a more general and therefore more philosophical way, to that defence of individual rational insight against blind dependence on authority which was offered in the *Letters on Toleration*.

The Second Book opens with the suggestion of a general proposition regarding the genesis and constitution of ideas or thoughts; it closes after a labored endeavor to verify it. This hypothetical proposition is that all human thoughts, even the most complex and abstract, are due to "experience." If so, the significance of all abstract words, and the objective truth of all individual thoughts, must be tested by the elements of which "experience" consists, and cannot in any instance claim protection against this test.

The important point is what "experience" consists of. Locke says that it all comes either from external sources or from the mind itself; and he promises to show that even our most abstract thoughts, which seem to reach to infinity, may be traced to one or other or both of these constituents. In his own words, our most "complex ideas" are all made up of "simple ideas," either from without or from the mind; they are due to phenomena of which we are percipient in the five senses, or else due to reflection upon "the operations of mind." The "verification" of this position, in the central chapters of the second book, is to the effect that even those thoughts which are "most abstruse, how remote soever they may seem from sense, or from any operations of our minds, are yet only such as the understanding frames to itself by repeating and joining together ideas that it had either from objects of sense, or from its own operations about objects of sense,"—so that even large and abstract ideas are derived from one or other of the two sources (bk. ii. chap. 12, § 8). For this purpose our thoughts of space, time, infinity, power, substance, personal identity, causality, and several others which "seem most remote from the supposed original," are examined one after another, in the "historical plain method," and their complex constitution is resolved into (*a*) perceptions of things external, through the five senses, or into (*b*) perceptions of operations of our own minds.

The source of experience which depends upon the five senses Locke calls *sensation*; the other, through which mind is reflectively aware of its own operations, he calls *reflection*. This last, "though it be not sense, as having nothing to do with external objects," is yet, he says, "very like it, and might properly enough be called internal sense." The suggestion that "sense" might designate both the springs of experience is misleading, when we find in the sequel how much Locke tacitly credits "reflection" with,—in the way of rational tendencies and intellectual obligations; it may be objected to on grounds like those on which the somewhat analogous employment by Reid and others of "common sense" for common reason has been condemned. They both mean to say that we may call that "sense" in which reason *at once* carries the light of its own evidence, and does not even admit of external proof. Reason in its own evidence is thus analogous to what sense is popularly assumed to be. The elasticity of Locke's language in explaining his thesis makes the most opposite interpretations of the *Essay* possible, and all we can do is to compare one part with another, and in doubtful cases to give him the benefit of the doubt. His vacillation in the use of words is unfortunate. It was partly caused by a determination to avoid rigid technicality and pedantry. "Sensation" for instance is, in one definition, confined to "impressions or motions made in some part of the body which produce perceptions in the understanding" (bk. ii. 1, § 23); yet, when treated as one of the two springs of experience, it is made equivalent to what philosophers now call *sense-perception*, while "reflection" turns out to be another name for *self-consciousness*. Accordingly, although the second book is professedly limited to the examination of our ideas or thoughts only, it by implication makes the (provisional) assumption that the "ideas" of which we are conscious in "sensation" are at the same time to be regarded as "qualities" of sensible things which in some sort of way exist "without us," and also that the successive "operations" presented in "reflection" are those of an individual mind, presumed to exist somehow independently of them. Locke thus starts as a *common sense perceptionist*, and likewise relieves himself of the difficulty of having at the outset to show how the data abstracted by each sense are united in real things and persons. In order to make his theory work, he begins by assuming a *hypothetical duality* beneath phenomena,—some phenomena referable to external things, others referable to the conscious self,—and in fact confesses that this dual experience is *the* ultimate fact, the denial of which would make it impossible to speak about the growth and constitution of our thoughts.

In the early chapters of the second book, the "simple" thoughts into which he promises to resolve all possible "complex" ones are arranged in classes. Some of them, he reports, are conditioned "by one sense only," as colors by sight, or heat, cold, and solidity by touch; others "by more senses than one," as space or extension and motion, which are perceivable both by the eyes and by touch; a third class are got from reflection only, when "the mind turns its view inward upon itself," and by this means we get our ideas of perception or thinking itself, and also of willing, as well as the "modes of these two," such as remembrance, discerning, reasoning, knowledge, faith, etc.; lastly, there are simple ideas which we have both from sensation and reflection, for instance, our thoughts of bodily and mental pleasures and pains, as well as thoughts of existence, unity, power, and succession. Such, according to Locke, are the elements of the sublimest human thoughts. While the mind is becoming gradually stored with simple ideas like these (which are, however, somehow complex for us, when we "are conscious of them"), we find a growing power to elaborate them for ourselves at pleasure in an almost infinite variety; we are in fact obliged to do this in our tentative endeavors inductively to bring the thoughts of our individual minds into harmony with the actual complexity of thought that is presented to us in the order of nature. "But it is not in the power of the most exalted wit or enlarged understanding to invent or frame any new simple idea not taken in in one or other of these two ways," —in proof of which Locke would have any one try to fancy any taste which had never affected his palate, or to frame the thought of a scent he had never smelt; and when he can do this he is ready to concede that a born blind man has ideas of colors, and a born deaf man notions of sounds.

The contrast and correlation of these two fountains of individual experience is suggested in the eighth chapter of this book, on the "qualities" of matter, in which we are introduced to a noteworthy vein of speculation running through the *Essay*. A chapter on "qualities of things" looks like an interpolation in an examination of our individual thoughts; its relevancy appears when we remember Locke's provisional hypothesis, according to which simple ideas of sense may also be viewed as qualities of things. Now, our original sense-thoughts are, we find, partly revelations of *external things themselves* in their essential externality or extension, and partly *sensations*, boundless in their variety, which are somehow raised in us through contact with the things. Locke calls the former primary, original, or essential qualities of matter, and the others its secondary or derived qualities. The primary, which involve mathematical relations, and might be called quantities rather than qualities, are inseparable from matter as matter, and somehow exactly correspond, he reports, to the thoughts we have of them. On the other hand, there is nothing in the mathematical relations of space-occupying body which in the least resembles our ideas or thoughts of the secondary qualities; they are qualities of bodies at all, rather than sensations in us, only in so far as our different secondary sensations somehow correlate with (unknown) sizes, shapes, and motions of the primary particles, with which they are thus in an established harmony. Therefore, if there were no sentient and intelligent beings in existence, the secondary qualities would cease to exist,—except perhaps as unknown modes of the primary, or, if not, as "something still more obscure." On the other hand, "solidity, extension, figure, motion, and rest would be really in the world as they are, whether there were any sensible being to perceive them or not" (bk. ii. chap. 21, § 2). The outcome of what Locke teaches about the mutual relations of matter (*a*) known as occupied-space, and (*b*) known in and through the sensations caused by secondary or relative qualities, is that it is something capable of being expressed at once in terms of mathematical quantity or extension, and also in terms of sense-consciousness. A further step would have led to the conception of the correlative dependence of all the so-called qualities of bodies upon "the bulk, figures, number, situation, and motions of the solid parts of which they consist," and which "exist as we think of them whether or not they are perceived." The true conception of an individual body would then be a conception of the actual mathematical relations of the atoms of which it consists, regarded as the established "occasions" of the sensations of color, resistance, sound, taste, or smell which we refer to it as qualities; and also of the changes that it occasions in the atoms of which other individual bodies consist, which are followed by *their* operating on sentient beings differently from what they did before, as when the sun melts wax. But Locke only suggests in a hesitating way that the powers of bodies which are manifested in sensible changes *may* be conditioned by unknown changes in the mathematical relations of their insensible atoms, or, if not thus dependent upon them, conditioned by "something yet more remote from our comprehension." For, not knowing what size, figure, and texture of parts they are on which depend and from which result those qualities which make our complex idea, for example, of gold, "it is impossible *we* should know what other qualities result from, or are incompatible with, the same constitution of the insensible parts of gold, and so consequently must always coexist with that complex idea we have of it, or else are inconsistent with it."

Some of the most remarkable chapters in the second book are those which relate to the verification of its initial proposition. They carry us towards the metaphysical mysteries which so attract meditative minds. The hypothesis that our most complex thoughts are all resolvable into "experience" is tested in these chapters by the *modes* or *modifications*, and *substantiations*, and *relations* which, in various degrees of complexity, we find ourselves somehow obliged to make the simple phenomenal thoughts of sense and reflection undergo. Such, for instance, are the thoughts of finite quantity in space and time and number, in which Locke reports that we find ourselves mentally impelled towards immensity, eternity, and the innumerable, that is to say, towards Infinity, which transcends quantity; the complex thought of Substance, towards which he reports that we find ourselves impelled in another of the "operations of our minds," when the simple phenomena of the senses have to be regarded as powers or qualities of "something;" the thought of the Identity of individuals, involved in the apparently inconsistent idea of their constant phenomenal changes; and, above all, the mental tendency we find we somehow have to suppose what we call a "Cause" whenever we observe a change. Let us see how Locke deals with these crucial instances.

He dwells much on our ideas of Space, Succession, and Number. The first he says begins to appear when we use our senses of sight and touch; the second he finds "suggested" by all the phenomena of sense, but still more by "what passes in our minds;" the third is "suggested by every object of our senses, and every thought of our minds, by everything that either doth exist or can be imagined." The modifications of which these three sorts of simple ideas are susceptible he reports to be "inexhaustible and truly infinite, extension alone affording a boundless field to the mathematicians." In his own patient judicial way, he finds many curious analogies between space and time. Neither is limited by the world of individual things. We can imagine space without bodies, but we cannot perceive or imagine bodies without space. Places and periods are all relative to objects and events, but both space and time are absolutely indivisible. A trinal space extends in all directions, while time has only one dimension. All things exist in the same present time, while no two things occupy the same space. The parts of time cannot be thought to coexist; the parts of space cannot be thought to succeed one another. Whether the thought of unoccupied space is the thought of a substance or of an attribute Locke professes that he cannot tell, at least till they that ask show him "a clear distinct idea of substance."—But the real mystery which he has to report of these thoughts of space and time is that "something in the mind" hinders us from imagining any limit to either. We find ourselves, when we try, obliged to lose our positive thought of space in the negative thought of Immensity, and our positive thought of time in the negative thought of Eternity. We have never seen, and we cannot mentally imagine, an object whose extent is boundless. Yet we find when we reflect that there is an "operation of the mind" which somehow forces us to think that space and time *have no limits*. "I would fain meet with that thinking man that *can* in his thoughts set any bounds to space more than he can to duration" (§ 21). Thus Locke by implication acknowledges something added by the mind to the originally presented "simple ideas" of extension and succession, though he explains that what is added is not positively imaginable. When we reflect on our thoughts of immensity and eternity, we find them to be thoughts, yet negations of all imaginable thought; and that whether we proceed by addition or by division. He characteristically accepts the fact; he does not inquire *why* mind should find itself thus obliged to add without limit, and to divide without limit. He simply reports that immensity and eternity *are* inevitable negative ideas, and that every endeavor to transform them into positive or imaginable ones only issues in the contradictory attempt to represent as a bounded quantity what is really infinite or beyond quantity. The idea of the infinite, or unquantifiable in extent and in succession, has so far, he finds, "something that is resolvable into the simple positive ideas of space and time." For, when we try to think of the infinite in space or duration, we at first usually make some very large idea (imaginable in itself, though by men unimaginable), as perhaps of millions of miles or ages, which possibly we multiply millions of millions of times. All that we thus amass in our thoughts is positive (*i. e.*, imaginable in its nature, although not imaginable by a human mind). But at the end of this we are as far from the infinite reality as we were at the beginning, so that what lies beyond the imaginable idea *towards* the infinite lies "in obscurity, and has the indeterminate confusion of a negative idea"—irresistible and incomprehensible.

Locke, with all his aversion to what is unrepresentable in forms of coexistence and succession, is too faithful to rational facts to overlook those mysterious elements of our rational experience. His integrity is also illustrated in his acknowledgment of the unimaginable, and in this sense incognizable, in our thought of Substance. He tries to phenomenalize it; but he finds that it cannot be phenomenalized, and yet that we cannot dispense with it. An unsubstantiated succession of phenomena, without a centre of unity to which they are referable, is unintelligible; we could not have a language consisting only of adjectives. Locke had an obscure apprehension of this intellectual obligation as a fact of rational consciousness. According to his report, "the operations of the mind" oblige us to suppose something beyond phenomena, to which as qualities phenomena must belong; but he was honestly perplexed by the "confused negative" thought of this "something," which was all that he could reach, and of which he says we "neither have nor can have any positive idea either by sensation or reflection." The word substance thus means "only an uncertain supposition of we know not what" (i. 4, § 18). All attempts to realize it is like the attempt to realize immensity or eternity, and we are involved in an endless—inevitable yet incomprehensible—regress. If one were to ask *what* the substance is in which this color and that taste and smelling "inhere," and was told that they belong to the solid and extended parts, or primary qualities, of the thing, he must again ask what *their* substance is, and so on for ever. "He would be in a difficulty like the Indian, who, after saying that the world rested on an elephant, and the elephant on a broad-backed tortoise, could only suppose the tortoise to rest on 'something, *I know not what*.'" We must fail, in short, when we try either to phenomenalize our thought of substance or to dispense with it. He finds that our only positive complex ideas of substances are those in which we imagine an aggregate of attributes; it is only thus that we can rise to any positive thought even of God, in "the power we have of enlarging indefinitely some of the ideas we receive from sensation and reflection" (ii. 23, § 33). *Why* we must be in this strange mental predicament with regard to our thought of substance, Locke characteristically did not inquire. He reported the fact in his own "plain, historical way."

He struggled bravely to be faithful to facts in his report of the not unlike mental predicament in which we find ourselves when reflection awakens in us the conviction of our own Individuality and continued personal sameness. The paradoxes of expression in which he gets involved in the chapter on "personal identity" are evidence of this. He mixes the thought of our actual individual personality, given in our consciousness of something external to self, and above all in our moral experience of responsible agency, with the negative thought of the transcendental relation of substance, which, when we try to phenomenalize it, becomes "an uncertain supposition of we know not what."

But we must pass on to his report about our thoughts of Causality and Power, especially as his theory of real knowledge in the fourth book is very much an application of the principle of causality. The intellectual demand for the cause of an event is what we find we cannot help having, and yet it is a demand for what in the end we cannot grasp in a phenomenal representation. The causal thought in the form of power very much perplexed Locke, in his famed chapter on that idea (21); the perplexity is not so obvious in the sections on "cause and effect," in another chapter (26), where he considers only the circumstances in which this relational thought arises.

Locke traces the thought of "cause and effect" back to our "constant observation" that "qualities and finite substances begin to exist, and receive their existence" from other beings which produce them. Seeing, for instance, that, "in the substance which we call wax, *fluidity* is constantly produced by the application of a certain degree of heat, we somehow come to think of heat as the cause and fluidity as the effect." This is to report what happens in our minds when we observe a particular example of that causal connection which gives intelligibility to successive phenomena, converting them into the concatenated system which we call the universe. Through calculated observations we, in this way, learn that *this* is the cause of *that*, and that *such as this* is the cause of *such as that*. But Locke's words in the 26th chapter do not explain the rational need for this causal expectation. Anything, as far as "constant observation" tells us, might have been the cause of anything; no finite number of instances of an "observed" sequence—in the strict meaning of the term "observation"—can guarantee its universality. Elsewhere, indeed, he adds to this meagre account the important statement that "our clearest idea of power is got through our consciousness of our own voluntary agency, and therefore through reflection" (chap. 21). Bodily phenomena he there reports to be incapable of presenting originative agency, this being an idea which cannot be phenomenalized in external sense. In changes among bodies we observe no origination, but only phenomenal order—significant and therefore interpretable phenomena. The thought of the "production" of motions is connected with what we are conscious of when we exert volition. Locke here approaches the view of power afterwards taken by Berkeley, which was the constructive principle of Berkeleyan philosophy. But neither Locke nor Berkeley explains the transformation of our moral consciousness of ourselves, as free or originative, and therefore, to this extent, responsible agents, into the universal rational principle, on which both proceed in explaining our knowledge of the real existence of God and of the sensible world. Locke's language sometimes suggests that the transformation is made through an induction that is either instinctive or produced by custom. Now, not to say that every inductive generalization presupposes causal connection, the particular fact that this, that, or the other person, through his moral experience, finds *himself* a free cause, does not, consistently with inductive rules, warrant the *universal* conclusion that the phenomenal changes of the universe must all be referred to power like our own personal power. That we are somehow obliged to think a caused or phenomenal cause, and ultimately an uncaused or free agent, of every change—that we are obliged to view changes as events or issues from adequate productive causes into which they may be refunded—is vaguely accepted in the *Essay* as a fact of rational consciousness; but no explanation is given of its origin, only of the circumstances in which it arises in the individual mind. The inquisitive reader still asks why the individual mind is obliged to think back all changes into sufficient causes of which they are the issues, and why each set of antecedent phenomena, into which we thus refund new phenomena, themselves occasion a fresh intellectual demand for a preceding cause, while, after all, the mind is still left dissatisfied until it rests in a truly originative or unconditioned cause. And yet if the intellectual need for a phenomenal cause were withdrawn, there could be no rationality in, and therefore no reasoning possible about, Nature; for all the physical government of the universe depends upon it; and again, if uncaused or unconditioned power were withdrawn, there could be no moral responsibility or moral government. This sort of *reductio ad absurdum* of every merely empirical analysis of the causal thought into what is strictly observable was foreign to Locke. His aversion from mysticism may have made him pass slightly over the mystery of an experience that like ours is conditioned by relations of place, which lead to the unimaginable thought of Immensity, of succession, which lead to the unimaginable thought of Eternity, and of change, which lead to the unimaginable thoughts of Substance and Power.

Locke's book about our individual ideas or thoughts leads naturally to his Third Book, which is especially about those of them that are general and abstract, and their connection with language. It is here that he describes "abstract ideas;" here also he illustrates the confusion apt to be produced in our thoughts by the imperfections of language.

But we must pass on to the Fourth Book, about knowledge, which closes the *Essay*. Knowledge, he says, is perception or discernment of relations among our thoughts; real knowledge is discernment of their relations to what is objectively real. In his books about our "ideas" he had dealt with "simple apprehensions;" here he is concerned with "judgments" and "reasonings," and largely with judgments and reasonings about matters of fact. At the end of the long and patient research among our mere thoughts or simple apprehensions, he supposes his reader apt to complain that he has been "all this while only building a castle in the air," and to ask what the purpose is of all this stir about our thoughts, or our knowledge either, if we are not thereby carried beyond our own individual thoughts, and must accordingly regard our own fancies as the universe. "If it be true that knowledge lies only in the agreement or disagreement of our own ideas, the visions of an enthusiast and the reasonings of a sober man will be equally certain. It is no matter how things themselves are" (iv. 4, § 1). This is the keynote of the fourth book. It does not, however, carry him into an analysis of the rational constitution of knowledge as knowledge, as it would carry a transcendentalist of the 19th century, or even an associative philosopher. Transcendental analysis is too remote from human affairs to interest Locke. Hume, moreover, had not yet shown the difficulties which sceptical ingenuity could suggest against those facts of rational consciousness which Locke accepted without analysis. The sceptic who doubted the very constitution of reason and experience, because it could not be supported by external proof, was less in his view than minds blindly resting on authority or on irrational instincts. Universal scepticism like Hume's he would at any rate probably have regarded as a frivolous amusement, into which no human mind could permanently subside, and therefore unworthy of the serious attention of a wise man. What he wanted was to awaken a conscious conviction of principles apt to be dormant in the individual, but to which he believed a response must be given when reflection was called forth. He was careless as to how far these principles might be developed into a reasoned system of speculative philosophy. "Where we perceive the agreement or disagreement of any of our ideas there is *certain* knowledge; and wherever we are sure these ideas agree with the reality of things, there is certain *real* knowledge" (chap. 4, § 18). He is anxious throughout to show that a great deal of commonly supposed real knowledge is not entitled to be called "knowledge," and that it is merely presumption more or less probable. Instead of the immediate or the demonstrable insight, which alone is what he intends by knowledge, it is only "assent," "opinion," "probability,"

Locke's report about human knowledge and the narrow extent of it is contained in the first thirteen chapters of the fourth book. The remainder of the book is concerned for the most part with what he found when he examined instances of "assent" or reasonable presumption, so liable to error, but on which human life really turns, as he and Butler are fond of reminding all transcendentalists. He takes for granted that "all the knowledge we have or are capable of" must be discernment of one or other of four sorts of agreement or disagreement among our thoughts themselves, or between our individual thoughts and the reality that is independent of them. All that can be conceivably known must be either (*a*) relations of identity and difference in what we are conscious of, that, for instance, "blue is not yellow;" or (*b*) this thought being mathematically related to that, as, for instance, that "two triangles upon equal bases between two parallels must be equal;" or (*c*) that one quality does or does not coexist with another in the same substance, as that "iron is susceptible of magnetical impression;" or (*d*) that a thought has a real objective existence, independent of our individual mind, as that "God exists," or the "earth exists." What would now be called merely analytical knowledge exemplifies the first sort; mathematical (Locke would add moral) knowledge represents the second; physical and natural science, if this can become knowledge proper at all, would come under the third head; metaphysical knowledge forms the fourth. The third and several following chapters of this concluding book of the *Essay* are really an inquiry, under these four heads, how far knowledge is possible for man in mathematics, and in morality; about nature or natural phenomena in relations of coexistence and succession; and about the hyperphenomenal reality of our own existence, the existence of God, and the existence of matter.

Locke found a difference among the examples of what "knowledge" is that were offered in his natural experience. In some instances the known relation was at once evident, as when he judged that a circle was not a triangle, or three more than two and equal to one and two. In other cases the known relation was perceived only through the medium of something else, as in a mathematical conclusion, in which each step is taken by a rational intuition. The former is rationally intuited and the latter rationally demonstrated knowledge. In strictness all knowledge or rational certainty, he would have it, is in one or other of these two kinds. There is, however, a third sort of certainty which rather puzzled him. He found that "our perceptions of the particular existence of finite beings without us" go beyond mere probability, although they are not examples of rational necessity. There is nothing contradictory to reason in the supposition that our sense-perceptions are illusory, although we are, in fact, incapable of doubting their reality. We find ourselves "inwardly conscious of a different sort of perception," when we look on the sun by day and only imagine the sun at night. This, which is Locke's third sort of knowledge, might be called sense-perception. The difficulty that a "sense-perception" only of the present moment, divorced from the past and the future, can be other than "blind," or irrational, does not occur to him.

Locke next inquired to what extent a human knowledge —in the way either of intuitive or demonstrative rationality, or of sense perception—is possible in regard to each of the four (already mentioned) sorts of knowable relation in which must be contained all knowledge we can be supposed capable of. Our knowledge must of course be confined within our "ideas;" for it is self-evident that we cannot have knowledge of a thing if consciousness is dormant. But there is only one of the four sorts of knowable relation in regard to which our knowledge is coextensive with our thoughts. The only knowable relation which he finds to be coextensive with his thoughts is that of "identity and diversity;" we cannot be conscious at all without distinguishing, and every affirmation implies negation. The second sort of knowable relation—purely rational concatenation among our thoughts—is intuitively and also demonstrably discernible in thoughts about quantities, in forms of space, time, and number; it is through this discernment that the mathematical sciences are constructed. Morality too, Locke thinks, as well as quantity, is capable of being thus rationalized. "Where there is no property there is no injustice," he offers as an example of a proposition "as certain as any demonstration in Euclid." Only we are more apt to be biassed, and thus to have reason withdrawn from us, in dealing with problems of morality than in dealing with those of mathematics. Mankind might in consequence, in questions of morals, "with Egyptian darkness expect Egyptian bondage, were not the candle of the Lord set up by himself in their minds" (ch. 4, § 20). It is not easy to say whether the mathematics and morality which Locke finds thus demonstrable would be, as understood by him, sciences of what Kantists call analytical judgments founded on arbitrary definitions, or sciences consisting of synthetical judgments *a priori*.

In turning from mathematical and moral relations to those of coexistence and succession among phenomena,— Locke's third sort of knowable relation,—he finds the light of pure reason disappear, although the relations in question are those in which "the greatest and most important part of what we desire to know" consists. Of relations of this third kind, with which all the physical and natural sciences are concerned, he reports that "our knowledge is very short, if indeed we have any at all," and are not wholly thrown on presumptions of greater or less probability, or even left in ignorance. According to the philosophy of the *Essay* "there can be no science of bodies." All physical and natural science depends on a knowledge of the relations between the secondary qualities and other powers of bodies on the one hand, and the primary or mathematical qualities of their atoms on the other, or else "on something yet more remote from our comprehension." Now, as a rational insight of these relations, either intuitively or through demonstration, is beyond our reach, we must be satisfied with inductive presumptions, which the completest "verification" leaves, after all, only presumptions that more facts might prove to be unwarranted. Our inductive generalizations about particular things must always involve an element of possible error, or at least inadequacy, and therefore of probability only. Arbitrariness of connection, and not rational necessity, reigns over the whole realm of physical government, with its relations of constant coexistence and succession; we only presume, as reasonably as we can, what its actually established laws are, and we can only presume that these laws are sustained in a steady and uniform government. The presumption is "sufficient for our purposes."

The amount of our knowledge under Locke's fourth category of knowable relations—those of real metaphysical or metaphenomenal existence—is reduced, in his report, to —(*a*) rational perception of our own individual existence as conscious persons; (*b*) the demonstrable rationality of the existence of God or Supreme Mind; and (*c*) sense-perception of the existence of particular objects—as long as, but only as long as, they are actually present in sense. That each individual person exists is manifested to himself in memory, and no certainty beyond that of each passing thought while it passes can be greater than this. "If I doubt all other things," says Locke, after Descartes, "that very doubt makes me perceive my own existence, and will not suffer me to doubt of that" (iv. 9, 3). The eternal existence of God or Supreme Reason is with Locke only another way of expressing the principle of causality and sufficient reason in its universality, as suggested by our conviction that our own personal existence had a beginning. Each individual person knows that he now exists, and is convinced that he once had a beginning; with not less intuitive certainty of reason he knows that "*nothing* can no more produce any real being than it can be equal to two right angles." The final rational conclusion is that there must be eternally "a most powerful and most knowing Being, in which, as the origin of all, must be contained all the perfections that can ever after exist," and out of which can come only what it has in itself, so that, as the adequate cause, it must involve mind. There is thus a rational necessity for Eternal Reason, or what we call God. He cautiously adds elsewhere, "Though I call the thinking faculty in me 'mind,' yet I cannot, because of that name, equal it in any thing to that infinite and incomprehensible Being which, for want of right and distinct conceptions, is called 'mind' also, or the eternal mind."

Turning from the metaphysics of religion to the metaphysics of matter, nearly—but perhaps not quite—all that one can affirm or deny about things external to us is, according to Locke, not knowledge but only presumptive trust. We have on the whole no knowledge of the real existence of anything other than our own individual existence, that of Universal Reason, and that of particular objects of sense—while, but only while, they are present to our senses. "When I see an external object at a distance, a man for instance, I cannot but be satisfied of his existence while I am looking at him. (Locke might have added that when one thus "sees a man" it is only his *visible* qualities that are perceived; for his other qualities are as little 'actual present sensations' as if he was out of the range of the senses altogether.) But when the man leaves me alone, I cannot be certain that he still exists. There is no necessary connection between his existence a minute since (when he was present to my sense of sight) and his existence now (when he is absent from all my senses); by a thousand ways he may have ceased to be. I have not that certainty of his continued existence which we call knowledge; though the great likelihood of it puts it past doubt. But this is but probability and not knowledge" (chap. 11, § 9). Either a rationally intuitive or a rationally demonstrative science of Nature is thus, according to Locke, impossible. A conception of the coexistences and successions of phenomena which form the external world being essentially the natural expression of the Universal Mind, and therefore capable of being reasoned about by our individual minds, in our gradual scientific progress towards agreement between the objective thought in nature and our subjective thoughts, was too speculative and mystical for Locke. He prefers to urge the matter-of-fact consideration that all our interpretations of nature can be only presumed probabilities—not purely rational certainties. For him the vast region of reality—beyond our immediate sense-perceptions, memory, and the demonstrably necessary causal connection with the Universal Mind—is either presumed probability, grounded on faith, or else it is within that veil which separates what is behind it from reasonable belief as well as from knowledge. And he even fails to explain how anything at all above the world of sense can be "known" in a sense-perception that is restricted to the transitory "actual present sensation" of each moment. No past events and no future events can be *known* in the strict meaning of "knowledge." It is unreasonable to demand a knowledge of more than abstract propositions and present momentary experiences. For the rest, we can only gradually convert beliefs into certainties that are absolute for all practical purposes. Such is the outcome of the *Essay*.

We might expect to learn from Locke something as to the rationale of the probable presumptions by which, as supplementary to our limited knowledge of real existence, we pass beyond the narrow sphere within which that knowledge is confined, according to his report of it, and possess ourselves so far of the unperceived past, distant and future, in our experimental reasonings. He does little to satisfy us here. The concluding chapters of the fourth book contain judicious advice for human beings, whose lives are passed in a world of probabilities and presumptions, for avoiding the consequent risks of error or misinterpretation in their reasonings about what they see,—with or without the help of syllogism, the function of which, as an organ of discovery, he criticises in the seventeenth chapter. Nothing is done to connect "probable" interpretations of the contingent phenomena of existence with the rational relations involved in the knowable part of its constitution, with which the preceding chapters were occupied.

This subject was resumed by Hume, very much at the point where Locke left it. With a still humbler view of the possible extent of human knowledge than Locke's, Hume proposed as a subject "worthy of curiosity," to inquire what is "the nature of that evidence which assures us of any real existence and matter of fact, beyond the present testimony of our senses and the records of our memory," remarking that "this part of philosophy has been little cultivated either by the ancients or the moderns." The result of the inquiry was his announcement that Custom and the associative tendencies are a sufficient practical explanation of the formation of our experience. All beyond each present transitory "impression" is connected with it, through "ideas," by means of Custom and Association. Hume's solvent, in the form either of individual or of inherited associative tendency, has since been made the philosophical explanation of all human experience in the Empirical Philosophy to which his *Inquiry* conducted. As for Locke, the "association of ideas"—either in the individual or as inherited—was not alluded to in the first edition of the *Essay*. The short chapter on the subject—now found at the end of the second book—was introduced in the second edition, not as in any way philosophically explanatory either of the thoughts or of the knowledge and probable beliefs of men, but as the chief source of human prejudices—as a cause of human errors against which men, dependent largely on probable presumptions, need in an especial manner to be warned. This useful chapter was an afterthought *caveat*, regarding a tendency which Locke saw was apt to spoil the "quality" of our individual thoughts,—apt, if one may put it so, to make them inconsistent with the Universal Thought latent in nature, by which our personal thoughts about what the laws in nature are must be tested.

On the other hand, an analysis like Kant's of what is abstractly implied in knowledge is even more foreign to the design of Locke, and to the tone of his philosophy, than the attempts of 18th and 19th century associationists and evolutionists to account for knowledge as if it were a fact of physical science. To show, in the case of any self-evident conception or judgment, that without it knowledge could not exist at all, would be to show what Locke took for granted for all the purposes he had in view. His aim was to determine to what extent experience, presumed to be rationally constituted, could come within the individual consciousness of man. On the one hand, to analyze in the abstract the rational constitution of knowledge, into which he found that man is able only very partially to subdue the universe, or, on the other hand, to seek for the physical causes of its (partial) realization in the human individual, were neither of them inquiries properly included in his enterprise.

Locke's function was to present to the philosophical mind of the modern world, in his own "historical plain method," the largest assortment ever made by any individual of the actual facts of sense consciousness and rational consciousness in man. The further investigation of these facts, in Germany on the Transcendental Method, in England and France on the Empirical Method, as well as, by Butler and Reid, in Locke's own Common Sense Method—all under the stimulus of Hume's sceptical analysis—has employed philosophers since the *Essay on Human Understanding* collected materials for speculation.

Literature.—The *Essay concerning Human Understanding*, which was thus the philosophy of Locke's own life, and also of the century which followed, has passed through more editions than any similar book of ancient or modern times. Before the middle of the 18th century it had reached a thirteenth, and it has now passed through some forty editions, besides being translated into Latin, French, Dutch, German, and modern Greek in various versions. There are also several abridgments, in which the attempt is made to remove some of its innumerable repetitions. A considerable philosophical library might be formed out of the criticisms and comments to which it has given rise in the last hundred and ninety years. In addition to those which appeared when Locke was alive, some of which are mentioned above, among the most important are Leibnitz's *Nouveaux Essais sur l'Entendement Humain*—written about 1700, and published in 1765, in which each chapter of the *Essay* of Locke is examined in a corresponding chapter; Cousin's "École Sensualiste: Système de Locke," in his *Histoire de la Philosophie au XVIII. Siècle*, 1829; and the recent criticisms in Professor Green's Introduction to the *Philosophical Works of Hume*, 1874. The *Letters on Toleration*, *Thoughts on Education*, and *Reasonableness of Christianity* have also gone through many editions, and been translated into different languages. The first collected edition of Locke's *Works* was in 1714, in three folio volumes. The best edition is that by Bishop Law, in four quartos, 1777. The one most commonly known is in ten volumes, 1812. The *Essay*, as well as the other treatises, needs textual revision and critical annotation.

The *Éloge* of Le Clerc (*Bibliothèque Choisie*, 1705) has been the basis of the memoirs of Locke prefixed to the successive editions of his *Works*, and contained in the biographical dictionaries. In 1830 a *Life of Locke*, in two volumes, was published by his descendant Lord King. This adds a good deal to what was previously known, as Lord King was able to draw from the mass of correspondence, journals, and commonplace books of Locke in his possession. In the same year Dr. Thomas Foster published some interesting letters from Locke to Benjamin Furley. The most copious account of the details of Locke's life is contained in the two volumes by Mr. Fox Bourne (1876), which are the results of laborious and faithful research in the Shaftesbury Papers, Locke MSS. in the British Museum, the Public Record Office, the Lambeth, Christ Church, and Bodleian libraries, and in the Remonstrants' library at Amsterdam. (A. C. F.)

LOCKHART, JOHN GIBSON (1794–1854), was born in the manse of Cambusnethan in Lanarkshire, where his father, Dr. Lockhart, was minister. His mother was daughter of the Rev. John Gibson, minister of St. Cuthbert's, Edinburgh. In 1796 his father was transferred to Glasgow, where John Lockhart was reared and educated. He derived his rare abilities from his mother, and his first regular teaching from the High School of Glasgow. He appears to have been from the first distinguished as a clever, but by no means industrious boy. Like most clever boys he read everything that came in his way; and what he had once devoured he never forgot; for his memory was so retentive that, in after life, like Macaulay and Sir George Lewis, he seldom found it necessary to verify a passage for quotation. No livelier boy than John Lockhart ever lived; in or out of school his sense of fun and humor, expressed in joke, sarcasm, and pencil caricatures, was irrepressible. At the same time, however merry and mischievous, he was a proud and reserved boy; and this was the side he mostly turned to the outer world as a man. The struggle between a very affectionate nature and a determination not to show his feelings, or perhaps an incapacity to give way to them, cost him dear. A younger brother and sister were carried off within a few days of each other. John appeared to bear the loss like a stoic, but he fell seriously ill, and had to be removed finally from the High School. On his recovery, though still under twelve years of age, he was entered at college, where he sketched the professor for the amusement of his companions, as he had sketched the masters before. When examination time came, he astonished all by a display of erudition, especially in Greek authors, of the acquisition of which he had given no signs; a Snell exhibition, just vacant at Oxford, was accordingly offered to him and accepted.

Lockhart was not turned fourteen when he was entered at Balliol College, but he soon asserted his character and his powers. His fun and satire made him at once popular and formidable, while beyond the regular studies of the place he acquired a great store of extra knowledge. He read French, Italian, German, and Spanish, was curious in classical and British antiquities, and well versed in heraldic and genealogical lore. Lockhart went up to the schools in the Easter term of 1813—not nineteen years of age—and, notwithstanding the most audacious employment of part of his time in caricaturing the examiners, he came out first in classics. The name of Henry Hart Milman, a subsequent friend through life, stood next his. For mathematics he never had the least inclination.

He now quitted Oxford, and before settling to the study of Scottish law, for which his father had designed him, he indulged a long cherished wish to visit Germany. His knowledge of German had introduced him to the great band of poets and scholars who had suddenly exalted the fame of German literature. Lockhart had no means to undertake the journey; but here his reputation came to his aid. A proposal to translate Frederick Schlegel's *Lectures on the Study of History* was accepted by Mr. Blackwood, and the price of the labor paid before a line was written. Lockhart always spoke of this as a most generous act on "Ebony's" part, and his friendship with the liberal publisher lasted through life. He meanwhile paid his visit to Germany, was introduced to Goethe at Weimar, traversed France and the Netherlands, made careful observations on pictures and architecture, and returned to Edinburgh to study law by the time he was twenty-one. In 1816 he was called to the bar. But he had no friends among writers and attorneys, his brilliant powers of conversation did not comprise that of public speaking, and few, if any, briefs came in. His habits of observation, however, turned the time to a use afterwards exemplified in *Peter's Letters*.

Edinburgh was then the stronghold of the Whig party. The *Edinburgh Review* was their organ, and it was not till 1817 that the Scotch Tories found a national channel of assertion and defence—namely, in *Blackwood's Magazine*. This periodical held its way dully enough with its first numbers, when suddenly an outburst of wit and ridicule directed against the hitherto unchallenged writers of the Whig party, surpassing them in cleverness and equalling them in personalities, electrified the Edinburgh world. Wilson (Christopher North), Hogg (the Ettrick Shepherd), and Lockhart had joined the staff, and retaliation for long pent-up wrongs began. Lockhart's pen contributed scholarly papers on various subjects, including hearty criticism and eulogium on Coleridge, Wordsworth, and other victims of a *Review* which could find only scant praise even for Walter Scott. His translations also of the Spanish ballads appeared for the greater part in *Blackwood*. But his pen was more often dipped in caustic, dealing out attacks and recriminations which led to regretable consequences. Meanwhile the gifted and handsome young man, for Lockhart's head was cast in the highest type of brilliant manly beauty, had attracted the notice of Walter Scott. They met first in 1818. The acquaintance soon ripened into friendship, and that friendship led to the union between Lockhart and Scott's eldest daughter, Sophia, in April, 1820. For more than five years after his marriage Lockhart tasted the best form of domestic happiness. Winters spent in Edinburgh and summers at a cottage fitted up for them at pretty Chiefswood, near Abbotsford, gave the young couple the constant enjoyment of friendship, society, and even worldly distinction, added to the blessing of a perfect home. At Chiefswood Lockhart's two eldest children, John Hugh and Charlotte, were born; Walter, later, at Brighton.

Between 1818, when he joined the *Blackwood* staff, and 1825 Lockhart's pen was indefatigably at work. As early as 1819 *Peter's Letters to his Kinsfolk* appeared. Like Goldsmith's *Citizen of the World*, these profess to give the impressions of a stranger in a new country. Dr. Peter Morris, a Welsh physician, passes some time in Scotland, especially in Edinburgh, and describes the men and manners very freely to his relations at home. His descriptions of the chief notabilities of the day have a certain historical, almost antiquarian interest, though now the least interesting part of the work. What we enjoy most is the reflection of a young and ardent mind dealing out opinions and estimates far beyond its years, the correctness of which time has singularly verified. The amount of reading too which crops out in every page is amazing; a perpetual play of allusions, quotations, and happy nicknames—for which Lockhart to his last days was famous—is given with a raciness of tone of which the reader might tire, but for the simple, vigorous English in which it is clad. A chapter on dandies is a *chef d'œuvre* in its way. That a work describing the appearance and idiosyncrasies of many living individuals should give offence was a matter of course. His description of the northern universities was not likely to please; while for the unsparing ridicule and ruthless quizzing heaped on the General Assembly—"men," he is supposed to have said, "of like passions with ourselves, but worse manners"—it would be strange indeed if the author had escaped with impunity.

Valerius, a Roman Story, followed next (1821). As *Valerius* was intended to illustrate the manners and customs of Rome in the time of Trajan, so *Reginald Dalton*, published in 1823, aimed at exhibiting the life of an undergraduate at Oxford as he had known it. Lockhart's strength did not lie in novel writing, and, to those who read *Reginald Dalton* now, the digressions of the author are far more interesting than the adventures of the hero. But a plot of simpler construction and intenser passion showed Lockhart's strength to greater advantage. *Adam Blair* (1822) is a tale of temptation, fall, and repentance, each fearful in its way, told with tremendous power, and as far removed from all that is morbid and false in sentiment as the author was himself. It gave great offence to the Scottish Church, for the erring man is a minister, and the scene is laid in a Scottish manse.

In 1826, on the death of Mr. Gifford, the editorship of the *Quarterly Review* was offered to Lockhart, and accepted. He was singularly free in position, however far from idle. He was next heir to Milton Lockhart, the property of his unmarried half-brother, who eventually survived him; the legal profession to which he had been destined was virtually abandoned; and time had shown him that the party strife which prevailed in Edinburgh was demoralizing to both sides. This last conviction did the most to reconcile him to the separation from all Scottish surroundings. His friends gave him a farewell dinner, when, laboring with strong feelings, and with his habitual dislike or incapacity to express them, he said, on returning thanks, "You all know that I am no speaker; had I been, there would have been no occasion for this parting."

The conduct of a great periodical like the *Quarterly Review* is the touchstone of a man's capacity, knowledge, and temper. Looking back to an editorship which lasted twenty-eight years, it must be admitted that Lockhart maintained a high position in all these respects. He contributed largely to the *Review* himself, his biographical articles being especially admirable. He also found time, being a very glutton in work, for many a paper in *Blackwood*; he wrote what remains the most charming of the biographies of Burns; and he undertook the superintendence of the series called *Murray's Family Library*, which he opened in 1829 with a *Life of Napoleon*. But his chief work was the *Life of Walter Scott*, a task at once of love and duty. Lockhart knew the great and good man as no one else did, and felt that, whatever the mistakes in judgment, no life from first to last could better afford complete revelation. There have not been wanting those in Scotland who have taxed him with ungenerous exposure of his subject, but to most healthy minds the impression conveyed by the biography was, and is, one of the most opposite kind—namely, that Lockhart has almost deified Scott. The labor incurred was in so far one of love, inasmuch as the writer reaped no part of its considerable proceeds, but resigned them absolutely for the benefit of Scott's creditors.

Lockhart's life in London was a long succession of constant work, of dignified social success, and of heavy bereavements. His eldest boy, the suffering "Hugh Littlejohn" of the *Tales of a Grandfather*, died in 1831. Sir Walter died in 1832; Anne Scott, the second daughter, who had come to live with the Lockharts in London, in 1833; Mrs. Lockhart in 1837. The love for his children was for long the one bright element in his life. But the death in 1852, and, sadder still, the previous life, of his surviving son Walter, a fine youth, who had entered the army under unfortunate auspices, broke down all that remained of health and spirit in the father.

Failing health compelled Lockhart to resign the editorship of the *Quarterly Review* in 1853. He spent the next winter in Rome, but returned to England with no restoration of vital power. He was conveyed to Abbotsford, where, under the tender care of his daughter Mrs. Hope Scott, and cheered by the prattle of his grand-daughter, now the possessor of Abbotsford, he lingered till his death, November 25, 1854. He was buried in Dryburgh Abbey, at the feet of Walter Scott. (E. E.)

LOCKPORT, capital of Niagara county, New York, about 21 miles east of Niagara Falls, at the point where the New York Central Railroad crosses the Erie canal. It takes its name from the locks (ten in number) by which the canal is lowered 66 feet from the level of Lake Erie to that of the Genesee river; and its prosperity as a manufacturing centre is due to the water-power. The surrounding country is a rich agricultural district, and in the vicinity are extensive limestone and sandstone quarries. Flour-mills are prominent among the industrial establishments; there are also numerous saw-mills, cotton and woollen factories, foundries, etc. Lockport was made a city in 1865. The population in 1870 was 12,426; in 1880, 13,522. The buildings in the business part of the city are generally heated by steam on the Holly distributing system, which originated in Lockport, as did the celebrated Holly water-works system.

LOCLE, LE, a large town-like village of Switzerland, in the canton of Neuchatel, 10 miles W. N. W. from Neuchatel. Along with La Chaux de Fonds, 5 miles north-east, it is the seat of the most extensive watch-making industry in the world; and it also carries on the domestic manufacture of lace. The valley in which Le Locle is situated used to be subject to inundation, but in 1802–6 a tunnel was constructed by which the surplus waters of the Bied discharge into the Doubs. About a mile to the west of the town the stream plunges into a deep chasm, and on the almost vertical face of the rock are what are usually called the subterranean mills of Cul des Roches, situated one above the other, to turn the water-power to account. The population of the commune was 10,464 in 1880.

LOCRI, a people of Greece who are found in two different districts, on the Ægean coast opposite Eubœa and on the Corinthian Gulf between Phocis and Ætolia. The former are divided into the northern Locri Epicnemidii, so called from Mount Cnemis, and the southern Locri Opuntii, whose chief town was Opus; but the name Opuntii is applied to the whole district by Thucydides, Herodotus, etc. Homer knows no distinction of tribes among the Locri. They were considered by Aristotle to be a Lelegian tribe; but they became Hellenized at an early time, and rank in Homer along with the other Greek tribes before Troy. Their national hero is Ajax Oileus, who often appears on coins. The Locri Ozolæ on the Corinthian Gulf were a rude and barbarous race who make no appearance in Greek history till the Peloponnesian War. It is said that they separated from the eastern Locri four generations before the Trojan war, but Homer does not mention them. The most probable view is that the Locri were once a single race spread from sea to sea, that subsequent immigrations forced them into two separate districts, and that the eastern Locri advanced with the growth of civilization, while the remote Ozolæ remained ignorant and barbarous.

A colony of Locrians, probably Opuntians, though Strabo expressly calls them Ozolæ, settled at the south-west extremity of Italy about the end of the 8th century B. C. They are often called Locri Epizephyrii from the promontory Zephyrion 15 miles south of the city. The earliest and most famous event recorded in the history of the Italian Locri is the legislation of Zaleucus about the middle of the 8th century B. C. The Locri boasted that Zaleucus was the first of the Greeks to promulgate a written code of laws. A body of laws under his name existed in the city throughout the historical period, but the name of Zaleucus is almost as much surrounded with legend as that of Lycurgus. The Locrians are said to have defeated the people of Crotona in a great battle at the Sagras, perhaps some time in the 6th century B. C., and in this flourishing period they founded colonies along the south coast of the peninsula. Their nearest neighbor was Rhegium, and the continual wars that raged between the two cities often drew other states into their quarrels. They sent ships to aid Sparta in the Lacedæmonian war. They were allied with the elder Dionysius of Syracuse, who gave them great accessions of territory (389–88 B. C.); the younger Dionysius ruled them as tyrant (356 B. C.). They admitted a Roman garrison before the expedition of Pyrrhus, but sided against the Romans with him and with Hannibal (216 B. C.). The town was finally captured by Scipio (205 B. C.). From this time we hear little of Locri. It seems still to have existed in the 6th century A. D., but in the Middle Ages it had disappeared entirely. The site and remains have been described by the Duc de Luynes (*Ann. Inst. Arch.*, ii.). It possessed a famous temple of Proserpine. The town is celebrated by Pindar, *Ol.* x. and xi.

LOCUS, in Greek *τόπος*, a geometrical term, the invention of the notion of which is attributed to Plato. It occurs in such statements as these:—The locus of the points which are at the same distance from a fixed point, or of a point which moves so as to be always at the same distance from a fixed point, is a circle; conversely a circle is the locus of the points at the same distance from a fixed point, or of a point moving so as to be always at the same distance from a fixed point; and so in general a curve of any given kind is the locus of the points which satisfy, or of a point moving so as always to satisfy, a given condition. The theory of loci is thus identical with that of curves; and it is in fact in this very point of view that a curve is considered in the article CURVE; see that article, and also GEOMETRY (ANALYTICAL). It is only necessary to add that the notion of a locus is useful as regards determinate problems or theorems: thus, to find the centre of the circle circumscribed about a given triangle ABC, we see that the circumscribed circle must pass through the two vertices A, B, and the locus of the centres of the circles which pass through these two points is the straight line at right angles to the side AB at its mid-point; similarly the circumscribed circle must pass through A, C, and the locus of the centres of the circles through these two points is the line at right angles to the side AC at its mid-point; thus we get the ordinary construction, and also the theorem that the lines at right angles to the sides, and their mid-points respectively, meet in a point. The notion of a locus applies, of course, not only to plane but also to solid geometry. Here the locus of the points satisfying a single (or onefold) condition is a surface; the locus of the points satisfying two conditions (or a twofold condition) is a curve in space, which is in general a twisted curve or curve of double curvature.

LOCUST. In its general acceptation this term is strictly applicable only to certain insects of the order *Orthoptera*, family *Acrydiidæ* (see INSECTS); and it is advisable to reiterate that according to modern classification the family *Locustidæ* is now viewed in a sense that does not admit of what are popularly termed "locusts" being included therein. We universally associate with the term the idea of a very destructive insect; therefore many orthopterous species that cannot be considered true locusts have had the term applied to them: in North America it has even embraced certain *Hemiptera-Homoptera*, belonging to the *Cicadidæ*, and in some parts of England cockchafers are so designated. In a more narrow definition of the term we are wont to associate with the destructive propensities the attribute of migration, and it therefore becomes necessary that a true locust should be a migratory species of the family

Acrydiidæ. Moreover, the term has yet a slightly different signification as viewed from the Old or New World. In Europe by a locust is meant an insect of large size, the smaller allied species being ordinarily known as "grasshoppers," hence the notorious "Rocky Mountain locust" of North America is to Eastern ideas rather a grasshopper than a locust.

In Europe, and a greater part of the Old World, the best known migratory locust is that which is scientifically termed *Pachytylus migratorius*, to which is attached an allied (but apparently distinct) species known as *P. cinerascens*. Another locust found in Europe and neighboring districts is *Caloptenus italicus*, and still another, *Acrydium peregrinum*, has once or twice occurred in Europe (even in England in 1869), though it can only be considered a straggler, its home (even in a migratory sense) being more properly Africa and Asia. These practically include all the locusts of the Old World, though a migratory species of South Africa known as *Pachytylus pardalinus* (presumed to be distinct from *P. migratorius*) should be mentioned. The Rocky Mountain locust of North America is *Caloptenus spretus*, and in that continent there occurs an *Acrydium* (*A. americanum*) so closely allied to *A. peregrinum* as to be scarcely distinct therefrom, though there it does not manifest migratory tendencies. In the West Indies and Central America the absolutely true *A. peregrinum* is also reported to occur.

As to general biology, a few words will suffice. The females excavate holes in the earth in which the eggs are deposited, regularly arranged in a long cylindrical mass enveloped in a glutinous secretion. The young larvæ hatch, and immediately commence their destructive career. As these insects are "hemimetabolic" (see INSECTS), there is no quiescent stage; they go on increasing rapidly in size, and as they approach the perfect state the rudiments of the wings begin to appear. Naturally in this stage they are incapable of flight, but their locomotive powers are nevertheless otherwise extensive, and their capacity for mischief very considerable, for their voracity is great. Once winged and perfect, these powers become infinitely more disastrous, redoubled by the development of the migratory instinct. The laws regulating this instinct are not yet perfectly understood. Food and temperature have a great deal to do with it, and there is a tendency for the flights to take a particular direction, varied by the physical circumstances of the breeding districts. So likewise it is certain that each species has its area of constant location in which it always exists, and its area of extraordinary migration to the extremes of which it only occasionally extends. Perhaps the most feasible of the suggestions as to the causes of the migratory impulse is that locusts naturally breed in dry sandy districts in which food is scarce, and are thus impelled to wander in order to procure the necessaries of life; but against this it has been argued that swarms bred in a highly productive district in which they have temporarily settled will seek the barren home of their ancestors. Another ingenious suggestion is that migration is intimately connected with a dry condition of the atmosphere, urging them to move on until compelled to stop for food or procreative purposes. The distance particular swarms may travel depends upon a variety of circumstances, such as the strength of impulse, the quantity of food, and many other causes. Certain it is that 1000 miles may, in particular cases, be taken as a moderate estimate; probably it is often very much less, certainly sometimes very much more. As a rule the progress is only gradual, and this adds vastly to the devastating effects, which may be likened to those caused by a foreign army levying black-mail upon the inhabitants of an invaded country through which it is marching. When an extensive swarm temporarily settles in a district, all vegetation rapidly disappears, and then hunger urges them on another stage. Such is their voracity that it has been tolerably well ascertained that the large Old World species, although undoubtedly phytophagous, are often compelled by hunger to attack at least dry animal substances, and even cannibalism has been asserted as an outcome of the failure of all other kinds of food. The length of a single flight must depend upon circumstances. From certain individual peculiarities in the examples of *Acrydium peregrinum* that were taken in England in 1869, it has been asserted that they must of necessity have come direct by sea from the west coast of Africa; and what is probably the same species has been seen in the Atlantic at least 1200 miles from land, in swarms completely covering the ship, and obscuring the air; thus, although it is no doubt usual for the swarms to rest during the night, it undoubtedly happens in certain cases that flight must be sustained for several days and nights together. The height at which swarms fly, when their horizontal course is not liable to be altered by mountains, has been very variously estimated at from 40 to 200 feet, or even in a particular case to 500 feet. A "dropping from the clouds" is a common expression used by observers when describing the apparition of a swarm. The extent of swarms, and the number of individuals in a swarm, are matters that must of necessity be purely speculative. That the sun may sometimes be utterly obscured, and the noise made by the rustling of the wings be deafening, is confirmed by a multitude of observers. We prefer to decline the attempt to grapple with so vast a subject,—not unnaturally so when one observer says of a particular swarm that, when driven out to sea and drowned, the dead bodies washed up formed a bank 50 miles long and 3 or 4 feet high.

No special periodicity appears to have governed these flights (which, it is necessary to state, happily do not occur to an alarming extent every year), still an American writer (Mr. Thomas) makes the interesting remark that the interim between the years of superlatively extraordinary appearance is both in Europe and America "very nearly a multiple of 11."

In Europe the best known and ordinarily most destructive species is *Pachytylus migratorius* (fig. 1), and it is to it that the numerous records of devastations in Europe mainly refer, but it is probably not less destructive in many parts of Africa and Asia. Eastern Europe, and especially the plains of southern Russia, appear to be more especially liable to its attacks. That the arid steppes of Central Asia are the home of this insect appears probable; still much on this point is enveloped in uncertainty. In any case the area of permanent distribution, according to Köppen (who published an elaborate memoir on the subject in 1871), is enormous, and that of occasional distribution is still greater. The former area extends from the parallel of 40° N. in Portugal, rising to 48° in France and Switzerland, and passing into Russia at 55°, thence continuing across the middle of Siberia, north of China to Japan; thence south to the Fiji Islands, to New Zealand, and North Australia; thence again to Mauritius and over all Africa to Madeira. But Köppen remarks that the southern distribution is uncertain and obscure. Taking exceptional distribution, it is well known that it occasionally appears in the British Isles, and has in them apparently been noticed as far north as Edinburgh; so also does it occasionally appear in Scandinavia, and it has probably been seen up to 63° N. in Finland. Looking at this vast area, it is easy to conceive that an element of uncertainty must always exist with regard to the exact determination of the species, and in Europe especially is this the case, because (as before stated) there exist an apparently distinct species, known as *P. cinerascens*, which Köppen does not take into account. This latter species is certainly the most common of the "locusts" occasionally found in the British Isles, and De Selys-Longchamps is of opinion that it breeds regularly in Belgium, whereas the true *P. migratorius* is only accidental in that country. In the case of this, as of all other locusts, it is impossible within the limits of this article to chronicle even the years of greatest abundance. That they are probably as destructive now as formerly appears within the bounds of belief. At any rate we read that a year or two ago a detachment of Russian soldiers in Turcomania was so beset that a stampede at last took place, and eventually the men were held prisoners by the insects forty-eight hours until the villagers killed them and carried them away for manure, locomotion being as difficult as if the men had been on ice.

Acrydium peregrinum (fig. 2) can scarcely be considered even an accidental visitor to Europe; yet it has been seen in the south of Spain, and, most extraordinarily, in many examples spread over a large part of England in the year 1869. It is a larger insect than *P. migratorius*. No serious attempt to define the range of this species has yet been made, but there is every reason to believe that it is the most destructive locust throughout Africa and India and other parts of tropical Asia, and its ravages are not one whit less important than are those of *P. migratorius*. Presumably it is the species that, on more than one occasion, has been noticed in a vast swarm in the Atlantic, very far from land, and presumably also it occurs in the West Indies and some parts of Central America. But it has been already remarked that *A. americanum* of North America, although so closely allied as to be scarcely distinguishable, is said not to be migratory, and is therefore scarcely a true "locust." In the Argentine Republic a (possibly) distinct species (*A. paranense*) is the migratory locust.

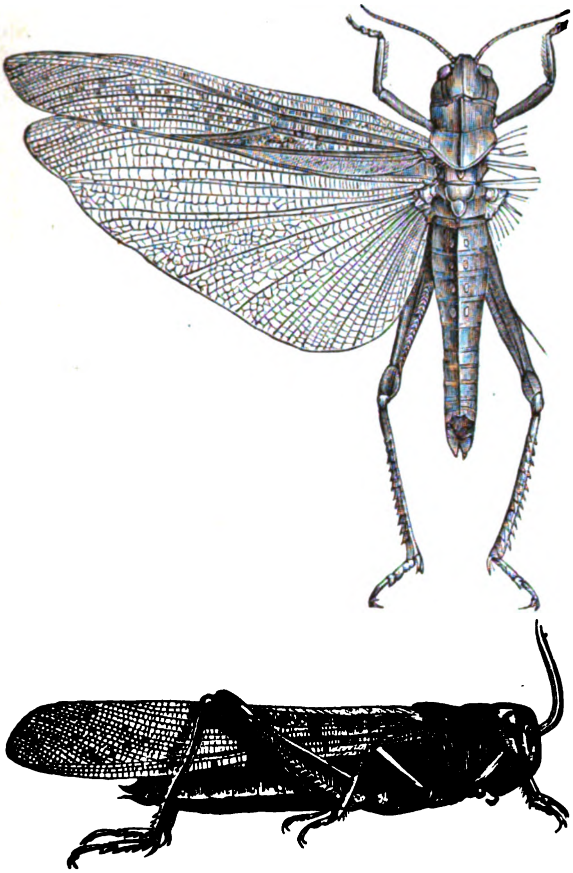

FIG. 1.—*Pachytylus migratorius*.—This and the other figures are all natural size.

Caloptenus italicus (fig. 3) is a smaller insect, with a less extended area of migration; and, though from this cause its ravages are not so notable, still the destruction occasioned in the districts to which it is limited is often scarce less than that of its more terrible allies. It is essentially a species of the Mediterranean district, and especially of the European side of that sea, yet it is also found in North Africa, and appears to extend far into southern Russia.

Caloptenus spretus (fig. 4) is the "Rocky Mountain locust" or "hateful grasshopper" of the North American continent. Though a comparatively small insect, not so large as some of the grasshoppers of English fields, its destructiveness has procured for it within the last twenty years a notoriety scarcely excelled by that of any other. It is only recently that the persistent migration of American settlers westward extended into the home of this creature. Travellers and prospectors in these regions had previously spoken of enormous swarms of a destructive grasshopper as existing there, and no doubt these occasionally extended into regions already civilized, but the species was not recognized as distinct from some of its non-migratory congeners to which it is so closely allied as to require a practised entomological eye to separate it therefrom. As time drew on, the various "State entomologists" made it their special duty to report on the insect, and at length, in 1877, the matter had become so serious that Congress appointed a United States Entomological Commission to investigate the subject, and to report upon the best (if any) means of counteracting the evil effects of the pest. The result, so far as published, consists of two enormous volumes, teeming with information, and taking up the whole subject of locusts both in America and the Old World. *C. spretus* has its home or permanent area in the arid plains of the central region east of the Rocky Mountains, extending slightly into the southern portion of British North America; outside this is a wide fringe to which the term sub-permanent is applied, and this is again bounded by the limits of only occasional distribution, the whole occupying a large portion of the North American continent; but it is not known to have crossed the Rocky Mountains westward, or to have extended into the eastern States.

As to remedial or preventive measures tending to check the ravages of locusts, little unfortunately can be said, but anything that will apply to one species may be used practically with all. One point is certain; direct remedies must always be of small avail. Something can be done (as is now done in Cyprus) by offering a price for all the egg-tubes collected, which is certainly the most direct manner of attacking them. Some little can be done by destroying the young larvæ while yet in an unwinged condition, and by digging trenches in the line of march into which they can fall and be drowned or otherwise put an end to. Infinitesimally little can be done with the winged hordes having the migratory instinct upon them; starvation, the outcome of their own work, probably here does much. It has been shown that with all migratory locusts the breeding places, or true homes, are comparatively barren districts (mostly elevated plateaus); hence the progress of civilization and colonization, with its concomitant necessity for converting those heretofore barren plains into areas of fertility, may (and probably will) gradually lessen the evil.

Locusts, like all other animals, have their natural enemies. Many birds greedily devour them, and it has many times been remarked that migratory swarms of the insects were closely followed by myriads of birds. Predatory insects of other orders also attack them, especially when they are in the unwinged condition. Moreover, like all other insects, they have still more deadly insect foes as parasites. Some attack the fully developed winged insect.

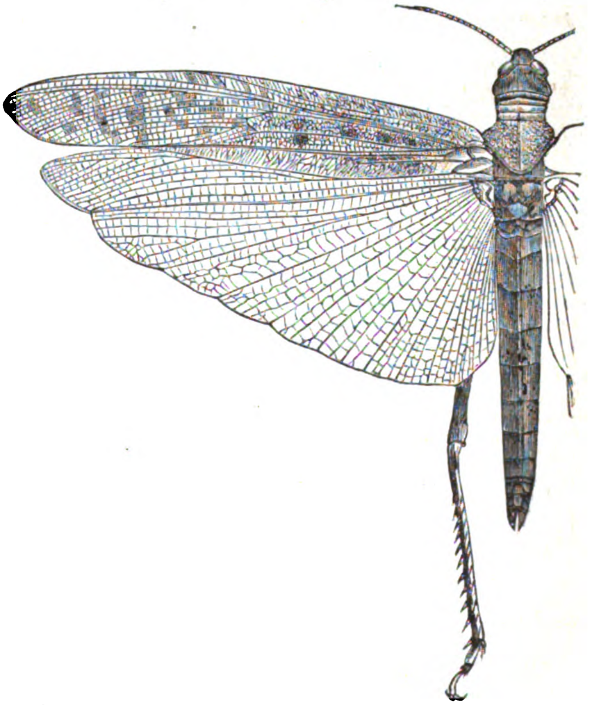

FIG. 2.—*Acrydium peregrinum*.

But the greater part adopt the more insidious method of attacking the eggs. To such belong certain beetles, chiefly of the family *Cantharidæ*, and especially certain two-winged flies of the family *Bombyliidæ*. These latter, both in the Old and New World, must prevent vast quantities of eggs from producing larvæ. Popular ignorance on this subject is yet great, and within a few months before this article was written it was exemplified in a remarkable manner by a suggestion from the Government officials of Cyprus that a certain parasite known to be destructive to the eggs in Asia Minor might be introduced into the island, a suggestion immediately followed by the discovery that what is probably the same parasite already existed there.

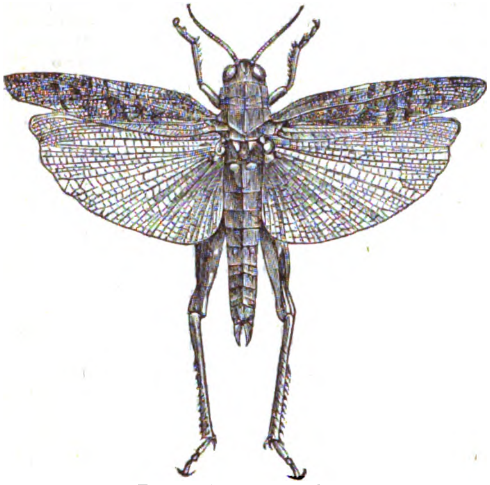

FIG. 3.—*Caloptenus italicus.*

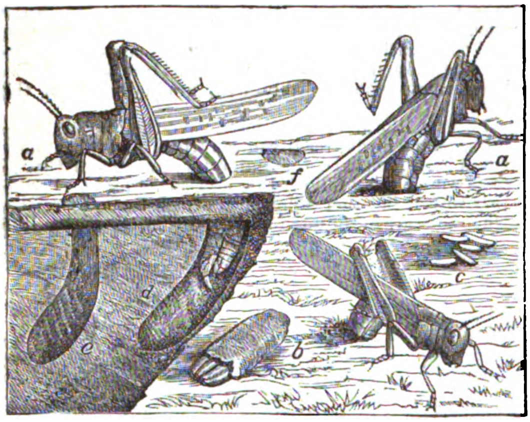

FIG. 4.—Rocky Mountain Locust (*Caloptenus spretus*). *a*, *a*, *a*, female in different positions, ovipositing; *b*, egg-pod extracted from ground, with the end broken open; *c*, a few eggs lying loose on the ground; *d*, *e* show the earth partially removed, to illustrate an egg-mass already in place, and one being placed; *f* shows where such a mass has been covered up. (After Riley.)

A flight of locusts would appear not to be always an unmixed evil, even to man. The larger Old World species form articles of food with certain semi-civilized and savage races, by whom they are considered as delicacies, or as part of ordinary diet, according to the race and the method of preparation.

Literature.—Kirby and Spence, *Introduction to Entomology*, 7th ed. London, 1856; Köppen, "Die geographische Verbreitung der Wanderheuschrecke," in *Geograph. Mittheilungen*, vol. xvii., 1871; Gerstäcker, *Die Wanderheuschrecke*, Berlin, 1876; *Reports of the United States Entomological Commission on the Rocky Mountain Locust*, by Riley, Packard, Thomas, and others, 2 vols., Washington, 1878–80. (R. M'L.)

LOCUST-TREE, *Ceratonia Siliqua*, L., the carob-tree, of the tribe *Cassieæ* of the order *Leguminosæ*, is the sole species, widely diffused spontaneously and by cultivation from Spain to the eastern Mediterranean regions, and from Egypt to Bornou in Central Africa (Hogg, Hooker's *Journ. of Bot.*, i. 113), and imported to Hindustan (Graham, p. 254). It differs from all leguminous plants by the dilated disk to the calyx. It has no petals, and flowers are polygamous or diœcious. The legume is compressed, often curved, indehiscent, and coriaceous, but with sweet pulpy divisions between the seeds, which, as in other genera of the *Cassieæ*, are albuminous. The pods are eaten by men and animals, and in Sicily a spirit and a syrup are made from them. These husks being often used for swine are called swine's bread, and are probably referred to in the parable of the Prodigal Son. It is also called St. John's bread, from a misunderstanding of Matt. iii. 4. The carob-tree was regarded by Sprengel as the tree with which Moses sweetened the bitter waters of Marah (Exod. xv. 25), as the *kharrûb*, according to Avicenna (p. 205), has the property of sweetening salt and bitter waters. Gerard (*Herball*, p. 1241) cultivated it in 1597, it having been introduced in 1570 (Loudon's *Arb.*, ii. 660). For various names, extent of distribution, historical references, etc., see Pickering's *Chron. Hist. of Pl.*, p. 141.

LODÈVE, capital of an arrondissement of the department of Hérault, France, lies at an elevation of 674 feet, under a range of hills rising to 2790 feet, in a small valley where the Soulondré joins the Lergue, a tributary of the Hérault, 34 miles east-north-east from Montpellier. A bridge over the Lergue connects the town with the faubourg of Carmes on the left bank of the river, and two bridges over the Soulondré lead to the extensive ruins of the Château de Montbrun. There is railway communication with Agde by a line following the Hérault valley. The old cathedral of St. Fulcran, founded by him in 950, was rebuilt in the 14th century and restored in the 16th; the cloister, dating from the 15th century, is ornate in style. In the picturesque environs of the town stands the well-preserved monastery of St. Michel de Grammont, dating from the 12th century; it is now used as farm buildings. In the neighborhood are three fine dolmens. Lodève is one of the most important industrial centres of the south of France, upwards of 7000 workmen being employed in the manufacture of woollens for army clothing; the aggregate horse-power of the factories is 1500. Wool is imported in large quantities from the neighboring provinces, and from Morocco; the exports are cloth to Italy and the Levant, wine, brandy, chemicals, and wood. The population in 1876 was 10,528.

Luteva existed prior to the invasion of the Romans, who for some time called it *Forum Neronis*. The inhabitants were converted to Christianity by St. Flour, first bishop of the city, about 323. After passing successively into the hands of the Visigoths, the Franks, the Ostrogoths, the Arabs, and the Carlovingians, it became in the 9th century a separate countship, and afterwards the domain of the bishops of Lodève. During the religious wars it suffered much, especially in 1573, when it was sacked. It ceased to be an episcopal see in 1789.

LODGE, THOMAS (*c.* 1556–1625), dramatist, novelist, pamphleteer, poet,—but *not* player,—was born about the year 1556 at West Ham, and was possibly the son of a namesake, shortly afterwards lord mayor of London. He was educated at Trinity College, Oxford, and then entered as a student at Lincoln's Inn, where, as in the other Inns of Court, a love of letters and a crop of debts and difficulties alike grew as matters of course. Thus already as a young man he preferred the looser ways of life and the lighter aspects of literature. When the penitent Stephen Gosson had (in 1579) published his *Schoole of Abuse*, Lodge took up the glove in his *Defence of Poetry, Music, and Stage-plays* (1579 or 1580), which shows some of the moderation as well as of the learning befitting a scholar and a gentleman. The publication was, however, prohibited, besides being answered by Gosson in his *Playes Confuted in Five Actions*, as by a man sure of his ground if not of his cause. Having fleshed his pen, Lodge displayed a strong inclination for continuing its use. In 1584 he published his *Alarum Against Usurers*, a pamphlet to which he no doubt gave the benefit of his personal experience, and in which he mentions the fate of his previous literary venture. Soon after this his years of wandering seem to have begun. It is clear that their primary cause lay in the straits to which he had been reduced, or had reduced himself; that he ever took so bold a leap into disreputableness as to become an actor is improbable in itself, and the assertion which has been made to that effect has been shown to rest on something less satisfactory than conjecture. Lodge joined Captain Clarke in his raid upon Terceira and the Canaries, and seems, in 1591, to have made another similar voyage with Cavendish. During the former expedition, he, to beguile the tedium of his voyage, composed his prose tale of *Rosalynde, Euphues' Golden Legacie*, which, published in 1590, afterwards suggested the story of *As You Like It*. The novel, which in its turn owes some, though no very considerable, debt to the *Tale of Gamelyn*, is a pleasing example of the Euphuistic manner, but proves how slight an advance an individual author of secondary rank is able to effect in a branch of composition of which the genius of his age has not taken hold. In the year before (1589) Lodge had already given to the world a volume of poems, including the delectable *Scillaes Metamorphosis*. One would gladly resign this and much else of Lodge's sugared verse, together with some of his perfumed prose, for the lost *Sailor's Kalender*, in which he must after some fashion have told of his sea adventures. During the last decade of the century he produced a *farrago* of literary products—a Juvenal, if not a very "Young Juvenal," at least in the readiness of his wit and in the robustness of his moral indignation. In conjunction with Greene he produced, in a popular vein, the odd but far from feeble play of *A Looking Glasse for London and England*. Probably about the same time he wrote his *Tragedy of the Wounds of Civil War lively set forth in the True Tragedies of Marius and Sylla* (published 1594), a good second-rate piece in the fashion of its age, and deficient neither in rhetorical nor in comic vigor. His *Life and Death of William Longbeard* (1593), and his *History of Robin the Divell*, are among his contemporary non-dramatic works; to which should be added *Phillis* (1593), a collection of lyrical pieces, and a *Fig for Momus* (on the strength of which he has been rather loosely termed the earliest English satirist). In his later years,—possibly about 1596, when he published his *Wits Miserie*, which is dated from Low Leyton, and the prose *Prosopopeia* (if, as seems probable, it was his), in which he repents him of his "lewd lines" of other days,—he was engaged in the practice of medicine, for which he is said to have qualified himself by a degree at Avignon. His works henceforth have a sober cast, comprising a translation of Josephus (1602) and another of Seneca (1614), besides a *Treatise of the Plague* (1603), and a popular manual, still in manuscript, on *Domestic Medicine*. He was abroad on urgent private affairs of one kind or another in 1616, from which time to his death from the plague, in 1625, nothing further concerning him remains to be noted. His life is one of those which attract the curiosity of the literary student, who knows that it is precisely in the mental and moral phases and experiences of able and active men devoid of original genius, such as he, that much of the history of an age of literature is to be read.

Lodge's works have not yet been completely reprinted, though the satisfaction of this want may no longer be far distant. His *Rosalynde* is accessible in Hazlitt's *Shakespeare's Library* (vol. ii.) and elsewhere. Its relation to Shakespeare's comedy is exhaustively discussed in an essay by Delius in the *Jahrbuch* of the German Shakespeare Society (1871). Other works of his are scattered through the publications of the old Shakespeare, the Hunterian, and possibly other Societies; lists of them will be found in the edition of *Glaucus and Silla*, etc., printed at the Chiswick Press in 1839, in Hazlitt, and elsewhere. The question, *Was Thomas Lodge an Actor?* has been set at rest by Dr. C. M. Ingleby in his pamphlet bearing that title (1868), of which the main conclusion is embodied in this notice.

(A. W. W.)

LODI, a city of Italy, in the province of Milan, lies on the right bank of the Adda, in 45° 18′ N. lat. and 9° 30′ E. long. The site of the city is an eminence rising very gradually from the Lombard plain, and the surrounding country is one of the richest dairy districts in Italy. A rather plain and ungainly cathedral (1158) with a huge lateral tower, the church dell' Incoronata erected by Bramante in 1476, the Palazzo Modegnani with a fine gateway in the style of Bramante, the episcopal palace dating from 1202, and the great hospital with its cloistered quadrangle, are the most noteworthy buildings. Besides an extensive trade in cheese (Lodi making more Parmesan than Parma itself) and other dairy produce, there are manufactures of linen, silk, majolica, and chemicals. The population of the city in 1871 was 18,537.

The ancient Laus Pompeia lay about 5 miles west of the present city, and the site is still occupied by a considerable village, Lodi Vecchio. In the 11th century, according to Landulphus Junior, Lodi was second to Milan among the cities of northern Italy. A dispute with the archbishop of Milan about the investiture of the bishop of Lodi (1024) proved the beginning of a bitter and protracted feud between the two cities. In 1111 the Milanese laid the whole place in ruins and forbade their rivals to restore what they had destroyed, and in 1158, when in spite of this prohibition a fairly flourishing settlement had again been formed, they repeated their work in a more thorough manner. A number of the Lodigians had settled on Colle Eghezzone and their village, the Borgo d'Isella, soon grew up under the patronage of Frederick Barbarossa into a new city of Lodi. At first subservient to the emperor, Lodi was before long compelled to enter the Lombard League, and in 1198 it formed alliance offensive and defensive with Milan. The strife between the Sommariva or aristocratic party and the Overgnaghi or democratic party was so severe that the city broke into two distinct communes. The Overgnaghi, expelled in 1226, were restored by Frederick II. who took the city after three months' siege. During the rest of the Guelf and Ghibelline struggle, and down to the beginning of the 16th century, the annals of Lodi are crowded with stirring events, connected for the most part with the general troubles of the country. In the main it was dependent on Milan. The duke of Brunswick captured it in 1625 in the interests of Spain; and it was occupied by the French (1701), by the Austrians (1706), by the king of Sardinia (1733), by the Austrians (1736), by the Spaniards (1745), and again by the Austrians (1746). On 10th May, 1796, was fought the battle of Lodi between the Austrians and Napoleon, which made the latter master of Lombardy.

LODZ (*Lodzi*), a town of Russian Poland, in the province of Piotrokow, lies 40 miles by rail to the north of the chief town of the province, on a branch railway of the line between Warsaw and Vienna. Only a small hamlet with 800 inhabitants in 1821, when its woollen manufactures were first introduced by Germans, it is now the second town of Poland, both by population and by the importance of its cotton-mills, the annual production of which amounts to a value of about £150,000, that is, five-sixths of the whole production of cottons in Poland. This, as well as the other less important industries of the place (woollen cloth manufacture, dyeing, and so on), is chiefly in the hands of Germans, and thus the German language predominates in the town. Although its population in 1872 amounted to 50,500, Lodz still maintains its village character, consisting of one broad street 7 miles long, on which are situated alike the factories, the houses of the merchants, and the dwellings of the working men.

LOFOTEN AND VESTERAALEN, a "fogderi" or bailiwick in the "amt" of Nordland, Norway, consists of a large and picturesque group of islands lying north-east and south-west off the north-west coast of Norway, between 67° 30′ and 69° 20′ N. lat., and between 12° and 16° 35′ E. long. The extreme length of the group from Andenæs, at the north of Andö, to Röst, is about 130 English miles; the aggregate area amounts to about 1560 square miles, supporting a permanent population of about 20,000. It is separated from the mainland by the Vestfjord, Tjældsund, and Vaagsfjord, and is itself divided into two sections by the Raftsund between Hindö and Öst-Vaagö: to the west and south of the Raftsund lie the Lofoten Islands proper, of which the most important are Öst-Vaagö, Gimsö, Vest-Vaagö, Flakstadö, Moskenæsö, Mosken, Värö, and Röst; east and north of the Raftsund are the islands of Vesteraalen, the chief being Hindö, Ulvö, Langö, Skogsoö, and Andö. The islands, which are all of granite or metamorphic gneiss, are precipitous and lofty; the highest peaks are in the Lofoten group, Vaagekallan on Öst-Vaagö rising directly from the sea to a height of 3090 feet. The channels which separate them are narrow and tortuous, and generally of great depth; they are remarkable for the strength of their tidal currents, particularly the Raftsund mentioned above, and the once famous Malström or Moskenström between Moskenæs and Mosken. Though situated wholly within the Arctic Circle, the Lofoten and Vesteraalen group enjoys a climate that cannot be called rigorous when compared with that of the rest of Norway. The isothermal line which marks a mean January temperature of 32° F. runs south from the Lofotens, passing a little to the east of Bergen onwards to Gothenburg and Copenhagen. The prevailing winds are those from the south and west; the mean temperature for the year is 38°·5 F., and the annual rainfall is 43·34 inches. In summer the hills have only patches of snow, the snow limit being about 3000 feet. The natural pasture produced in favorable localities permits the rearing of cattle to some extent; but the growth of cereals (chiefly barley, which here matures in ninety days) is insignificant. A few potatoes are planted. The islands yield no wood. The great and characteristic industry of the district, and an important source of the national wealth, is the cod fishery which is carried on along the east coast of the Lofotens in the Vestfjord from January to April. It employs about 18,000 men from all parts of Norway; the annual take of cod amounts to an average of twenty millions, worth on the spot about £250,000. The fish, which is dried during early summer, is exported principally to Spain (where it is known as bacalao), but also to Holland, Sweden, and Belgium. Other industries arising out of the fishery are the manufacture of cod-liver oil and of artificial manure. The summer cod fisheries and the lobster fishery are also valuable. The herring is frequently taken in large quantities off the west coasts of Vesteraalen, but is a somewhat capricious visitant. The bailiwick contains no towns properly so called, but Kabelvaag on Öst-Vaagö and Svolvær on a few rocky islets off that island are considerable centres of trade and (in the fishing season) of population; Lödingen also, at the head of the Vestfjord on Hindö, is much frequented as a port of call. Regular means of communication are afforded by the steamers which trade between Hamburg or Christiania and Hammerfest, and also by local vessels; less accessible spots can be visited by means of boats, in the management of which the natives are adepts. There are some roads on Hindö, Langö, and Andö. The largest island in the group, and indeed in Norway, is Hindö, with an area of 864 square miles. The south-eastern portion of it belongs to the amt of Tromsö. In the island of Andö there is a bed of coal at the mouth of Ramsaa which is likely to prove ultimately of some practical value.

LOG. The ordinary log for ascertaining the speed of a ship consists of four parts, viz., the log-glass, log-line, log-reel, and log-ship. The word log may have been derived from the fact that a piece of wood was thrown overboard, to lie as a log in a fixed position, motionless; now the same name is applied to many contrivances and ingenious inventions for indicating directly, or for registering, the ship's progress through the water.

Though such information now appears to be so essential, nay, imperatively necessary to the safe conduct of a ship, it is a fact that no such simple means as the log and line was devised before the 17th century, or the subject even thought of theoretically before 1570. At least nothing can be found in ancient writings, or even in the works professedly treating upon navigation, till after 1620, while, on the contrary, various passages occur from which we may fairly infer that there was nothing better at the command of the mariner than a rough unassisted estimate. The work of Martin Cortes (Seville, 1556), after giving much valuable information for that day, including a description and use of the cross-staff, astrolabe, etc., a table of the sun's declination, with much else, makes no other reference to the ship's motion through the water than this,—the pilot must estimate the distance, making allowance for the effects of winds and currents, every day, and as the estimation "is imperfect, especially in a long voyage and long time, it is convenient that he should rectify his position by the corresponding position of the heavens." Mr. J. Tapp, who published a translation and improved edition of Martin Cortes fifty-three years after (1609), made no alteration in that part of the work.

In 1578 William Bourne published *Inventions and Devices*. There are one hundred and thirteen subjects treated of, many of them highly interesting, as they contain the crude germ of useful inventions. The twenty-first device is a close approach to Massey's self-registering log, which was found so useful two hundred and sixty years later. The credit of the device is ascribed to Humfray Cole; the probable date is 1570. The proposal was to have a "little small close boat" with a wheel, or wheels, and an axletree, to turn clock-work in the little boat, with dials and pointers to indicate respectively fathoms, leagues, scores of leagues, and hundreds of leagues. If a small screw rotator had been used instead of a wheel, this might have been a great success. It was only a suggestion, perhaps untried; and in common with seamen and writers about that time the author allows only 5000 feet to a mile. Edward Wright's *Certain Errors in Navigation Detected and Corrected* (1610) gives much new and useful information, but the nearest allusion to the ship's speed is in the part translated from the Spanish of Roderigo Samorano, under the head of finding the ship's place on the chart, called the "point of imagination." "This point doth presuppose the knowledge of two things: to wit, the rhumb by which we have sailed, and that is known by the compass, and the leagues which we have run; and this hath no certainty, but is a little more or less than a good mariner according to his imagination supposeth that he hath sailed; whereof the said point took its name." In 1624 an edition of Gunter by Edward Weaver, after much valuable geometric information, proposes at chap. vi., in a long rambling manner, that an account should be kept of the ship's way. "The way that a ship maketh may be known to an old seaman by experience, by others it may be found," as he recommends, with the log-line or by known marks on the ship's side, bearing the proportion to a league or mile, that a certain number of seconds do to an hour. So far good; but he reckons a mile as 5866 feet (214 too little), and states that seamen count in paces of 5 feet each, and 1000 to a mile, *i. e.*, only 5000 feet. He also proposes to divide the degrees into one hundred parts, each to be called "centesmes." The whole subject is treated as a new thing. It is stated by Purchas (1625) that Christopher Columbus (1492) deceived his crew with respect to the distance sailed from home, and that "even the pilots did not know how far they had gone" as they glided so smoothly with a continuous fair wind. Had any kind of log been hove, the ship's speed would have been publicly known. Mr. Burnaby (*Ancient Geography*, p. 554) states that "no ancient writer has preserved any account of the mode in which ancient navigators computed distance." Following such an authority and the quotations above, we may safely agree with the statement of Purchas that it was first used in 1607. Also we know that it did not become general till many years after. In one of our best works on navigation, printed in 1843, the log is inaccurately described.

If we are surprised that so many centuries passed, and that long voyages were made, after the discovery of the compass, without any means of measuring the distance sailed, we may be almost as much so at the diversity of opinion which prevailed among seamen with regard to the length of the log-line and the length of a mile. At the present day the principle upon which this log is arranged is easily understood. The mean degree of the meridian (see vol. x. p. 177) is assumed to be 69·09 statute miles, which gives 6080 feet to the mean nautical mile,—an estimate sufficiently accurate for navigating upon any part of the sphere. The distances upon the log-line being marked by pieces of line placed between the strands and carrying the requisite number of knots, this has given the name of knot to the nautical mile. The line is marked to knots and half knots (a single knot) only; the intermediate fractions are estimated. Two measurements are now in common use; that in the British navy is 47 feet 3 inches of line for each knot made per hour, which corresponds with a twenty-eight second glass,—thus (28 × 6080) ÷ 3600 = 47,288 feet; in the merchant service a knot is 50 feet 7 inches, which is the correct proportion to a mile with the half minute glass. When a ship is going more than five or six knots, a short glass is used, fourteen or fifteen seconds, then the indications by the line are doubled. The shorter measure was probably chosen in consequence of the custom in vogue till about 1833 of marking the run on the log-board, or book, in knots and fathoms (or sea furlongs); the fractions are now invariably entered as tenths. The whole length of line is 60 to 80 fathoms, according to the speed anticipated; 10 to 20 fathoms of which is allowed as stray line, that the log ship may be in a fair position, before the rag of bunting called the turn mark passes the hand. The line should be stretched and well wet before it is measured, and should be remeasured every day at sea. The inner end of the line is made fast to a light reel upon which it is wound.

The "log-ship" (fig. 1) is a piece of wood about ½ inch thick and the fourth part of a circle, having a radius of 5 or 6 inches, weighted with lead round the curve in order to keep it upright in the water, but not to sink it. Two holes are bored, about 1½ inches from the lower angles; through one a short piece of line is passed and knotted; the other end of the line has a bone or hard peg spliced to it, which is inserted in the other hole, thus forming a span by which it is attached to the log-line, and hangs square.

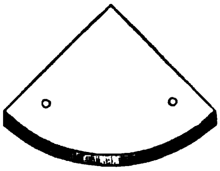

Fig. 1.

When the log is used, a man holds the reel over his head, the officer places the peg in the log-ship, and throws it well clear of the wake, then allows it to run the "stray line" off without assistance, steadying it just before the turn mark comes to hand; as the mark passes he calls to his assistant with the glass to "turn." As the sand runs pay out freely till the word "stop" is expected, then bring the line into a state of tension similar to what it was in when the turn mark passed. At the word "stop" nip the line instantly, count the nearest knots, and estimate the tenths. When the line is stopped the strain should cause the peg to draw from the log-ship, and it can easily be hauled in. In ships of war it is hove every hour. The value of the operation depends, of course, entirely upon the care bestowed.

Ground-Log.—In large rivers, such as Rio de la Plata, where a strong current runs, and shoals are found out of the sight of land, a lead of four or five pounds weight is used instead of the log-ship; the lead rests on the bottom, the line and sand-glass being used in a manner similar to that above described. This is called the ground-log, and indicates the speed at which the ship is passing over the ground, irrespective of currents or tides; it will show also the lateral effect of current as it is hauled in; this is the only log which can do so.

The sand-glasses are very primitive contrivances for measuring the requisite number of seconds; they are much affected by damp and change of temperature, and no reliance can be placed on their accuracy. In 1868 a timepiece sounding a gong at the required intervals was devised by the late Admiral Sir Walter Tarleton, and was tried on board some of Her Majesty's ships, but failed after a short time from damp or other causes. The writer of this article was then attempting to produce a log-gong, but abandoned it on being told that they could be obtained below his estimated cost.

Screw Logs.—In 1725 Henry de Saumarez described a machine which was to supersede the ordinary log. This was on the principle of the screw, having vanes which caused it to revolve and communicate a rotary motion to a piece of rope; this most probably went inboard to clockwork; hence the failure. Mr. Smeaton made many experiments about 1751; he found the results very irregular, especially at high velocities, just as the writer of this article did with one of Massey's flies and a line or wire attached to a spindle, supported by large friction rollers inboard; both experiments were dead failures on account of the friction. In 1773 two screw logs were tried on board H. M. ship "Racehorse" during a short voyage to the Polar Sea; each was made to communicate motion to a counter inboard. In 1792 Mr. Gower took out a patent for a screw log. None of these experiments were sufficiently successful to gain the confidence of seamen.

We see that the principle was not new in 1834 when Mr. Massey patented a screw log, which has been so generally adopted that it deserves special notice and description. Though Massey took out other patents, and others have followed with modifications, the principle of all is the same, and likely to remain in use with the "common log" for many years to come. Massey fitted his log to the sternpost of a few vessels, a vertical spindle conveying the rotations of the fly to a register in the cabin above, but it did not answer.

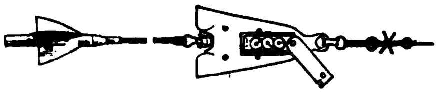

Fig. 2.

The log of 1836 which came into general use is represented in fig. 2. It consists of two parts united by 2 or 3 feet of rope. The "fly" consists of a hollow copper cylinder about 9 or 10 inches long with four fins or blades placed at a given angle, causing it to rotate once in a certain distance. The rope is attached to the fly and to a spindle which freely revolves in a brass box; an endless screw acting upon a system of wheel-work records the fractions of a mile on one dial, units upon a second, and tens up to one hundred on the third, on the same principle with the index of a gas meter.

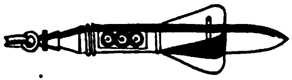

Fig. 3.

The last patent was for the "frictionless log" shown in fig. 3, which is similar to the former except that, by dispensing with the piece of rope and part of the heavy box, it is much more compact and less liable to foul,—an accident to which all logs when towed after a ship are very liable. Walker's harpoon log is very similar to the last of Massey's, but has a plate at the back in the shape of a harpoon to prevent the upper part from revolving. This log is now supplied to Her Majesty's ships. The fins or blades which cause the rotation in each of the logs above described are flat pieces of brass (not portions of a screw) soldered to a cylinder, which is hollow in order to diminish the tendency to sink when going slowly; but if the log be left overboard when the ship stops, the tow-line will allow it to sink about 100 feet, the pressure of water will then fill it, and there is no means provided for getting the water out. Screw logs will also at slow speeds hang obliquely and be useless. Mr. Friend tried a log with paddles protruding from a brass box instead of using a screw; but the plan was not adopted. However accurate the registering logs may be, an hourly log cannot be dispensed with, unless the ship be on one course during the whole twenty-four hours, or her speed be uniform; even then the old log and line should not be neglected. Both Massey and Walker are now trying logs the rotators of which are towed, while the dials for registering are on the ship's stern.

Pressure Log.—In 1849 the Rev. E. L. Berthon patented a log (fig. 4), indicating the speed of the ship by means of the pressure of water due to the velocity acting upon a tube about ¾ of an inch diameter in the clear, closed at the end, protruding some 8 inches below the ship's bottom, with an aperture of about an ⅛ of an inch in diameter in the front side, near the closed end. A vane was used to turn the aperture in the direction of the ship's progress (course and leeway combined). At the upper end of the same pipe a pointer indicated the amount of leeway. To take into account the effect which change of draught would produce, another pipe was used having the aperture in a neutral direction (41°30) with regard to the ship's progress, so that the water was neither forced in nor drawn out. The two pipes communicated with air vessels, which were allowed to be about half full of water; thence two flexible tubes conveyed the pressure to the ends of an inverted siphon partly filled with mercury, one leg of which forms a glass index tube, a graduated scale being placed behind it, calculated upon the principle that the pressure will increase according to the square of the velocity. As the specific gravity of mercury is so great, the scale even up to 16 knots is brought within a convenient compass; and it can be hung in gimbals (as a barometer) in any part of the ship. The leeway indicator in more recent fittings has been abandoned. The writer of this article first saw it in one of the Jersey packets, when she was steaming about 13 knots; it appeared to be very sensitive, and he was strongly impressed in its favor. For details respecting this log see paper by Vaughan Pendred, before the Society of Engineers, December 6, 1869.

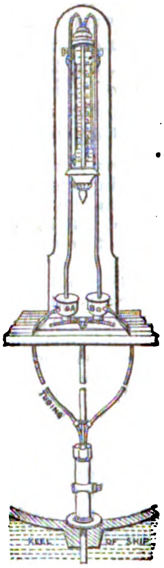

Fig. 4.

The motions or disturbances imparted to the water by the body of the ship passing through it at high velocity must vitiate in a great degree all attempts to measure the speed by instruments placed near the hull of the ship, and under varying circumstances of draught, speed, and foulness of bottom. For the results of experiments and opinions on this point, by the late William Froude, F. R. S., and Mr. R. Edmund Froude, see *Brit. Assoc. Rep.*, 1874, p. 225, and 1879, p. 210.

Electric Log.—In the chronological order in which we have taken various descriptions of log, the last deserving notice is Kelway's "electric log," the only such log known to the public. Its chief feature is the making and breaking of an electric circuit by means of a screw revolving in the water and an electric battery connected with the step motion indicator. One of the difficulties to be overcome was that of securing a chamber wherein to form the electric contacts, which should remain watertight under the pressure due to its depth below the surface of the sea, particularly in the event of the ship stopping and suffering it to sink when being towed with 50 fathoms of line. Mr. Kelway now believes that he has overcome that difficulty, and his log has been tried on board several of Her Majesty's ships at Portsmouth, with satisfactory results, a screw similar to Massey's being towed, while in electric connection with a dial on board.

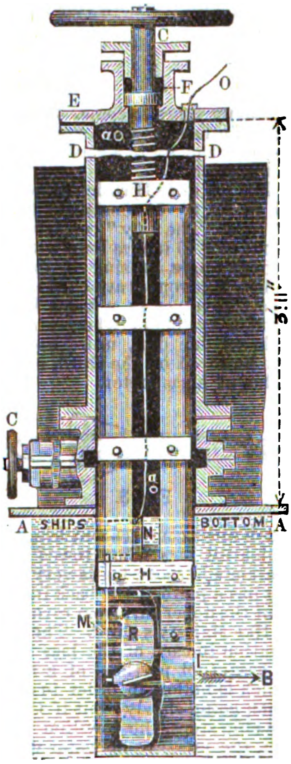

Fig. 5.

What is considered by Mr. Kelway to be an improved application of the principle is now (1882) on view in the International Exhibition at the Crystal Palace. It is intended that a hole should be cut in the ship's bottom, by preference in the engine-room, large enough to allow a short cylinder (fig. 5) containing the screw R to pass down below the ship's bottom. The cylinder is open in the fore-and-aft line and attached to a cage H, which is drawn up or lowered by means of a large screw G working through a stuffing box F. The iron box D containing the cage is 4 feet in height, made in three parts; the lower part (high enough to receive a sluice valve C) is to be bolted to the ship's bottom, and must, with the rest of the box, be nearly as strong; the central part is secured to the valve box and covered by a lid E, there being space enough above the sluice valve for the cage and screw.

To place the log, let the sluice valve C be lightly closed; open two small taps to let the water out of the box and to prove that the valve is acting. Open the lid, run the lowering screw through the cage, place it, secure the lid, open the sluice valve, and lower the rotator to the desired distance. The blades of the rotator are portions of a true screw. An endless screw on the spindle of the rotator communicates the revolutions to a vertical spindle M, which moves a train of wheels in a watertight box N; the last of these wheels revolves once in a mile, and on the same spindle is a wheel having eight ratchet teeth, which by moving a lever complete an electric current, which passes by the wire O to a dial placed in any part of the ship, sounding a bell and causing one hand of the dial to make a step and mark an eighth; one revolution indicates a mile, and other dials carry the register up to 100 miles. This form of electric log has, however, the disadvantage pointed out as affecting the Berthon or any log placed under the hull of a ship.

The electric towing log (by Kelway) promises to show continuously on board the ship what she is doing, while keeping a record of what has been done. A rating table would be at the dial, in any part of the ship; or several dials could be worked by the same electric current. It will be exposed to the danger of fouling seaweed, etc., as other towing logs are.

The logs now generally used are Massey's, Walker's, and a few of Berthon's, generally in conjunction with the old log-ship and line. (H. A. M.)

LOGAN, John (1748–88), a Scottish poet of some reputation, was born in 1748, and was son of George Logan, a farmer at Soutra, in East Lothian. Being destined for the church, he was in 1762 sent to study at the university of Edinburgh. After finishing his course, Logan was in 1768–69 tutor at Ulbster to the well-known Sir John Sinclair, and in 1770 he edited some of the poems of his college friend Michael Bruce (*q. v.*). This publication was for the benefit of Bruce's parents, who were in humble circumstances. In order to make up a volume he inserted some poems of his own, with some from other sources, and in his preface he stated that these could be easily distinguished without any names being attached. Of the seventeen pieces in the volume five were by Bruce, two by Bruce and Logan, eight by Logan, one by Sir James Foulis, and of one the authorship is unknown. One of the poems by Logan was "The Ode to the Cuckoo."

In 1770 Logan was licensed as a preacher by the presbytery of Edinburgh, and in 1771 was presented to the charge of South Leith, but was not inducted till 1773. In 1779 he delivered a course of lectures on the philosophy of history in St. Mary's Chapel, Edinburgh. An analysis of these lectures was published in 1781 under the title of *Elements of the Philosophy of History*, and was followed by one of the lectures *On the Manners and Government of Asia*, 1781.

Logan was an active member of the committee of the General Assembly of the Church of Scotland appointed in 1775 to revise the "Translations and Paraphrases" drawn up in 1745 for use in private families, and to adapt them for public worship. The committee finished its labors in 1781, and their collection of paraphrases is still in use. Eleven of them are the composition of Logan, and others were revised or altered by him. In the same year he published his poems in a volume which attracted so much attention that a second edition was issued in 1782. It also included the "Ode to the Cuckoo," with which Edmund Burke was so pleased that when in Edinburgh he sought out Logan and complimented him as the author of the finest ode in the English language.

In 1783 he published a tragedy called *Runnamede*, which met with little success. In 1786 he resigned his charge at South Leith, retaining part of his stipend. He then went to London, where he devoted himself to literature. He was engaged on the management of the *English Review*, and in 1788 published a pamphlet on the charges against Warren Hastings. He died in December, 1788.

A work on ancient history, published that year under the name of Dr. Rutherford, rector of an academy at Uxbridge, is believed to have been the lectures written by Logan. His sermons were published in 1790-91, in two volumes, and have been several times reprinted. His poems were collected and published in 1812, with a memoir understood to be by the Rev. R. Douglas of Galashiels.

About forty years after Logan's death what may be called the Bruce-Logan controversy arose by the publication in 1836 of the life of Michael Bruce, prefixed to an edition of his poems by the Rev. Dr. MacKelvie. In this work there is claimed for Bruce the authorship of sixteen of the pieces in the volume issued by Logan in 1770. Logan was at the same time charged with having retained some of Bruce's MSS. entrusted to him, which he used in the revision of the paraphrases. These statements have been reiterated with much abuse of Logan in a memoir of Bruce prefixed to an edition of his works published in 1865, by the Rev. Dr. Grosart. In this edition the paraphrases written by Logan are inserted as having been written by Bruce. The evidence, however, brought against Logan in these biographies of Bruce, being nearly altogether of a hearsay character, is not of much value, and it may be urged that Logan was not blamed during his life for any such literary delinquencies. If anything can be brought against him with justice, it is his publishing as his own, with very few alterations, the second Paraphrase, which is the composition of Dr. Doddridge.

Within the last few years the various pieces in the volume of Bruce's poems issued by Logan in 1770 have been subjected to careful criticism, and the statements made from personal knowledge by the Rev. Dr. Robertson of Dalmeny, the college friend of Bruce and Logan, who was often referred to on the subject, must be held to be substantially correct. These will be found in a *brochure* by Dr. David Laing, *Ode to the Cuckoo* (Edinburgh, 1770), *with remarks on its authorship, in a letter to J. C. Shairp*, LL.D., 1873. See also a paper by J. Small in the *Brit. and For. Evan. Rev.*, 1877, and especially two papers by the Rev. R. Small, *ibid.*, 1878.

LOGANSPORT, capital of Cass county, Indiana, U. S., is situated at the confluence of the Wabash and the Eel rivers, and on the Wabash and Erie canal, 75 miles north-west of Indianapolis. It is an important railway junction, and the trading-centre of an extensive agricultural district—dealing in grain, pork, and timber (poplar and black walnut). The Pittsburg, Cincinnati, and St. Louis railroad maintains at this point large carriage-works, occupying 25 acres, and employing 600 men. The population was 11,198 in 1880.

LOGARITHMS. The definition of a logarithm is as follows:—if a, x, m are any three quantities satisfying the equation $a^x = m$, then a is called the base, and x is said to be the logarithm of m to the base a. This relation between x, a, m, may be expressed also by the equation $x = \log_a m$.

Properties.—The principal properties of logarithms are given by the equations

$$\log_a (mn) = \log_a m + \log_a n, \qquad \log_a \frac{m}{n} = \log_a m - \log_a n,$$

$$\log_a m^r = r \log_a m, \qquad \log_a \sqrt[r]{m} = \frac{1}{r} \log_a m,$$

which may be readily deduced from the definition of a logarithm. It follows from these equations that the logarithm of the product of any number of quantities is equal to the sum of the logarithms of the quantities, that the logarithm of the quotient of two quantities is equal to the logarithm of the numerator diminished by the logarithm of the denominator, that the logarithm of the rth power of a quantity is equal to r times the logarithm of the quantity and that the logarithm of the rth root of a quantity is equal to $\frac{1}{r}$th of the logarithm of the quantity.

Logarithms were originally invented for the sake of abbreviating arithmetical calculations, as by their means the operations of multiplication and division may be replaced by those of addition and subtraction, and the operations of raising to powers and extraction of roots by those of multiplication and division. For the purpose of thus simplifying the operations of arithmetic, the base is taken equal to 10, and use is made of tables of logarithms in which the values of x, the logarithm, corresponding to values of m, the number, are tabulated. The logarithm is also a function of frequent occurrence in analysis, being regarded as a known and recognized function like $\sin x$ or $\tan x$; but in mathematical investigations the base generally employed is not 10, but a certain quantity usually denoted by the letter e, of value 2.71828 18284 . . . .

Thus in arithmetical calculations if the base is not expressed it is understood to be 10, so that $\log m$ denotes $\log_{10} m$; but in analytical formulæ it is understood to be e.

The logarithms to base 10 of the first twelve numbers to 7 places of decimals are

$$\begin{array}{lll}
\log 1 = 0{\cdot}0000000 & \log 5 = 0{\cdot}6989700 & \log 9 = 0{\cdot}9542425 \\
\log 2 = 0{\cdot}3010300 & \log 6 = 0{\cdot}7781513 & \log 10 = 1{\cdot}0000000 \\
\log 3 = 0{\cdot}4771213 & \log 7 = 0{\cdot}8450980 & \log 11 = 1{\cdot}0413927 \\
\log 4 = 0{\cdot}6020600 & \log 8 = 0{\cdot}9030900 & \log 12 = 1{\cdot}0791812
\end{array}$$

The meaning of these results is that

$$\begin{array}{lll}
1 = 10^0, & 2 = 10^{0\cdot3010300}, & 3 = 10^{0\cdot4771213}, \ldots \\
10 = 10^1, & 11 = 10^{1\cdot0413927}, & 12 = 10^{1\cdot0791812}.
\end{array}$$

The integral part of a logarithm is called the index or characteristic, and the fractional part the mantissa. When the base is 10, the logarithms of all numbers in which the digits are the same, no matter where the decimal point may be, have the same mantissa; thus, for example,

$$\log 2{\cdot}5613 = 0{\cdot}4084604, \quad \log 25{\cdot}613 = 1{\cdot}4084604,$$
$$\log 2561300 = 6{\cdot}4084604, \text{ etc.}$$

In the case of fractional numbers (*i. e.*, numbers in which the integral part is 0) the mantissa is still kept positive, so that, for example,

$$\log {\cdot}25613 = \bar{1}{\cdot}4084604, \quad \log {\cdot}0025613 = \bar{3}{\cdot}4084604, \text{ etc.},$$

the minus sign being usually written over the characteristic, and not before it, to indicate that the characteristic only and not the whole expression is negative; thus

$$\bar{1}{\cdot}4084604 \text{ stands for } -1 + {\cdot}4084604.$$

The fact that when the base is 10 the mantissa of the logarithm is independent of the position of the decimal point in the number affords the chief reason for the choice of 10 as base. The explanation of this property of the base 10 is evident, for a change in the position of the decimal points amounts to multiplication or division by some power of 10, and this corresponds to the addition or subtraction of some integer in the case of the logarithm, the mantissa therefore remaining intact. It should be mentioned that in most tables of trigonometrical functions, the number 10 is added to all the logarithms in the table in order to avoid the use of negative characteristics, so that the characteristic 9 denotes in reality $\bar{1}$, 8 denotes $\bar{2}$, 10 denotes 0, etc. Logarithms thus increased are frequently referred to for the sake of distinction as *tabular logarithms*, so that the tabular logarithm = the true logarithm + 10.

In tables of logarithms of numbers to base 10 the mantissa only is in general tabulated, as the characteristic of the logarithm of a number can always be written down at sight, the rule being that, if the number is greater than unity, the characteristic is less by unity than the number of digits in the integral portion of it, and that if the number is less than unity the characteristic is negative, and is greater by unity than the number of ciphers between the decimal point and the first significant figure.

It follows very simply from the definition of a logarithm that

$$\log_a b \times \log_b a = 1; \quad \log_b m = \log_a m \times \frac{1}{\log_a b}.$$

The second of these relations is an important one, as it shows that from a table of logarithms to base a, the corresponding table of logarithms to base b may be deduced by multiplying all the logarithms in the former by the constant multiplier $\frac{1}{\log_a b}$, which is called the *modulus* of the system whose base is b with respect to the system whose base is a.

The two systems of logarithms for which extensive tables have been calculated are the Napierian, or hyperbolic, or natural system, of which the base is e, and the Briggian, or decimal, or common system, of which the base is 10; and we see that the logarithms in the latter system may be deduced from those in the former by multiplication by the constant multiplier $\frac{1}{\log_e 10}$, which is called the modulus of the common system of logarithms. The numerical value of this modulus is 0·43429 44819 03251 82765 11289 . . . , and the value of its reciprocal, $\log_e 10$ (by multiplication by which Briggian logarithms may be converted into Napierian logarithms) is 2·30258 50929 94045 68401 79914. . . .

The quantity denoted by e is the series,

$$1 + \frac{1}{1} + \frac{1}{1.2} + \frac{1}{1.2.3} + \frac{1}{1.2.3.4} + \dots$$

the numerical value of which is,

2·71828 18284 59045 23536 02874 . . .

The mathematical function $\log x$, or $\log_e x$, is one of the small group of transcendental functions, consisting only of the circular functions (direct and inverse) $\sin x$, $\cos x$, etc., arc $\sin x$, arc $\cos x$, etc., e^x, and $\log x$, which are universally treated in analysis as known functions. It is the inverse of the exponential function e^x, the theory of which may be regarded as including that of the circular functions, since

$$\sin x = \frac{1}{2i}(e \quad - e^{-ix}), \qquad \cos x = \tfrac{1}{2}(e^{ix} + e^{-ix}).$$

There is no series for $\log x$ proceeding either by ascending or descending powers of x, but there is an expansion for $\log(1 + x)$, viz. :—

$$\log(1 + x) = x - \tfrac{1}{2}x^2 + \tfrac{1}{3}x^3 - \tfrac{1}{4}x^4 + \text{etc.};$$

the series, however, is convergent for real values of x only when x lies between $+1$ and -1. Other formulæ which are deducible from this equation are given in the portion of this article relating to the calculation of logarithms.

We have also the fundamental formulæ—

(i.) Limit of $\frac{x^h - 1}{h}$, when h is indefinitely diminished, $= \log x$;

(ii.) $$\int \frac{dx}{x} = \log x + \text{const.}$$

Either of these results might be regarded as the definition of $\log x$; they may be readily connected with one another, for we have in general

$$\int x^n dx = \frac{x^{n+1}}{n+1} + \text{const.};$$

but if $n = -1$, this formula no longer gives a result. Putting, however, $n = -1 + h$, where h is indefinitely small, we have

$$\int \frac{dx}{x} = \frac{x^h}{h} + \text{const.} = \frac{x^h - 1}{h} + \text{const.} = \log x + \text{const. by (i.)}.$$

The result (ii.) establishes a relation, which is of historical interest, between the logarithmic function and the quadrature of the hyperbola, for, by considering the equation of the hyperbola in the form $xy = \text{const.}$, we see at once that the area included between the arc of a hyperbola, its nearest asymptote, and two ordinates drawn parallel to the other asymptote from points on the first asymptote distant a and b from their point of intersection is proportional to $\log \frac{b}{a}$.

The function $\log x$ is not a *uniform* function, that is to say, if x denotes a complex variable of the form $a + ib$, and if complex quantities are represented in the usual manner by points in a plane, then it does not follow that if x describes a closed curve $\log x$ also describes a closed curve; in fact we have

$$\log(a + ib) = \log \sqrt{(a^2 + b^2)} + i(\alpha + 2n\pi),$$

where α is a determinate angle, and n denotes any integer. Thus, even when the argument is real, $\log x$ has an infinite number of values; for, putting $b = 0$ and taking a positive, in which case $\alpha = 0$, we obtain for $\log a$ the infinite system of values $\log a + 2n\pi i$. It follows from this property of the function that we cannot have for $\log x$ a series which shall be convergent for all values of x, as is the case with $\sin x$, $\cos x$, and e^x; as such a series could only represent a uniform function, and in fact the equation

$$\log(1 + x) = x - \tfrac{1}{2}x^2 + \tfrac{1}{3}x^3 - \tfrac{1}{4}x^4 + \text{etc.},$$

is true only when the analytical modulus of x is less than unity.

The notation $\log x$ is generally employed in English works, but Continental writers usually denote the function by lx or $\lg x$.

History.—The invention of logarithms has been accorded to John Napier, baron of Merchiston, in Scotland, with a unanimity which is rare with regard to important scientific discoveries. The first announcement was made in Napier's *Mirifici logarithmorum canonis descriptio* (Edinburgh, 1614), which contains an account of the nature of logarithms, and a table giving natural sines and their logarithms for every minute of the quadrant to seven or eight figures. These logarithms are not what would now be called Napierian or hyperbolic logarithms (*i. e.*, logarithms to the base e), though closely connected with them, the relation between the two being

$$e^l = 10^7 e^{-\frac{L}{10^7}}, \text{ or } L = 10^7 \log_e 10^7 - 10^7 l,$$

where l denotes the logarithm to base e and L denotes Napier's logarithm. The relation between N (a sine) and L its Napierian logarithm is therefore

$$N = 10^7 e^{-\frac{L}{10^7}},$$

and the logarithms decrease as the sines increase. Napier died in 1617, and his posthumous work *Mirifici logarithmorum canonis constructio*, explaining the mode of construction of the table, appeared in 1619, edited by his son.

Henry Briggs, then professor of geometry at Gresham College, London, and afterwards Savilian professor of geometry at Oxford, admired the *Canon mirificus* so much that he resolved to visit Napier. In a letter to Ussher he writes, "Naper, lord of Markinston, hath set my head and hands at work with his new and admirable logarithms. I hope to see him this summer, if it please God; for I never saw a book which pleased me better, and made me more wonder." Briggs accordingly visited Napier in 1615, and stayed with him a whole month. He brought with him some calculations he had made, and suggested to Napier the advantages that would result from the choice of 10 as a base, having explained them previously in his lectures at Gresham College, and written to Napier on the subject. Napier said that he had already thought of the change, and pointed out a slight improvement, viz., that the characteristics of numbers greater than unity should be positive and not negative, as suggested by Briggs. In 1616 Briggs again visited Napier and showed him the work he had accomplished, and, he says, he would gladly have paid him a third visit in 1617 had Napier's life been spared.

Briggs's *Logarithmorum chilias prima* was published, probably privately, in 1617, after Napier's death, as in the short preface he states that why his logarithms are different from those introduced by Napier "sperandum, ejus librum posthumum abunde nobis propediem satisfacturum." The *liber posthumus* was the *Canonis constructio* already mentioned. This work of Briggs's, which contains the first published table of decimal or common logarithms, is only a small octavo tract of sixteen pages, and gives the logarithms of numbers from unity to 1000 to 14 places of decimals. There is no author's name, place, or date. The date of publication is, however, fixed as 1617 by a letter from Sir Henry Bourchier to Ussher, dated December 6, 1617, containing the passage—"Our kind friend, Mr. Briggs, hath lately published a supplement to the most excellent tables of logarithms, which I presume he has sent to you." Briggs's tract of 1617 is extremely rare, and has generally been ignored or incorrectly described. Hutton erroneously states that it contains the logarithms to 8 places, and his account has been followed by most writers. There is a copy in the British Museum.

Briggs continued to labor assiduously at the calculation of logarithms, and in 1624 published his *Arithmetica logarithmica*, a folio work containing the logarithms of the numbers from 1 to 20,000, and from 90,000 to 100,000 (and in some copies to 101,000) to 14 places of decimals. The table occupies 300 pages, and there is an introduction of 88 pages relating to the mode of calculation of the tables, and the application of logarithms.

There was thus left a gap between 20,000 and 90,000, which was filled up by Adrian Vlacq, who published at Gouda, in Holland, in 1628, a table containing the logarithms of the numbers from unity to 100,000 to 10 places of decimals. Having calculated 70,000 logarithms and copied only 30,000, Vlacq would have been quite entitled to have called his a new work. He designates it, however, only a second edition of Briggs's *Arithmetica logarithmica*, the title running *Arithmetica logarithmica sive logarithmorum chiliades centum, . . . Editio secunda aucta per Adrianum Vlacq, Goudanum.* This table of Vlacq's was published, with an English explanation prefixed, at London in 1631 under the title *Logarithmicall Arithmetike . . . London, printed by George Miller*, 1631. There are also copies with a French title page and introduction (Gouda, 1628).

Briggs had himself been engaged in filling up the gap, and in a letter to Pell, written after the publication of Vlacq's work, and dated October 25, 1628, he says:—

> "My desire was to have those chiliades that are wantinge betwixt 20 and 90 calculated and printed, and I had done them all almost by my selfe, and by some frendes whom my rules had sufficiently informed, and by agreement the busines was conveniently parted amongst us; but I am eased of that charge and care by one Adrian Vlacque, an Hollander, who hathe done all the whole hundred chiliades and printed them in Latin, Dutche, and Frenche, 1000 bookes in these 3 languages, and hathe sould them almost all. But he hathe cutt off 4 of my figures throughout; and hathe left out my dedication, and to the reader, and two chapters the 12 and 13, in the rest he hath not varied from me at all."

The original calculation of the logarithms of numbers from unity to 101,000 was thus performed by Briggs and Vlacq between 1615 and 1628. Vlacq's table is that from which all the hundreds of tables of logarithms that have subsequently appeared have been derived. It contains of course many errors, which have gradually been discovered and corrected in the course of the two hundred and fifty years that have elapsed, but no fresh calculation has been published. The only exception is Mr. Sang's table (1871), part of which was the result of an original calculation.

The first calculation or publication of Briggian or common logarithms of trigonometrical functions was made in 1620 by Gunter, who was Briggs's colleague as professor of astronomy in Gresham College. The title of Gunter's book, which is very scarce, is *Canon triangulorum*, and it contains logarithmic sines and tangents for every minute of the quadrant to 7 places of decimals.

The next publication was due to Vlacq, who appended to his logarithms of numbers in the *Arithmetica logarithmica* of 1628 a table giving log sines, tangents, and secants for every minute of the quadrant to 10 places; these were obtained by calculating the logarithms of the natural sines, etc., given in the *Thesaurus Mathematicus* of Pitiscus (1613).

During the last years of his life Briggs devoted himself to the calculation of logarithmic sines, etc., and at the time of his death in 1631 he had all but completed a logarithmic canon to every hundredth of a degree. This work was published by Vlacq at his own expense at Gouda in 1633, under the title *Trigonometria Britannica*. It contains log sines (to 14 places) and tangents (to 10 places), besides natural sines, tangents, and secants, at intervals of a hundredth of a degree. In the same year Vlacq published at Gouda his *Trigonometria artificialis*, giving long sines and tangents to every 10 seconds of the quadrant to 10 places. This work also contains the logarithms of the numbers from unity to 20,000 taken from the *Arithmetica logarithmica* of 1628. Briggs appreciated clearly the advantages of a centesimal division of the quadrant, and by dividing the degree into hundredth parts instead of into minutes, made a step towards a reformation in this respect, and but for the appearance of Vlacq's work the decimal division of the degree might have become recognized, as is now the case with the corresponding division of the second. The calculation of the logarithms not only of numbers but also of the trigonometrical functions is therefore due to Briggs and Vlacq; and the results contained in their four fundamental works—*Arithmetica logarithmica* (Briggs), 1624; *Arithmetica logarithmica* (Vlacq), 1628; *Trigonometria Britannica* (Briggs), 1633; *Trigonometria artificialis* (Vlacq), 1633—have never been superseded by any subsequent calculations.

A translation of Napier's *Descriptio* was made by Edward Wright, whose name is well known in connection with the history of navigation, and after his death published by his son at London in 1616 under the title *A Description of the admirable Table of Logarithmes* (12mo); the edition was revised by Napier himself. Both the *Descriptio* (1614) and the *Constructio* (1619) were reprinted at Lyons in 1620 by Bartholomew Vincent, who thus was the first to publish logarithms on the Continent.

Napier calculated no logarithms of numbers, and, as already stated, the logarithms invented by him were not to base *e*. The first logarithms to the base *e* were published by John Speidell in his *New Logarithmes* (London, 1619), which contains hyperbolic log sines, tangents, and secants for every minute of the quadrant to 5 places of decimals.

In 1624 Benjamin Ursinus published at Cologne a canon of logarithms exactly similar to Napier's in the *Descriptio* of 1614, only much enlarged. The interval of the arguments is 10″, and the results are given to 8 places; in Napier's canon the interval is 1′, and the number of places is 7. The logarithms are strictly Napierian, and the arrangement is identical with that in the canon of 1614. This is the largest Napierian canon that has ever been published.

Kepler took the greatest interest in the invention of logarithms, and in 1624 he published at Marburg a table of Napierian logarithms of sines, with certain additional columns to facilitate special calculations.

The first publication of Briggian logarithms on the Continent is due to Wingate, who published at Paris in 1625 his *Arithmétique logarithmétique*, containing seven-figure logarithms of numbers up to 1000, and log sines and tangents from Gunter's *Canon* (1620). In the following year, 1626, Denis Henrion published at Paris a *Traicté des Logarithmes*, containing Briggs's logarithms of numbers up to 20,001 to 10 places, and Gunter's log sines and tangents to 7 places for every minute. In the same year De Decker also published at Gouda a work entitled *Nieuwe Telkonst, inhoudende de Logarithme voor de Ghetallen beginnende van 1 tot 10,000*, which contained logarithms of numbers up to 10,000 to 10 places, taken from Briggs's *Arithmetica* of 1624, and Gunter's log sines and tangents to 7 places for every minute. Vlacq rendered assistance in the publication of this work, and the privilege is made out to him.

The preceding paragraphs contain a brief account of the main facts relating to the invention of logarithms. In describing the contents of the works referred to the language and notation of the present day have been adopted, so that for example a table to radius 10,000,000 is described as a table to 7 places, and so on. Also, although logarithms have been spoken of as to the base *e*, etc., it is to be noticed that neither Napier nor Briggs, nor any of their successors till long afterwards, had any idea of connecting logarithms with exponents.

The invention of logarithms and the calculation of the earlier tables form a very striking episode in the history of exact science, and, with the exception of the *Principia* of Newton, there is no mathematical work published in the country which has produced such important consequences, or to which so much interest attaches as to Napier's *Descriptio*. The calculation of tables of the natural trigonometrical functions may be said to have formed the work of the last half of the 16th century, and the great canon of natural sines for every 10 seconds to 15 places which had been calculated by Rheticus was published by Pitiscus only in 1613, the year before that in which the *Descriptio* appeared. In the construction of the natural trigonometrical tables England had taken no part, and it is remarkable that the discovery of the principles and the formation of the tables that were to revolutionize or supersede all the methods of calculation then in use should have been so rapidly effected and developed in a country in which so little attention had been previously devoted to such questions.

The only possible rival to Napier in the invention of logarithms is Justus Byrgius, who about the same time constructed a rude kind of logarithmic or rather anti-logarithmic table; but there is every reason to believe that Napier's system was conceived and perfected before that of Byrgius; and in date of publication Napier has the advantage by six years. The title of the work of Byrgius is *Arithmetische und geometrische Progress-Tabulen*; in his table he has $\log 1 = 0$ and $\log 10 = 230270022$. The only contemporary reference to Byrgius is contained in the sentence of Kepler, "Apices logistici Justo Byrgio multis annis ante editionem Neperianam viam præiverunt ad hos ipsissimos logarithmos," which occurs in the "Præcepta" prefixed to the *Tabulæ Rudolphinæ* (1627); the *apices* are the signs $^\circ$, $'$, $''$, used to denote the orders of sexagesimal fractions. The system of Byrgius is greatly inferior to that of Napier, and it is to the latter alone that the world is indebted for the knowledge of logarithms. The claims of Byrgius are discussed in Kästner's *Geschichte der Mathematik*, vol. ii. p. 375, and vol. iii. p. 14; Montucla's *Histoire des Mathématiques*, vol. ii. p. 10; Delambre's *Histoire de l'Astronomie moderne*, vol. i. p. 560; De Morgan's article on "Tables" in the *English Cyclopædia*; and Mr. Mark Napier's *Memoirs of John Napier of Merchiston* (1834).

An account of the facts connected with the early history of logarithms is given by Hutton in his *History of Logarithms*, prefixed to all the early editions of his logarithmic tables, and also printed in vol. i. pp. 306–340 of his *Tracts* (1812); but unfortunately Hutton has interpreted all Briggs's statements with regard to the invention of decimal logarithms in a manner clearly contrary to their true meaning, and unfair to Napier. This has naturally produced retaliation, and Mr. Mark Napier has not only successfully refuted Hutton, but has fallen into the opposite extreme of attempting to reduce Briggs to the level of a mere computer. It seems strange that the relations of Napier and Briggs with regard to the invention of decimal logarithms should have formed matter for controversy. The statements of both agree in all particulars, and the warmest friendship subsisted between them. Napier at his death left his manuscripts to Briggs, and all the writings of the latter show the greatest reverence for him. The words that occur on the title page of the *Logarithmicall arithmetike* of 1631 are: "These numbers were first invented by the most excellent Iohn Neper, Baron of Merchiston; and the same were transformed, and the foundation and use of them illustrated with his approbation by Henry Briggs." No doubt the invention of decimal logarithms occurred both to Napier and to Briggs independently; but the latter not only first announced the advantage of the change, but actually undertook and completed tables of the new logarithms. For more detailed information relating to Napier, Briggs, and Vlacq, and the invention of logarithms, the reader is referred to the life of Briggs in Ward's *Lives of the Professors of Gresham College*, London, 1740; Thomas Smith's *Vitæ quorundam eruditissimorum et illustrium virorum* (Vita Henrici Briggii), London, 1707; Mr. Mark Napier's *Memoirs of John Napier* already referred to, and the same author's *Naperi libri qui supersunt* (1839); Hutton's *History*; De Morgan's article already referred to; Delambre's *Histoire de l'Astronomie Moderne*; the report on mathematical tables in the *Report of the British Association* for 1873; and the *Philosophical Magazine* for October and December, 1872, and May, 1873. It may be remarked that the date usually assigned to Briggs's first visit to Napier is 1616, and not 1615 as stated above, the reason being that Napier was generally supposed to have died in 1618; but it was shown by Mr. Mark Napier that the true date is 1617.

For a description of existing logarithmic tables, and the purposes for which they were constructed, the reader is referred to the article TABLES (MATHEMATICAL). In what follows only the most important events in the history of logarithms, subsequent to the facts connected with their invention and the original calculations, will be noticed.

Nathaniel Roe's *Tabulæ logarithmicæ* (1633) was the first complete seven-figure table that was published. It contains seven-figure logarithms of numbers from 1 to 100,000, with characteristics unseparated from the mantissæ, and was formed from Vlacq's table (1628) by leaving out the last three figures. All the figures of the number are given at the heads of the columns, except the last two, which run down the extreme columns,—1 to 50 on the left hand side, and 50 to 100 on the right hand side. The first four figures of the logarithms are printed at the tops of the columns. There is thus an advance half way towards the arrangement now universal in seven-figure tables. The final step was made by John Newton in his *Trigonometria Britannica* (1658), a work which is also noticeable as being the only extensive eight-figure table that has ever been published; it contains logarithms of sines, etc., as well as logarithms of numbers.

In 1705 appeared the original edition of Sherwin's tables, the first of the series of ordinary seven-figure tables of logarithms of numbers and trigonometrical functions such as are in general use now. The work went through several editions during the last century, and was at length superseded in 1785 by Hutton's tables, which have continued in successive editions to maintain their position up to the present time.

In 1717 Abraham Sharp published in his *Geometry Improv'd* the Briggian logarithms of numbers from 1 to 100, and of primes from 100 to 1100, to 61 places; these were copied into the later editions of Sherwin and other works.

In 1742 a seven-figure table was published in quarto form by Gardiner, which is celebrated on account of its accuracy and of the elegance of the printing. A French edition, which closely resembles the original, was published at Avignon in 1770.

In 1783 appeared at Paris the first edition of Callet's tables, which correspond to those of Hutton in England. These tables, which form perhaps the most complete and practically useful collection of logarithms for the general computer that has been published, have passed through many editions, and are still in use.

In 1794 Vega published his *Thesaurus logarithmorum completus*, a folio volume containing a reprint of the logarithms of numbers from Vlacq's *Arithmetica logarithmica* of 1628, and *Trigonometria artificialis* of 1633. The logarithms of numbers are arranged as in an ordinary seven-figure table. In addition to the logarithms reprinted from the *Trigonometria*, there are given logarithms for every second of the first two degrees, which were the result of an original calculation. Vega devoted great attention to the detection and correction of the errors in Vlacq's work of 1628. He also published in 1797, in 2 vols. 8vo, a collection of logarithmic and trigonometrical tables which has passed through many editions, a very useful one volume stereotype edition having been published in 1840 by Hülsse. The tables in this work may be regarded as to some extent supplementary to those in Callet.

If we consider only the logarithms of numbers, the main line of descent from the original calculations of Briggs and Vlacq is Roe, John Newton, Sherwin, Gardiner; there are then two branches, viz., Hutton founded on Sherwin and Callet on Gardiner, and the editions of Vega form a separate offshoot from the original tables. Among the most useful and accessible of modern ordinary seven-figure tables of logarithms of numbers and trigonometrical functions may be mentioned those of Bremiker, Schrön, and Bruhns. For logarithms of numbers only perhaps Babbage's table is the most convenient.

In 1871 Mr. Sang published a seven-figure table of logarithms of numbers extending from 20,000 to 200,000; and the logarithms of the numbers between 100,000 and 200,000 were calculated *de novo* by Mr. Sang as if logarithms had never been computed before. In tables extending from 10,000 to 100,000 the differences near the beginning of the table are large, and they are so numerous that the proportional parts must either be very crowded, or some of them have to be omitted; and to diminish this inconvenience many tables extend to 108,000. By beginning the table at 20,000 instead of at 10,000, the differences are halved in magnitude, while the number of them in a page is quartered. In this table multiples of the differences, instead of proportional parts, are given.

As regards the logarithms of trigonometrical functions, the next great advance on the *Trigonometria artificialis* took place more than a century and a half afterwards, when Michael Taylor published in 1792 his seven-decimal table of log sines and tangents to every second of the quadrant; it was calculated by interpolation from the *Trigonometria* to 10 places and then contracted to 7. On account of the great size of this table, and for other reasons, it never came into very general use, Bagay's *Nouvelles tables astronomiques* (1829), which also contains log sines and tangents to every second, being preferred, but this work is now difficult to procure. The only other logarithmic canon to every second that has been published forms the second volume of Shortrede's *Logarithmic Tables* (1849). It contains also proportional parts, and is the most complete and accessible table of logarithms for every second. Shortrede's tables originally appeared in 1844 in one volume, during the author's absence in India; but, not being satisfied with them in some respects, he made various alterations, and published a second edition in two volumes in 1849. There have been subsequent editions of the volume containing the trigonometrical canon. The work is an important one, and the pages are clear, although the number of figures on each is very great.

On the proposition of Carnot, Prieur, and Brunet, the French Government decided in 1784 that new tables of sines, tangents, etc., and their logarithms, should be calculated in relation to the centesimal division of the quadrant. Prony was charged with the direction of the work, and was expressly required "Non seulement à composer des tables qui ne laissassent rien à désirer quant à l'exactitude, mais à en faire le monument de calcul le plus vaste et le plus imposant qui eût jamais été exécuté ou même conçu." Those engaged upon the work were divided into three sections: the first consisted of five or six mathematicians, including Legendre, who were engaged in the purely analytical work, or the calculation of the fundamental numbers; the second section consisted of seven or eight calculators possessing some mathematical knowledge; and the third comprised seventy or eighty ordinary computers. The work, which was performed wholly in duplicate, and independently by two divisions of computers, occupied two years. As a consequence of the double calculation, there are two manuscripts in existence, one of which is deposited at the Observatory, and the other in the library of the Institute, at Paris. Each of the two manuscripts consists essentially of seventeen large folio volumes, the contents being as follows:—

Logarithms of numbers up to 200,000	8 vols.
Natural sines	1 "
Logarithms of the ratios of arcs to sines from $0^r{\cdot}00000$ to $0^r{\cdot}05000$, and log sines throughout the quadrant	4 "
Logarithms of the ratios of arcs to tangents from $0^r{\cdot}00000$ to $0^r{\cdot}05000$, and log tangents throughout the quadrant	4 "

The trigonometrical results are given for every hundred-thousandth of the quadrant (10″ centesimal or 3″·24 sexagesimal) The tables were all calculated to 14 places, with the intention that only 12 should be published, but the twelfth figure is not to be relied upon. The tables have never been published, and are generally known as the *Tables du Cadastre*, or, in England, as the great French manuscript tables.

A very full account of the *Tables du Cadastre*, with an explanation of the methods of calculation, formulæ employed, etc., has been published by M. Lefort in vol. iv. of the *Annales de l'Observatoire de Paris*. The printing of the table of natural sines was once begun, and M. Lefort states that he has seen six copies, all incomplete, although including the last page. Babbage compared his table with the *Tables du Cadastre*, and M. Lefort has given in his paper just referred to most important lists of errors in Vlacq's and Briggs's logarithms of numbers which were obtained by comparing the manuscript tables with those contained in the *Arithmetica logarithmica* of 1624 and of 1628. These are almost the only uses that have been made of the French tables, the calculation of which involved so great an expenditure of time and money.

It may be mentioned here that the late Mr. John Thomson of Greenock made an independent calculation of the logarithms of numbers up to 120,000 to 12 places, and that the manuscript of the table was presented in 1874 to the Royal Astronomical Society by his sister. The table has been used to verify the errata which M. Lefort found in Vlacq and Briggs by means of the *Tables du Cadastre*. An account of Mr. Thomson's table, and of this and other comparisons between it and the printed tables, is to be found in the *Monthly Notices* of the Society, vol. xxxiv. pp. 447–75 (1874).

Although the *Tables du Cadastre* have never been published, other tables have appeared in which the quadrant is divided centesimally, the most important of these being Hobert and Ideler's *Nouvelles tables trigonométriques* (1799), and Borda and Delambre's *Tables trigonométriques décimales* (1800–1). The former work contains natural and log sines, cosines, tangents, and cotangents to 7 places, up to 3° (centesimal) at intervals of 10″ (centesimal), and thence to 50° at intervals of 1′. The latter gives log sines, cosines, tangents, and cosines for centesimal arguments, viz., from 0′ to 10′ at intervals of 10″, and from 0° to 50° at intervals of 10′, to 11 places, and also, in another table, log sines, cosines, tangents, cotangents, secants, and cosecants from 0° to 3° at intervals of 10″, and thence to 50° at intervals of 1′ to 7 places. After the work was printed it was read by Delambre with the *Tables du Cadastre*, and a number of last-figure errors which are given in the preface were thus detected. Callet's tables already referred to contain in a convenient form logarithms of trigonometrical functions for centesimal arguments.

Two tables of logarithms of numbers which have been recently published may be noticed, as they involve points of novelty. The first of these is Pineto's *Tables de logarithmes* (St. Petersburg, 1871). The tables are intended to give in a small space (56 pages) all the results that can be obtained from a complete ten-figure table by means of the following principle:—only the logarithms of the numbers from 1,000,000 to 1,011,000 are given directly, all other numbers being brought within the range of this table by multiplication by a factor, the logarithm of which factor is to be subtracted from the logarithm in the table. A list of the most convenient factors and their logarithms is given in a separate table. The principle of multiplying by a factor which is subsequently cancelled by subtracting its logarithm is one that is frequently employed in the calculation of logarithms, but the peculiarity of the present work is that it forms part of the process of using the table. The other tables, which occupy only ten pages, were published in a tract entitled *Tables de logarithmes à 12 décimales jusqu' à 434 milliards* by MM. Namur and Mansion at Brussels in 1877. The fact that the differences of the logarithms of numbers near to 434294 (these being the first figures of the modulus of the Briggian logarithms) commenced with the figures 100..., so that the interpolations in this part of the table are very easily and accurately performed, is ingeniously made use of. A table is given of logarithms of numbers near to 434294, and other numbers are brought within the range of the table by multiplication by one or two factors which are indicated.

In the ordinary tables of logarithms the natural numbers are all integers, while the logarithms tabulated are incommensurable. In an antilogarithmic table, the logarithms are exact quantities such as ·00001, ·00002, etc., and the numbers are incommensurable. The earliest and largest table of this kind that has been constructed is Dodson's *Antilogarithmic canon* (1742), which gives the numbers to 11 places, corresponding to the logarithms from ·00001 to ·99999 at intervals of ·00001. The only other extensive tables of the same kind that have been published occur in Shortrede's *Logarithmic tables* already referred to, and in Filipowski's *Table of antilogarithms* (1849). Both are similar to Dodson's tables, from which they were derived, but they only give numbers to seven places.

The most elaborate table of hyperbolic logarithms that exists is due to Wolfram, a Dutch lieutenant of artillery. His table gives the logarithms of all numbers up to 2200, and of primes (and also of a great many composite numbers) from 2200 to 10,009, to 48 decimal places. The table appeared in Schulze's *Neue und erweiterte Sammlung logarithmischer Tafeln* (1778), and was reprinted in Vega's *Thesaurus* (1794), already referred to. Six logarithms omitted in Schulze's work, and which Wolfram had been prevented from computing by a serious illness, were published subsequently, and the table as given by Vega is complete. The largest hyperbolic table as regards range was published by Zacharias Dase at Vienna in 1850 under the title *Tafel der natürlichen Logarithmen der Zahlen*. It gives hyperbolic logarithms of numbers from 1000·0 to 10500·0 at intervals of ·1 to 7 places, with differences and proportional parts, arranged like an ordinary seven-figure table of Briggian logarithms. The table appeared in the thirty-fourth part (new series, vol. xiv.) of the *Annals of the Vienna Observatory* (1851); but separate copies were issued.

Hyperbolic antilogarithms are simple exponentials, *i. e.*, the hyperbolic antilogarithm of x is e^x. A seven-figure table of e^x and its Briggian logarithm from $x = {}$·01 to $x = 10$ at intervals of ·01 is given in Hülsse's edition of Vega's *Sammlung*, and in other collections of tables; but by far the most complete table that has been published occurs in Gudermann's *Theorie der potenzial-oder cyklisch-hyperbolischen Functionen*, Berlin, 1833. This work consists of reprinted papers from Crelle's *Journal*, and one of the tables contains the Briggian logarithms of the hyperbolic sine, cosine, and tangent of x from $x = 2$ to $x = 5$ at intervals of ·001 to 9 places, and from $x = 5$ to $x = 12$ at intervals of 0·01 to 10 places. Since the hyperbolic sine and cosine of x are respectively $\frac{1}{2}(e^x - e^{-x})$ and $\frac{1}{2}(e^x + e^{-x})$, the values of e^x and e^{-x} may be deduced from the results given in the table by simple addition and subtraction.

Logistic numbers is the old name for what would now be called ratios or fractions. Thus a table of $\log \dfrac{a}{x}$, where x is the argument and a a constant, is called a table of logistic or proportional logarithms; and since $\log \dfrac{a}{x} = \log a - \log x$ it is clear that the tabular results differ from those given in an ordinary table of logarithms only by the subtraction of a constant and a change of sign. The first table of this kind appeared in Kepler's *Chilias logarithmorum* (1624) already referred to. The object of a table of $\log \dfrac{a}{x}$ is to facilitate the working out of proportions in which the third term is a constant quantity a. In most collections of tables of logarithms, and especially those intended for use in connection with navigation, there occurs a small table of logistic logarithms in which $a = 3600''$ ($= 1^\circ$ or 1^h), the table giving $\log 3600 - \log x$, and x being expressed in minutes and seconds. It is also common to find tables in which $a = 10800''$ ($= 3^\circ$ or 3^h), and x is expressed in degrees (or hours), minutes, and seconds. Such tables are generally given to 4 or 5 places. The usual practice in books seems to be to call logarithms logistic when a is $3600''$, and proportional when a has any other value.

Gaussian logarithms are intended to facilitate the finding of the logarithms of the sum and difference of two numbers whose logarithms are known, the numbers themselves being unknown; and on this account they are frequently called addition and subtraction logarithms. The object of the table is in fact to give $\log (a \pm b)$ by only one entry when $\log a$ and $\log b$ are given. The utility of such logarithms was first pointed out by Leonelli in a book entitled *Supplément logarithmique*, printed at Bordeaux in the year XI. (1802-3); this work being very scarce, a reprint of it was published by M. J. Houel in 1876. Leonelli calculated a table to 14 places, but only a specimen of it which appeared in the *Supplément* was printed. The first table that was actually published is due to Gauss, and was printed in Zach's *Monatliche Correspondenz*, vol. xxvi. p. 498 (1812). Corresponding to the argument A it gives, to 5 places, B and C, where

$$\mathrm{A} = \log x, \quad \mathrm{B} = \log\left(1 + \frac{1}{x}\right), \quad \mathrm{C} = \log(1 + x),$$

so that C = A + B.

We have identically

$$\log(a + b) = \log a + \log\left(1 - \frac{b}{a}\right)$$

$$= \log a + \mathrm{B} \text{ (for argument } \log \frac{a}{b});$$

and, in using the table, the rule is to take $\log a$ to be the larger of the two logarithms, and to enter the table with $\log a - \log b$ as argument; we then have $\log(a + b) = \log a + b$, or, if we please, $= \log b + \mathrm{C}$. The formula for the difference is $\log(a - b) = \log b + \mathrm{A}$ (argument sought in column C) if $\log a - \log b$ is greater than ·30103 and $= \log b - \mathrm{A}$ (argument sought in column B) if $\log a - \log b$ is less than ·30103.

The principal tables of Gaussian logarithms are (1) Mathiessen, *Tafel zur bequemern Berechnung* (Altona, 1818), giving B and C for argument A to 7 places,—this table is not a convenient one; (2) Peter Gray, *Tables and Formulæ* (London, 1849), and *Addendum* (1870), giving full tables of C and $\log(1 - x)$ for argument A to 6 places; (3) Zech, *Tafeln der Additions- und Subtractions-logarithmen* (Leipsic, 1849), giving 7-place values of B for argument A, and 7-place values of C for argument B. These tables appeared originally in Hülsse's edition of Vega's *Sammlung* (1849); (4) Wittstein, *Logarithmes de Gauss* (Hanover, 1866), giving values of B for argument A to 7 places. This is a large table, and the arrangement is similar to that of an ordinary seven-figure table of logarithms.

In 1829 Widenbach published at Copenhagen a small table of modified Gaussian logarithms giving $\log \dfrac{x+1}{x-1}$ ($=$ D) corresponding to A as argument; A and D are thus reciprocal, the relation between them being in fact $10^{\mathrm{A}+\mathrm{D}} = 10^{\mathrm{A}} + 10^{\mathrm{D}} + 1$, so that either A or D may be regarded as the argument.

Gaussian logarithms are chiefly useful in the calculations connected with the solution of triangles in such a formulæ as $\cot \frac{1}{2}\mathrm{C} = \dfrac{a+b}{a-b} \tan(\mathrm{A} - \mathrm{B})$, and in the calculation of life contingencies.

Calculation of Logarithms.—The name logarithm is derived from the words λόγων ἀριθμός, the number of the ratios, and the way of regarding a logarithm which justifies the name may be explained as follows. Suppose that the ratio of 10, or any other particular number, to 1 is compounded of a very great number of equal ratios, as for example 1,000,000, then it can be shown that the ratio of 2 to 1 is very nearly equal to a ratio compounded of 301,030 of these small ratios, or *ratiunculæ*, that the ratio of 3 to 1 is very nearly equal to a ratio compounded of 477,121 of them, and so on. The small ratio, or *ratiuncula*, is in fact that of the millionth root of 10 to unity, and if we denote it by the ratio of a to 1, then the ratio of 2 to 1 will be nearly the same as that of $a^{301{,}030}$ to 1, and so on; or, in other words, if a denotes the millionth root of 10, then 2 will be nearly equal to $a^{301{,}030}$, 3 will be nearly equal to $a^{477{,}121}$, and so on.

Napier's original work, the *Descriptio canonis* of 1614, contained, not logarithms of numbers, but logarithms of sines, and the relations between the sines and the logarithms were explained by the motions of points in lines, in a manner not unlike that afterwards employed by Newton in the method of fluxions. An account of the processes by which Napier constructed his table is given in the *Constructio canonis* of 1619. These methods apply, however, specially to Napier's own kind of logarithms, and are different from those actually used by Briggs in the construction of the tables in the *Arithmetica logarithmica*, although some of the latter are the same in principle as the processes described in an appendix to the *Constructio*. It may be observed that in the *Constructio* logarithms are called artificials, and this seems to have been the name first employed by Napier, but which he subsequently replaced by logarithms. It is to be presumed that he would have made the change of name also in the *Constructio*, had he lived to publish it himself.

The processes used by Briggs are explained by him in the preface to the *Arithmetica logarithmica* (1624). His method of finding the logarithms of the small primes, which consist in taking a great number of continued geometric means between unity and the given primes, may be described as follows. He first formed the table of numbers and their logarithms:

Number.	Logarithm.
10	1
3·162277 . .	0·5
1·778279 . . .	0·25
1·333521 . . .	0·125
1·154781 . . .	0·0625
. . .	. . .

each quantity in the left hand column being the square root of the one above it, and each quantity in the right hand column being the half of the one above it. To construct this table Briggs, using about thirty places of decimals, extracted the square root of 10 fifty-four times, and thus found that the logarithm of 1·00000 00000 00000 12781 91493 20032 35 was 0·00000 00000 00000 05551 11512 31257 82702, and that for numbers of this form (*i. e.*, for numbers beginning with 1 followed by fifteen ciphers, and then by seventeen or a less number of significant figures) the logarithms were proportional to these significant figures. He then by means of a simple proportion deduced that log 1·00000 00000 00000 (1) = 0·00000 00000 00000 04342 94481 90325 1804, so that, a quantity 1·00000 00000 00000 x (where x consists of not more than seventeen figures) having been obtained by repeated extraction of the square root of a given number, the logarithm of 1·00000 00000 00000 x could then be found by multiplying x by ·00000 00000 00000 04342 . . . . .

To find the logarithm of 2, Briggs raised it to the tenth power, viz., 1024, and extracted the square root of 1·024 forty-seven times, the result being 1·00000 00000 00000 16851 60570 53949 77. Multiplying the significant figures by 4342 . . . he obtained the logarithm of this quantity, viz., 0·00000 00000 00000 07318 55936 90623 9336, which multiplied by 2^{47} gave 0·01029 99566 39811 95265 277444, the logarithm of 1·024, true to 17 or 18 places. Adding the characteristic 3, and dividing by 10, he found (since 2 is the tenth root of 1024) log 2 = ·30102 99956 63981 195. Briggs calculated in a similar manner log 6, and thence deduced log 3.

It will be observed that in the first process the value of the modulus is in fact calculated from the formula

$$\frac{h}{10^h - 1} = \frac{1}{\log_e 10},$$

the value of h being $\frac{1}{2^{54}}$, and in the second process $\log_{10}2$ is in effect calculated from the formula

$$\log_{10}2 = \left(2^{\frac{10}{2^{47}}} - 1\right) \times \frac{1}{\log_e 10} \times \frac{2^{47}}{10}.$$

Briggs also gave methods of forming the mean proportionals or square roots by differences; and the general method of constructing logarithmic tables by means of differences is due to him.

The following calculation of log 5 is given as an example of the application of a method of mean proportionals. The process consists in taking the geometric mean of numbers above and below 5, the object being to at length arive at 5·000000. To every geometric mean in the column of numbers there corresponds the arithmetical mean in the column of logarithms. The numbers are denoted by A, B, C, etc., in order to indicate their mode or formation.

	Numbers.	Logarithms.
$A =$	1·000000	0·0000000
$B =$	10·000000	1·0000000
$C = \surd(AB) =$	3·162277	0·5000000
$D = \surd(BC) =$	5·623413	0·7500000
$E = \surd(CD) =$	4·216964	0·6250000
$F = \surd(DE) =$	4·869674	0·6875000
$G = \surd(DF) =$	5·232991	0·7187500
$H = \surd(FG) =$	5·048065	0·7031250
$I = \surd(FH) =$	4·958069	0·6953125
$K = \surd(HI) =$	5·002865	0·6992187
$L = \surd(IK) =$	4·980416	0·6972656
$M = \surd(KL) =$	4·991627	0·6982421
$N = \surd(KM) =$	4·997242	0·6987304
$O = \surd(KN) =$	5·000052	0·6989745
$P = \surd(NO) =$	4·998647	0·6988525
$Q = \surd(OP) =$	4·999350	0·6989135
$R = \surd(OQ) =$	4·999701	0·6989440
$S = \surd(OR) =$	4·999876	0·6989592
$T = \surd(OS) =$	4·999963	0·6989668
$V = \surd(OT) =$	5·000008	0·6989707
$W = \surd(TV) =$	4·999984	0·6989687
$X = \surd(WV) =$	4·999997	0·6989697
$Y = \surd(VX) =$	5·000003	0·6989702
$Z = \surd(XY) =$	5·000000	0·6989700

Great attention was devoted to the methods of calculating logarithms during the 17th and 18th centuries. The earlier methods proposed were, like those of Briggs, purely arithmetical, and for a long time logarithms were regarded from the point of view indicated by their name, that is to say, as depending on the theory of compounded ratios. The introduction of infinite series into mathematics effected a great change in the modes of calculation and the treatment of the subject. Besides Napier and Briggs, special reference should be made to Kepler (*Chilias*, 1624) and Mercator (*Logarithmotechnia*, 1668), whose methods were arithmetical, and to Newton, Gregory, Halley and Cotes, who employed series. A full and valuable account of these methods is given in Hutton's "Construction of Logarithms," which occurs in the introduction to the early editions of his *Mathematical Tables*, and also forms tract 21 of his *Mathematical Tracts* (vol. i., 1812). Many of the early works on logarithms were reprinted in the *Scriptores logarithmici* of Baron Maseres (6 vols. 4to, 1791–1807).

In the following account only those formulæ and methods will be referred to which would now be used in the calculation of logarithms.

Since

$$\log_e (1 + x) = x - \tfrac{1}{2}x^2 + \tfrac{1}{3}x^3 - \tfrac{1}{4}x^4 + \text{etc.},$$

we have, by changing the sign of x,

$$\log_e (1 - x) = - x - \tfrac{1}{2}x^2 - \tfrac{1}{3}x^3 - \tfrac{1}{4}x^4 - \text{etc.};$$

whence

$$\log_e \frac{1 + x}{1 - x} = 2(x + \tfrac{1}{3}x^3 + \tfrac{1}{5}x^5 + \text{etc.}),$$

and, therefore, replacing x by $\frac{p - q}{p + q}$,

$$\log_e \frac{p}{q} = 2\left\{\frac{p - q}{p + q} + \tfrac{1}{3}\left(\frac{p - q}{p + q}\right)^3 + \tfrac{1}{5}\left(\frac{p - q}{p + q}\right)^5 + \text{etc.}\right\},$$

in which the series is always convergent, so that the formula affords a method of deducing the logarithm of one number from that of another.

As particular cases we have, by putting $q = 1$,

$$\log_e p = 2\left\{\frac{p - 1}{p + 1} + \tfrac{1}{3}\left(\frac{p - 1}{p + 1}\right)^3 + \tfrac{1}{5}\left(\frac{p - 1}{p + 1}\right)^5 + \text{etc.}\right\},$$

and by putting $q = p + 1$,

$$\log_e (p + 1) - \log_e p = 2\left\{\frac{1}{2p + 1} + \tfrac{1}{3}\frac{1}{(2p + 1)^3} + \tfrac{1}{5}\frac{1}{(2p + 1)^5} + \text{etc.}\right\};$$

the former of these equations gives a convergent series for $\log_e p$, and the latter a very convergent series by means of which the logarithm of any number may be deduced from the logarithm of the preceding number.

From the formula for $\log_e \frac{p}{q}$ we may deduce the following very convergent series for $\log_e 2$, $\log_e 3$, and $\log_e 5$, viz. :—

$$\log_e 2 = 2(7\text{P} + 5\text{Q} + 3\text{R}),$$
$$\log_e 3 = 2(11\text{P} + 8\text{Q} + 5\text{R}),$$
$$\log_e 5 = 2(16\text{P} + 12\text{Q} + 7\text{R}),$$

where

$$\text{P} = \frac{1}{31} + \tfrac{1}{3} \cdot \frac{1}{(31)^3} + \tfrac{1}{5} \cdot \frac{1}{(31)^5} + \text{etc.}$$
$$\text{Q} = \frac{1}{49} + \tfrac{1}{3} \cdot \frac{1}{(49)^3} + \tfrac{1}{5} \cdot \frac{1}{(49)^5} + \text{etc.}$$
$$\text{R} = \frac{1}{161} + \tfrac{1}{3} \cdot \frac{1}{(161)^3} + \tfrac{1}{5} \cdot \frac{1}{(161)^5} + \text{etc.}$$

The following still more convenient formulæ for the calculation of $\log_e 2$, $\log_e 3$, etc., are given by Professor J. C. Adams in the *Proceedings of the Royal Society*, vol. xxvii. (1878), p. 91. If

$$a = \log \frac{10}{9} = - \log \left(1 - \frac{1}{10}\right), \quad b = \log \frac{25}{24} = - \log \left(1 - \frac{4}{100}\right),$$
$$c = \log \frac{81}{80} = \log \left(1 + \frac{1}{80}\right), \quad d = \log \frac{50}{49} = - \log \left(1 - \frac{2}{100}\right),$$
$$e = \log \frac{126}{125} = \log\left(1 + \frac{8}{1000}\right),$$

then

$$\log 2 = 7a - 2b + 3c,\ \log 3 = 11a - 3b + 5c,\ \log 5 = 16a - 4b + 7c,$$

and

$$\log 7 = \tfrac{1}{2}(39a - 10b + 17c - d) \text{ or } = 19a - 4b + 8c + e,$$

and we have the equation of condition,

$$a - 2b + c = d + 2e.$$

By means of these formulæ Professor Adams has calculated the values of $\log_e 2$, $\log_e 3$, $\log_e 5$, and $\log_e 7$ to 260 places of decimals, and he has deduced the value of $\log_e 10$ and its reciprocal M, the modulus of the Briggian system of logarithms. The value of the modulus found by Professor Adams is

M =	·43429	44819	03251	82765	11289
	18916	60508	22943	97005	80366
	65661	14453	78316	58646	49208
	87077	47292	24949	33843	17483
	18706	10674	47663	03733	64167
	92871	58963	90656	92210	64662
	81226	58521	27086	56867	03295
	93370	86965	88266	88331	16360
	77384	90514	28443	48666	76864
	65860	85135	56148	21234	87653
	43543	43573	17247	48049	05993
	55353	05			

The values of the other logarithms are given in the paper referred to.

If the logarithms are Briggian all the series in the preceding formulæ must be multiplied by M, the modulus; thus, for example,

$$\log_{10}(1 + x) = \mathrm{M}(x - \tfrac{1}{2}x^2 + \tfrac{1}{3}x^3 + \tfrac{1}{4}x^4 + \text{etc.}),$$

and so on.

As has been stated, Abraham Sharp's table contains 61-decimal Briggian logarithms of primes up to 1100, so that the logarithms of all composite numbers whose greatest prime factor does not exceed this number may be found by simple addition; and Wolfram's table gives 48-decimal hyperbolic logarithms of primes up to 10,009. By means of these tables and of a factor table we may very readily obtain the Briggian logarithm of a number to 61 or a less number of places or of its hyperbolic logarithm to 48 or a less number of places in the following manner. Suppose the hyperbolic logarithm of the prime number 43,867 required. Multiplying by 50, we have 50 × 43,867 = 2,193,350, and on looking in Burkhardt's *Table des diviseurs* for a number near to this which shall have no prime factor greater than 10,009, it appears that

$$2{,}193{,}349 = 23 \times 47 \times 2029;$$

thus

$$43{,}867 = \tfrac{1}{50}(23 \times 47 \times 2029 + 1),$$

and therefore

$$\log_e 43{,}867 = \log_e 23 + \log_e 47 + \log_e 2029 - \log_e 50$$
$$+ \frac{1}{2{,}193{,}349} - \frac{1}{2}\frac{1}{(2{,}193{,}349)^2} + \frac{1}{3}\frac{1}{(2{,}193{,}349)^3} - \text{etc.}$$

The first term of the series in the second line is

$$0{\cdot}00000\ \ 04559\ \ 23795\ \ 07319\ \ 6286;$$

dividing this by 2 × 2,193,349 we obtain

$$0{\cdot}00000\ \ 00000\ \ 00103\ \ 93325\ \ 3457,$$

and the third term is

$$0{\cdot}00000\ \ 00000\ \ 00000\ \ 00003\ \ 1590,$$

so that the series =

$$0{\cdot}00000\ \ 04559\ \ 23691\ \ 13997\ \ 4419;$$

whence, taking out the logarithms from Wolfram's table,

$$\log_e 43{,}867 = 10{\cdot}68891\ \ 76079\ \ 60568\ \ 10191\ \ 3661.$$

The principle of the method is to multiply the given prime (supposed to consist of 4, 5, or 6 figures) by such a factor that the product may be a number within the range of the factor tables, and such that, when it is increased by 1 or 2, the prime factors may all be within the range of the logarithmic tables. The logarithm is then obtained by use of the formula

$$\log_e(x + d) = \log_e x + \frac{d}{x} - \frac{1}{2}\frac{d^2}{x^2} + \frac{1}{3}\frac{d^3}{x^3} - \text{etc.},$$

in which of course the object is to render $\frac{d}{x}$ as small as possible. If the logarithm required is Briggian, the value of the series is to be multiplied by M.

If the number is incommensurable or consists of more than seven figures, we can take the first seven figures of it (or multiply and divide the result by any factor, and take the first seven figures of the result) and proceed as before. An application to the hyperbolic logarithm of π is given by Burkhardt in the introduction to his *Table des diviseurs* for the second million.

The best general method of calculating logarithms consists, in its simplest form, in resolving the number whose logarithm is required into factors of the form $1 - {\cdot}1^r n$, where n is one of the nine digits, and making use of subsidiary tables of logarithms of factors of this form. For example, suppose the logarithm of 543839 required to twelve places. Dividing by 10^5 and by 5 the number becomes 1·087678, and resolving this number into factors of the form $1 - {\cdot}1^r n$ we find that

$$543839 = 10^5 \times 5(1 - {\cdot}1^2 8)(1 - {\cdot}1^4 6)(1 - {\cdot}1^5 6)(1 - {\cdot}1^6 3)(1 - {\cdot}1^7 8)$$
$$\times(1 - {\cdot}1^8 5)(1 - {\cdot}1^9 7)(1 - {\cdot}1^{10} 9)(1 - {\cdot}1^{11} 3)(1 - {\cdot}1^{12} 2)$$

where $1 - {\cdot}1^2 8$ denotes $1 - {\cdot}08$, $1 - {\cdot}1^4 6$ denotes $1 - {\cdot}0006$, etc., and so on. All that is required therefore in order to obtain the logarithm of any number is a table of logarithms, to the required number of places of ·n, ·9n, ·99n, ·999n, etc., for $n = 1, 2, 3, \ldots 9$.

The resolution of a number into factors of the above form is easily performed. Taking, for example, the number 1·087678, the object is to destroy the significant figure 8 in the second place of decimals; this is effected by multiplying the number by 1 − ·08, that is, by subtracting from the number eight times itself advanced two places, and we thus obtain 1·00066376. To destroy the first 6 multiply by 1 − ·0006 giving 1·000063361744, and multiplying successively by 1 − ·00006 and 1 − ·000003, we obtain 1·000000857932, and it is clear that these last six significant figures represent without any further work the remaining factors required. In the corresponding antilogarithmic process the number is expressed as a product of factors of the form $1 + {\cdot}1^n x$.

This method of calculating logarithms by the resolution of numbers into factors of the form $1 - {\cdot}1^r n$ is generally known as Weddle's method, having been published by him in *The Mathematician* for November, 1845, and the corresponding method for antilogarithms by means of factors of the form $1 + ({\cdot}1)^r n$ is known by the name of Hearn, who published it in the same journal for 1847. In 1846 Mr. Peter Gray constructed a new table to 12 places, in which the factors were of the form $1 - ({\cdot}01)^r n$, so that n had the values 1, 2, . . . 99; and subsequently he constructed a similar table for factors of the form $1 + ({\cdot}01)^r n$. He also discovered a method of applying a table of Hearn's form (*i. e.*, of factors of the form $1 + {\cdot}1^r n$) to the construction of logarithms, and calculated a table of logarithms of factors of the form $1 + ({\cdot}001)^r n$ to 24 places. This was published in 1876 under the title *Tables for the formation of logarithms and antilogarithms to twenty-four or any less number of places*, and contains the most complete and useful application of the method, with many improvements in points of detail. Taking as an example the calculation of the Briggian logarithm of the number 43,867, whose hyperbolic logarithm has been calculated above, we multiply it by 3, giving 131,601, and find by Mr. Gray's process that the factors of 1·31601 are

(1) $1{\cdot}316$	(5) $1{\cdot}(001)^4 002$
(2) $1{\cdot}000007$	(6) $1{\cdot}(001)^5 602$
(3) $1{\cdot}(001)^2 598$	(7) $1{\cdot}(001)^6 412$
(4) $1{\cdot}(001)^3 780$	(8) $1{\cdot}(001)^7 340$.

Taking the logarithms from Mr. Gray's tables we obtain the required logarithm by addition as follows:—

522	878	745	280	337	562	704	972	= colog 3
119	255	889	277	936	685	553	913	= log (1)
	3	040	050	733	157	610	239	= log (2)
		259	708	022	525	453	597	= log (3)
			338	749	695	752	424	= log (4)
					868	588	904	= log (5)
					261	445	278	= log (6)
						178	920	= log (7)
							148	= log (8)
4·642	137	934	655	780	757	288	·464	= $\log_{10}$ 43,867

In Shortrede's *Tables* there are tables of logarithms and factors of the form $1 \pm ({\cdot}01)^r n$ to 16 places and of the form $1 \pm ({\cdot}1)^r n$ to 25 places; and in his *Tables de Logarithmes à 27 Décimales* (Paris, 1867) Fédor Thoman gives tables of logarithms of factors of the form $1 \pm {\cdot}1^r n$. In the *Messenger of Mathematics*, vol. iii. pp. 66–92, 1873, Mr. Henry Wace gave a simple and clear account of both the logarithmic and antilogarithmic processes, with tables of both Briggian and hyperbolic logarithms of factors of the form $1 \pm {\cdot}1^r n$ to 20 places.

Although the method is usually known by the names of Weddle and Hearn, it is really, in its essential features due to Briggs, who gave in the *Arithmetica logarithmica* of 1624 a table of the logarithms of $1+\cdot 1^r n$ up to $r=9$ to 15 places of decimals. It was first formally proposed as an independent method, with great improvements, by Robert Flower in *The Radix, a new way of making logarithms*, which was published in 1771; and Leonelli, in his *Supplément logarithmique* (1802-3), already noticed, referred to Flower and reproduced some of his tables. A complete bibliography of this method has been given by Mr. A. J. Ellis in a paper "on the potential radix as a means of calculating logarithms," printed in the *Proceedings of the Royal Society*, vol. xxxi., 1881, pp. 401-407, and vol. xxxii., 1881, pp. 377-379. Reference should also be made to Hoppe's *Tafeln zur dreissigstelligen logarithmischen Rechnung* (Leipsic, 1876), which give in a somewhat modified form a table of the hyperbolic logarithm of $1+\cdot 1^r n$.

The preceding methods are only appropriate for the calculation of isolated logarithms. If a complete table had to be reconstructed, or calculated to more places, it would undoubtedly be most convenient to employ the method of differences. A full account of this method as applied to the calculation of the *Tables du Cadastre* is given by M. Lefort in vol. iv. of the *Annales de l'Observatoire de Paris*.

(J. W. L. G.)

LOGIC.

1. LOGIC, in the most general acceptation of the term, may be regarded as the systematic study of thought. So wide a definition is certainly sufficient to comprehend all that may have been at various times included within the scope of logical doctrine, but in other respects it is of small value. It does not serve to mark off logic from philosophy as a whole, which is unquestionably the systematic exposition of thought, nor from psychology, which includes within its wider range what may well be described as the study of thought. Without some more accurate discrimination of the province and method of logic, neither the extent of matter to be included within the study nor the peculiarity of the method by which such matter is treated can be determined.

Preliminary queries of a similar kind are naturally encountered in the case of all other branches of human knowledge, and are generally answered by two methods. We may refer either to the distinct characteristics of the matter to be treated, or to the essential features of the method of treatment. We may determine the province of a science either by external division, by classification of objects according to their prevailing resemblances and differences, or by internal definition, by exposition of the fundamental characters of the method employed. By neither process, unfortunately, can an unambiguous answer be supplied, at least without much art, in the case of logic.

2. The reasons for the manifold difficulties encountered in the attempt to determine accurately the province of logic, whether by reference to a division of the sciences or by precise definition of the essential features of logical analysis, are not far to seek. The systematic classification of the sciences involves not only consideration of the contents of the sciences as empirically presented, but also certain leading principles or fundamental views, which are in essence of a philosophical character. According to the general conception of knowledge which in various kinds is manifested in the special sciences, there will be radically divergent methods of classification, and the province assigned to each member of the ensemble will, for the most part, have its limits determined according to the character of the general view adopted. Moreover, if any of the more prominent specimens of classification of the sciences be critically inspected, they will be found to presuppose a certain body of principles, of scope wider than any of these special disciplines, and to which no place in the ensemble can be assigned. In short, a systematic distribution of human knowledge into its distinctly marked varieties rests upon and presupposes a general philosophy, the character of which affects the place and function of each part of the distribution. Logic, as may readily be imagined, has therefore experienced a variety of treatment at the hands of systematizers of scientific knowledge. It has appeared as one of the abstract sciences, in opposition to those disciplines in which the character of the concrete material is the essential fact; as a subordinate branch of a particular concrete science, the investigation of mental phenomena; as a nondescript receptacle for the formulation in generalized fashion of the method and logical precepts exemplified in the special sciences. By such processes no more has been effected than to bring into light, more or less clearly, some of the characteristics of the supposed science, without in any way supplying an exhaustive and comprehensive survey of its boundaries and relations to other branches of knowledge. Thus, when logic is marked off from the concrete sciences and associated with mathematics in the most general sense, as the treatment of formal relations,[1] and further differentiated from mathematics as implying no reference to the quantitative character of the most general relations under which facts of experience present themselves,[2] there is certainly brought to the front what one would willingly allow to be a commonplace respecting all logical analysis, namely, that its principles are coextensive with human knowledge, and that all objects as matters of conscious experience have an aspect in which they are susceptible of logical treatment. But no more is effected. It is still left to a wider consideration to determine what the specific aspect of things may be which shall be called the *formal* and be recognized as the peculiarly logical element in them. There may be selected for this purpose either the general relations of coincidence and succession in space and time, or the fundamental properties of identity and difference, or the existences of classes, but in any case such selection depends upon and refers to a theory of the nature of knowledge and of the constitution of things as known. In truth, the notions of *form* and *formal relations* are by no means so simple and free from ambiguity that by their aid one can at once solve a complicated problem of philosophic arrangement. To lay stress upon *form* as the special object of logical treatment still leaves undecided the nature and ground of the principles which are to be employed in evolving a science of form, and therefore leaves the logical problem untouched.

Still less satisfactory are the results when logic is regarded as in some way a subordinate branch of the psychological analysis of mental phenomena.[3] Neither the grounds on which such a classification rests, nor the conclusions deduced from it, seem beyond criticism. The simple facts that certain mental processes are analyzed in logic, and that psychology is generally the treatment of all mental processes, by no means necessitate the view that logic is therefore the outgrowth from and a subordinate part of psychology. For it is clear, on the one hand, that logic has a scope wider than psychology, since in any sense of the term it has to deal with all the processes (or with some aspect of all the processes) by which on any subject knowledge is formed out of disjointed or disconnected experiences. And, on the other hand, since the subordination of one science to another, as species to genus, is fallacious, unless the two agree in fundamental characteristics, the position so assigned to logic would imply that in aim and method it shall be essentially one with psychology, a position equivalent to the negation of logic as a separate and independent discipline. It is not surprising therefore to find that so soon as logic has been distinguished as arising from psychology, and so dependent on it, the peculiarity of its position and functions compels the recognition of its more general scope and the reduction of its connection with psychology to an amount small enough to be compatible with absolute independence. Strong reasons, indeed, may be advanced for holding that logic is entirely to be separated from psychology, as differing from it in aim, method, and principle, that logical analysis is generally distinct from psychological, and that the two disciplines, while connected as parts of the general body of philosophical reflection, hold to one another a relation the reverse of that commonly accepted.[1]

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[1] As, *e.g.*, by H. Spencer, *Classification of the Sciences*, pp. 6, 12; H. Grassmann, *Die Ausdehnungslehre von 1844* (1878), Einleitung, xxii.-xxiii.

[2] Logic and mathematics, under this view, may be regarded either as generically distinct—which is apparently the opinion of Spencer, H. Grassmann, and Jevons—or as species of a more comprehensive genus, the theory of formal (symbolic) operations—which is apparently the opinion of R. Grassmann (see his *Formenlehre*, 1872) and Boole (see his *Mathematical Analysis of Logic*, 1847, p. 4, and *Differential Equations*, 1859, chap. xvi., specially pp. 388, 389). An admirable treatment of that which is implied in Boole's method is given in Mr. Venn's *Symbolic Logic*, 1881.

[3] For this extremely common arrangement, see Hamilton, *Lectures on Metaphysics*, i. p. 121-3; Ueberweg, *System der Logik*, § 6.

As to the endeavor to collect from consideration of the sciences in detail a body of precepts, the rules of scientific method, and to assign the systematic arrangement of such rules to one special discipline, called logic, it seems to stand on the same footing and to be open to the same criticism as the allied attempt to treat general philosophy as the receptacle for the most abstract propositions reached in scientific knowledge. There is a peculiar assumption underlying the supposed possibility of distinguishing between scientific method and its concrete exemplifications in the special sciences, and only on the ground of this assumption could there be rested the independence of logic as the systematic treatment of method. It is taken for granted, without examination, that the characteristic features of correct and well-founded thinking are palpable and general, and that we thus possess a criterion for marking off what is common to all scientific procedure from that which is special and peculiar to the individual sciences. An elaborate philosophic doctrine lies at the root of this assumption, and the position assigned to logic may easily be seen to depend, not on what is apparent in the argument, namely, comparison of the sciences with one another, but on what lies implicit in the background, the philosophic conception of the nature of scientific knowledge in general. Without reference to the ultimate philosophic view, no definite content could be assigned to logic, and it would remain impossible to distinguish logic from the sciences in detail.[2]

3. Thus the various attempts to define the province and functions of logic from general classification of the sciences, to define, in short, by the method of division, yield no satisfactory answer, and refer ultimately to the philosophic view on which classification and division must be based. A similar result becomes apparent when we consider the various descriptions of logic that have been presented as following from more precise and accurate determination of the essential features of logical analysis and method.

"The philosophical deduction or construction of the notion of logic presupposes a comprehensive and well-grounded view, whether of the nature and mode of operation of the human mind, a definite part of which falls under logical treatment, or of the problems and objects of philosophy in general, from among which in due order may be distinguished the particular problem of logic."[3] The most elementary distinctions, by means of which, in the ordinary exposition of logic, progress is effected towards an accurate determination of the province of the science, not only refer to some such ultimate philosophic view, but lead to the most diverse results, according to the peculiarity of the views on which they are based. Of these elementary distinctions the following are at once the more usual and the more important:—the distinction between the province of logic and the province of the special sciences, as that between general and special; the distinction between natural growth of knowledge, with its natural laws, and the normal procedure whereby grounded knowledge is obtained, with its normal or regulative principles; the distinction between knowledge as a whole and its several parts, immediate and mediate, with restriction of logic to the treatment of all or portion of mediate knowledge; the distinction between the constituents of knowledge as on the one hand given from without (in experience), and on the other hand due to the elaborative action of intellect itself. To one or other of these may be traced the common definitions of logic, and a brief consideration of their contents will be sufficient to show that they severally rest upon more or less developed general philosophic doctrines, and that their significance for accurate determination of the field of logic depends not so much on what is explicitly stated in them as on what is implied in the general doctrines from which they have taken their rise.

The distinction of logic from the sciences, as dealing in the abstract with that which is concretely exemplified in each of them, is certainly a first step in the process of determination about which there can be little or no doubt. But if the distinction remain vague, it is not sufficient to differentiate logic from many other disciplines, philosophical or philological, and if it be made more precise, the new characteristics will be found to involve some special view as to what constitutes the common feature in the sciences, and to vary with the possible varieties of view. As a rule, too, the added characteristics do not serve by themselves to mark off logical treatment as an independent kind of investigation. They are most frequently obtained by a general survey of scientific procedure. Thus it may be said that in all sciences there are implied clearly defined notions, general statements or judgments, and methodical proofs; logic therefore, as the theory of the general element in science, will appear as the treatment of notions, judgments, and proofs generally, or in the abstract. If so, then, unless some implied principle further determine the course of procedure, logic would be regarded as a merely descriptive account of the parts making up scientific knowledge, and it would be not only impossible to assign to it an independent position, but hard to discriminate it from psychology, which likewise deals with the parts of knowledge. If it be understood, however, or explicitly stated, that in all scientific knowledge there is community of method, resting on common principles or laws of knowledge as such, then clearly not only the province of logic, as now made identical with the treatment of the essence of knowledge, but the special nature of the theorems making up the body of logic, must depend upon the general conception of knowledge with which the thinker starts. In the view of logic taken, *e. g.*, by Mill, the fundamental idea is that of *evidence*, under which must be included all the grounds for any judgment not resting on immediate perception. So far as verbal statement is concerned, the adoption of this as the root idea would not distinguish in any special way the treatment of logical problems resting on it, but in fact each problem is dealt with in accordance with the particular theory of what, from the nature of human knowledge, constitutes evidence. Logic thus involves, or in truth becomes, a theory of knowledge, and in the end, for general spirit and details of doctrine, refers to an ultimate philosophic view. There seems no escape from this conclusion. Start as we may, with popular, current distinctions, no sooner do logical problems present themselves than it becomes apparent that, for adequate treatment of them, reference to the principles of ultimate philosophy is requisite, and logic, as the systematic handling of such problems, ceases to be an independent discipline, and becomes a subordinate special branch of general philosophy.

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[1] It is to be acknowledged that most of the writers on logic who emphasize the connection of psychology with logic introduce distinctions equivalent to the remarks above made, but the grounds for such distinctions and the conclusions to be deduced from them are not generally brought into clear light.

[2] See, for a clear statement of this impossibility, Comte, *Philos. Positive*, i. 84, 85. Definitions of logic as theory of method, which are based on general philosophic views (*e. g.*, the definition by Sigwart, *Logik*, i. § 1), stand on a different footing, and are to be examined on different principles.

[3] Twesten, *Die Logik, insbesondere die Analytik* (1825), p. 2.

The attempt to avoid this conclusion must of necessity take form in some discrimination of logic from other varieties which may with it be classed under philosophy in general, and such discrimination is usually effected by laying stress on one or other of the following characteristics.

(1) In the whole process of knowledge, it may be said, we are able to distinguish and to regard in isolation the methods according to which, from a combination of various elements, cognition of things grows up, and the laws according to which these elements must be ordered, if our subjective consciousness is to represent accurately and faithfully the relations of things. The laws of knowledge, there being understood by knowledge the whole sum of mental determinations in and through which the world of external and internal experience is realized for us, are of two distinct kinds, natural and normal. For the treatment of the natural laws the most appropriate title is psychology; for that of the normal or regulative laws the title logic is peculiarly appropriate. By the one science knowledge is regarded in its relation to the subjective consciousness, as so much of what enters into and constitutes the world of inner experience; by the other knowledge is regarded in its relation to truth, to the objective system, as the means whereby, for theoretical or practical purposes, an orderly and verifiable conception of this system is realized. A definite place seems thus secured for logic, but, if one may judge merely from the various attempts to expound the body of logical doctrines from this point of view, the characteristic feature is not yet sufficient to determine the boundaries of the science or the specific nature of its problems. In fact, the feature selected might be accepted as the distinguishing mark of logical science by writers who would include under that common title the most diverse matters, and who would differ fundamentally in respect to the treatment of isolated problems. The metaphysical logic of Hegel, the empirical logic of Mill, the formal logic of Kant, might all claim to be developments of this one view of the essence of logic. So wide a divergence is clear evidence that the criterion selected, though possibly accurate, is not sufficiently specific, and that the interpretation of it, which in truth determines for each the nature and boundaries of the science, depends upon the view taken respecting knowledge as a whole in its relation to the objective order of experience, respecting the import of the so-called normal laws, and respecting the subjective elements supposed to constitute knowledge.

On all sides this particular definition of logic is beset with difficulties, which it cannot afford to dismiss by means of the simple demand that knowledge shall be accepted as somehow given. For, apart altogether from the danger that under so wide a term as knowledge many differences may be accommodated, it then becomes impossible to do more than treat in a quasi-empirical fashion mental facts, the nature and peculiarities of which are to be learned from some external source. In the later, more detailed examination of the view of logic here briefly described, it will be pointed out that the usual formula by which the several logical notions are introduced, viz., that their nature as mental facts is dealt with in psychology, from which logic borrows, is in fact much more than a formula. The logical peculiarities will be found to rest mainly upon the psychological characteristics as borrowed, while it is evident that no substantive, independent existence can be vindicated for a doctrine the succession of whose parts and their essential nature are given externally.

(2) Some of the perplexities that arise when logic is treated as the theory of the normal laws of knowledge may be obviated by the current distinction between immediate and mediate knowledge. The normal laws of knowledge might be said to apply solely to the process of mediate cognition, and their final aim would be defined as harmony between mediate knowledge and immediate experience. But it is difficult to distinguish with perfect accuracy between the two kinds of knowledge in question; it is impossible that the treatment of the logical problem should not depend entirely on the view taken as to the nature of that which differentiates mediate from immediate knowledge. Whether we express this as thought or as belief, its nature then becomes the all-important factor in determining the course of logical treatment, and further progress will manifest divergencies according as stress is laid on the subjective characteristics of thought, the laws to which, from its essential nature, all its products must conform, or on the limitations imposed by principles which have reference to the most general relations of the things thought about. In the one case a formal logic, of the type commonly known as the Kantian, would be developed, in the other either an empirical logic, like that of Mill, wherein the nature of notions, propositions, and reasonings is considered from the point of view of the empirical conception of experience, or a transcendental logic, like that involved in the *Critique of Pure Reason*, or a metaphysical logic, like that of Hegel, or a mixed doctrine, like that of Trendelenburg, Lotze, and Ueberweg. In short, the general philosophic view of thought is that upon which the character of logic as a science rests.

(3) There has above appeared, incidentally, one of the most current methods of solving the logical problem, by procedure from the distinction between that which is given to the mind in knowledge, and that which is supplied by the mind itself. No distinction seems more simple; none is in reality more complex. The opposition on which, in its popular acceptation, it rests is that between the individual concrete thinking subject and the world of objective facts, existing, as it were, to be cognized. The full significance of such an opposition, the forms in which it presents itself in conscious experience, the qualifications which must be introduced into the statement of it that it may have even a semblance of reality,—these are problems not solved by a simple reference to the distinction as existing. It may well be held that knowledge is, for the individual, the mode (or one of the modes) in which his relation to the universe of fact is subjectively seized, but it is not therefore rendered possible to effect an accurate and mechanical separation of knowledge into its matter and form. Even on lower grounds it may be held that by the employment of this criterion little or no light is thrown upon the logical question. For no determination is supplied by it of the universal characteristic of form as opposed to matter in knowledge, and a comparison of various expositions will show the most startling diversity of view respecting the nature and boundaries of the formal element in knowledge. It is of course true that in one sense any scientific treatment of knowledge is formal. Our analysis extends only to the general or abstract aspect of cognition, not to its actual details. But we are not, on that account, dealing with the form of knowledge. So soon as it is attempted to define more accurately what shall be understood by form then it is found that various views of logic arise, corresponding to the variety of principles supposed to be applied in the treatment of form. Thus the stricter followers of the Kantian logical idea, *e. g.*, Mansel and Spalding, recognize, as sole principles which can be said to be involved universally in the action of thought, the laws of identity, non-contradiction, and excluded middle, and in their hands logic becomes merely the systematic statement of these laws, and the exposition of the conditions which they impose upon notions, judgments, and reasonings. Analytical consistency, *i. e.*, absence of contradiction, is on this view the one aspect of knowledge which is susceptible of logical treatment. On the other hand, the idea of a contribution furnished by the mind itself to knowledge may lead to a more concrete and yet not less exact system of the forms of knowledge, if there be taken into account the real character of the

operation by which such contribution is made. Thus in the logic of Ulrici, from the view of thought as essentially the distinguishing faculty, by which definiteness is given to the elements entering into knowledge, there follows not simply an iteration of the principle that thought must not contradict itself, but a systematic evolution of the fundamental relations involved in the action of thought, in which the more specifically logical products, the notion, judgment, and reasoning, have a determinate place assigned to them.

Not only, then, may quite distinct provinces be assigned to logic by thinkers who start with the same idea of thought as contributing to knowledge, but, as may well be imagined, the treatment of special logical problems presents a most bewildering variety. The nature of judgment, the principle of reasoning, the characteristics of thought which is in accordance with logical rule, will be viewed differently according to the special interpretation put upon the functions of the subjective factor in knowledge. Here again we find that the really influential fact in the determination of the province and method of logical science is a general philosophic conception of knowledge or thought.[1]

4. There remains yet one method by which a clear and sufficient definition of the province and function of logic may be attainable. It may be that the separation of logic from other philosophic disciplines has come about historically, and that the assignment to logic of a special body of problems and a special kind of treatment is due to the accidents of its development. We might therefore hope to gain from a comparative survey of the field of logic, as that has been historically marked out, some definite view not only respecting the specific problems of logical theory, but also regarding the grounds for the isolated treatment of them. That in the history of logic there should be found a certain continuity of doctrine and development may, however, be compatible with entire absence of a common body of received logical matter, and the result of an historical research may be little more than a statement of distinct conceptions regarding the nature and province of the science, leading to the inclusion of very distinct materials within its scope. It requires but a superficial investigation of that which at various intervals has presented itself as logical theory to arrive at the conclusion that the differences in general spirit and in the mass of details far outbalance any agreement as to a few detached doctrines and technical symbols. If the survey were limited even to the period preceding the attempts at radical reformation of philosophy in general, and of logic as included therein, to the period in which the Aristotelian doctrines, as they may be called, formed the common basis of logical treatment, we should be able to detect differences of such a kind as to indicate radically distinct fundamental views. The scholastic logic, which, even by itself, cannot be regarded as one theory with unimportant modifications, is most falsely described as Aristotelian. The technical terminology, the general idea and plan, and some of the formal details are certainly due to the Aristotelian analysis of reasoned knowledge, but in spirit, in ruling principles, and in the mass of details the method of the scholastic logic is alien to that of Aristotle. It will be shown later that the Aristotelian analysis is saturated with the notions and aims of the Aristotelian metaphysics and general theory of knowledge, and that on this account alone, apart from the introduction of many foreign ingredients, from Stoic, Arab, and Byzantine sources, into the scholastic system, an important difference must subsist between the original doctrine and that which presents itself as but its historical development. Even more radical is the divergence of modern logic from the Aristotelian ideal and method. The thinker who claimed for logic a special pre-eminence among sciences because "since Aristotle it has not had to retrace a single step, . . . and to the present day has not been able to make one step in advance,"[2] has himself, in his general modification of all philosophy, placed logic on so new a basis that the only point of connection retained by it in his system with the Aristotelian may be not unfairly described as the community of subject. Both deal in some way with the principles and methods of human thinking, but as their general views of the constitution of thought are diverse, little agreement is to be found in the special treatment of its logical aspect. So when a later writer prefaces his examination of logical principles with the declaration that "logic is common ground on which the partisans of Hartley and of Reid, of Locke and of Kant, may meet and join hands,"[3] we are not unprepared for the result that, with a few unimportant exceptions, his views of logical principle coincide with those of no recognized predecessor in the same field, diverge widely from either the currently received or the genuine Aristotelian doctrines, and lead to a totally new distribution, in mass and detail, of the body of logical theorems and discussions. Such divergence is, indeed, most intelligible. If one reflects on the significance which would be attached in any one of these logical systems, of Aristotle, of Kant, of Mill, to the *universal* or universalizing element of thought, and on the fact that such universal must manifest itself as the characteristic feature in all the important products of thinking, the notion, the judgment, the syllogism, the conclusion is inevitable that difference of view in respect to the essence must make itself felt in difference of treatment of details. The ultimate aim of proof, and the general nature of the methods of proof, must appear differently according as the accepted ground is the Aristotelian conception of nature and thought, the Kantian theory of cognition, or subjective empiricism.

If, adopting a simpler method, one were to inspect a fair proportion of the more extensive recent works on logic, the conclusion drawn would be probably the same,—that, while the matters treated show a slight similarity, no more than would naturally result from the fact that thought is the subject analyzed, the diversity in mode of treatment is so great that it would be impossible to select by comparison and criticism a certain body of theorems and methods, and assign to them the title of logic. That such works as those of Trendelenburg, Ueberweg, Ulrici, Lotze, Sigwart, Wundt, Bergmann, Schuppe, De Morgan, Boole, Jevons, and these are but a selection from the most recent, treat of notions, judgments, and methods of reasoning, gives to them indeed a certain common character; but what other feature do they possess in common? In tone, in method, in aim, in fundamental principles, in extent of field, they diverge so widely as to appear, not so many different expositions of the same science, but so many different sciences. In short, looking to the chaotic state of logical text-books at the present time, one would be inclined to say that there does not exist anywhere a recognized, currently received body of speculations to which the title logic can be unambiguously assigned, and that we must therefore resign the hope of attaining by any empirical consideration of the received doctrine a precise determination of the nature and limits of logical theory.

5. In order to make clear the reasons for this astonishing diversity of opinion regarding the province and method of logic, and so make some advance towards a solution of what may well be called the logical problem, it seems necessary to consider some of the leading conceptions of logic, with such reference to details as will suffice to show how difference of fundamental view determines the treatment of special logical problems. In this consideration the order must be historical rather than systematic. Not, indeed, that it is needful, nor

[1] In Rosenkranz, *Die Modificationen der Logik abgeleitet aus dem Begriff des Denkens* (1846), a similar conclusion is illustrated by an elaborate classification of possible modifications of the view of logic. Compare also Braniss, *Die Logik in ihrem Verhältniss zur Philosophie geschichtlich betrachtet* (1823).

[2] Kant, *Kritik*, Vorrede, p. 13.

[3] Mill, *System of Logic*, i. p. 13.

is it proposed, to present an historical account of philosophy at large, or even of logic in particular; our purpose is merely to disentangle and bring clearly forward the nature of the principles respecting logical theory which have served as basis for the most characteristic logical systems. Such an inquiry will not only assist in explaining the divergencies of logical systems, but throw light upon the essence of logic itself.[1]

In this historico-critical survey, the first section must naturally be devoted to a consideration of the Aristotelian logic. The records of Oriental attempts at analysis of the procedure of thought may, for our present purpose, be disregarded.[2]

The Aristotelian Logic.

6. In a remarkable passage at the close of the tract called by us the *Sophistical Refutations*, Aristotle claims for himself distinct originality in the conception of subjecting to analysis the forms or types of argument. "The system I have expounded had not been partially, though imperfectly, elaborated by others; its very foundations had to be laid. . . . The teachers of rhetoric inherited many principles that had long been ascertained; dialectic had absolutely no traditional doctrines. Our researches were long, tentative, and troublesome. If, then, starting from nothing, it bears a comparison with others that have been developed by division of labor in successive generations, candid criticism will be readier to commend it for the degree of completeness to which it has attained than to find fault with it for falling short of perfection."[3] Although the specific reference in this passage is to the analysis of dialectical argument contained in the *Topica*, the same claim might with justice have been made in regard to the more extensive analysis of the forms of reasoning in general which makes up the substance of the other books of the *Organon*. There had been, prior to Aristotle, much discussion of problems that would under any view be included under the head of logic, but no systematic attempt had been made to analyze knowledge as a whole in its formal aspect, to throw under general heads or classes the types of reasoning, whether dialectical or scientific, and to exhibit the general relations in which the elements of all reasoning stand to one another. After Aristotle, it became possible to refer all such discussions to a common head, and to view them as component parts of one systematic doctrine. In a peculiar sense, then, Aristotle may be described as the founder of logical science.

The precise nature of the inquiries falling within the scope of the Aristotelian logic may receive some preliminary explanation supplementary to that which can only be given by a careful study of the chief theorems of the system, if there be taken into account (*a*) the advances towards a theory of logical method contained in the speculations of earlier Greek thinkers, (*b*) the classification of philosophic discipline which underlies the body of Aristotle's writings, and (*c*) the general conception of the matter of logical analysis which may be deduced from any special or incidental treatment of the question in Aristotle. Of these in order.

7. (*a*) Logical discussions prior to Aristotle.

The inquiries which find a place in the Aristotelian logic are all, in a large sense, problems of the theory of knowledge. They arise, therefore, only in connection with critical reflection on the nature, grounds, and method of knowledge. The earliest forms of Greek speculation, turning rather upon explanation of natural fact, being in essence attempts to reduce the multiplicity of known fact to unity of principle, contain, as a consequence, problems of a metaphysical character, which might involve problems of strictly logical character, but were logical only in potentiality. Of all these metaphysical questions the most important centre round the fundamental opposition between unity of principle and multiplicity of fact, between the one and the many, an opposition which under varied forms presents itself at every stage in the history of philosophic speculation. In the first period of Greek speculation, the problem presented itself in its simplest, most direct aspect, and, after a few rough attempts at a quasi-physical explanation of the genesis of many out of one, there come forward, as reasoned, ultimate solutions, the Eleatic doctrine that only unity has real being, the Heraclitic counter-doctrine that only in change, in the many, is truth to be found, and the Pythagorean notion of number, harmony, as containing in *abstracto* the union of the opposites, one and many. No one of these philosophic treatments can be said to contain specifically logical elements, but they raise questions of a logical kind, and, especially in the records of the Eleatic views, one can trace a close approximation to the critical reflection which marks the transition to a new order of ideas. Results which in these systems are stated with metaphysical reference only, reappear with new aspect among the sophists and the Socratic schools. The transition stage, indeed, partly aided by the atomic separation of objective fact from subjective sense experience, is mainly the effect of the sophistic and Socratic teaching. Socrates and the sophists have this in common that both treat the fundamental problem of philosophy as it had been handed down with special reference to the subjective experience of the individual. In the teaching of the sophists generally is to be discerned the opposition between subjective reflection and objective fact; in that of Protagoras and Gorgias in particular there appear as problems of the theory of knowledge difficulties for the older metaphysic of Heraclitus and the Eleatics respectively. The Heraclitic principle of change is the general foundation for the doctrine that the momentary perception is the only fact of cognition, and upon it may be based the conclusions that all truth is relative to the individual state of the individual subject, and that judgment, as a mode of expressing truth, is a contradiction in itself. Thus the extreme Heracliteans, as Cratylus, rejected the proposition, or combination of words, as expressing a unity and permanence not to be found in things, and reduced speech to the symbolism of pointing with the finger. Less developed but not less clear is the connection between the brief sceptical theses of Gorgias and the Eleatic doctrine of unity. As knowledge was impossible on the Heraclitean view, since it implied a synthesis not discoverable amidst incessant change, so for Gorgias knowledge was impossible, since in the synthesis was involved an element of difference, multiplicity, not reconcilable with the all-embracing unity of things. It is evident from the treatment of such views in Plato and in Aristotle, how many of the illustrations used in support of the general thesis depended for their apparent strength on neglect of some of the elementary conditions of thought, and how inevitably reflection upon these difficulties led to the construction of a theory of thought. The first outlines of such a theory are to be found in the Socratic principle of the notion (or concept, as we may call it, for the notion as viewed by Socrates is certainly the concrete class notion, the simple result of generalization and abstraction), and to Socrates is assigned by Aristotle the first statement of two important logical processes—induction, or the collection of particulars from which by critical comparison a generalized result might be drawn, and definition, or the explicit statement of the general elements disclosed by critical comparison of instances.[4] In the Socratic teaching, so far as records go, no explicit reference was made to the problems in connection with which those processes are of greatest significance, but in the lesser Socratic schools on the one hand, and in Plato on the other, we find the new principle either brought to bear upon the old difficulties, or developed into a comprehensive method.

The Socratic concept contains in itself the union of one and many, but it is in nature subjective; it is a mode of knowledge. If, then, it be regarded as only subjective, the old difficulties reappear. How is it possible to reconcile, even in thought, an opposition so fundamental as that between unity and plurality? Must there not be a like irreconcilable opposition between the subjective counterparts of these objective relations, between the individual notion, the atom of knowledge, and the proposition or definition? How, indeed, can there be a combination in thought of that which is in essence uncombinable? Whether we take Aristippus, who draws mainly for theory of knowledge on the Heraclitic-Protagorean sources, or Antisthenes, who leans towards the Eleatic, or the Megarics, who also, in accordance with the Eleatic thoughts, devoted chief attention to the polemical aspect of the theory, we find a set of problems appearing, the solution of which imperatively called for a theory of knowledge as the combination of one and many. Perhaps the most interesting of these early thinkers, so far as the history of logic is concerned, is Antisthenes, whose extreme nominalism presents the most curious analogies to some recent logical work.[5] According to Antisthenes, the world of cognizable fact consists of combinations of elementary parts (πρῶτα). These πρῶτα appear in cognition as irreducible elements denoted by the simplest elements of speech, names. The name is the mark for the sense-impression by which each πρῶτον is communicated to us, for they are only known by sense, and are strictly individual. A composite thing is known through the combination of names of its parts, and such a combination (συμπλοκή) is a proposition or definition (λόγος). Each thing has its specific λόγος (οἰκεῖος λόγος), and a judgment is merely the expression of this. There is therefore no distinction of subject and predicate possible; even identical propositions, the only possible forms under this theory, are mere repetitions of the complex name. Predication is either impossible or reduces itself to naming in the predicate what is named in the subject. It is the simple result of so consistent a nominalism that all truth is arbitrary or relative; there is no possibility of contradiction, not even of one's self.

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[1] For a notice of works on the history of logic, see note A, p. 811.

[2] For a notice of some of the more developed systems of Oriental logic, see note B, p. 811.

[3] The above translation, which is somewhat free, is taken from Mr. Poste's edition of the *Sophistici Elenchi*, p. 95.

[4] *Metaph.*, 1078b, 27–29.

[5] On Antisthenes, see the third part of the *Theætetus*, which appears, beyond doubt, to refer to him (comp. Peipers, *Untersuchungen über das System Plato's*, 1874, pp. 124–48), and Aristotle, *Metaphysics*, 1024b, 32; 1043b, 24; *Topica*, 104b, 21.

The theory of Antisthenes, strange as it may at first sight appear, rested on certain metaphysical difficulties, which lie at the root of all the perplexity regarding the import of propositions, and it is not too much to say that these difficulties were kept continually in mind by Plato and Aristotle in their several attempts to explain the nature of knowledge. Both thinkers find themselves confronted with the ultimate question, What is the ground of unity in things known, and in what way does thought unite the detached attributes of things into a subjective whole? What is the nature of the unity which binds things, themselves in a sense units, into classes or wholes, and how comes it that in the judgment subject and predicate are, in a sense, set at one?

In Plato, for whom the solution was found in the participation in or imitation of ideas by things, we find more distinctly conceived the series of logical processes involved obscurely in the Socratic method. So far as positive statements regarding the ideas can carry one, it may be said that in essence these processes concern only the formation of or deduction from the concrete universal concept or general notion. The ideas, in the Platonic system, at least in reference to the thought which apprehends them, resemble most closely class notions. A deeper significance often appears to attach to the relative processes of *induction*, whereby the resemblances of things, the idea in them, is disclosed, *definition*, whereby the content of the idea is made explicit, and *division*, whereby the external connection of ideas with one another, their system, is deduced, but such significance attaches to the more purely metaphysical aspects of the theory, and had no particular bearing on the Aristotelian treatment of the same problems. Not much is given in Plato towards a theory of the proposition, though sometimes an analysis of its elements is sketched; and the method of division could yield only a few of the types of deductive reasoning. But, over and above these more definite contributions towards the construction of a theory of knowledge, there are general aspects of the Platonic work of not secondary importance for the Aristotelian logic. In Plato the fundamental differences of earlier philosophic views appear in a new phase, and are elevated to a higher stage. Sophistic method is analyzed, not as in forms actually existing, but in its essential features, and the opposition between sophist and philosopher is viewed as the opposition between opinion and knowledge. Heraclitic principle of change and Eleatic doctrine of unity are resolved into the more comprehensive opposition of the universal and the particular, while hints of an ultimate solution, of a universal which is at once and *per se* particular, are not wanting. The Socratic method of thought appears as that by which alone a solution of philosophic difficulties is to be obtained, and the consideration of thought in its relation to facts is marked out for special investigation. A deeper view of thought was thus made at once possible and necessary.

8. (*b*) Much, then, had been effected by Aristotle's predecessors in the way of preparing a definite body of problems and a method of dealing with them, problems and method which might fairly be said to belong to a theory of knowledge as such, and from the occasional references in the *Organon* to opinions of contemporaries it is evident that many isolated attempts at solution of such questions were being carried on. In Aristotle we find a systematic examination of many of these problems, but it is left by him doubtful what place in the general scheme of philosophic sciences should be assigned to it. The distribution into physics, mathematics, and first philosophy, or the wider classification of doctrines as poetic, practical, or theoretical, in no way enables us to class logic or the body of speculation making up the *Organon*. That the forms of proof analyzed in these writings are of universal scope is unambiguously declared; that the first principles assumed in all proof are dealt with in first philosophy is also made clear; but the relations between the two doctrines so reciprocally related cannot be determined from any statement made by Aristotle himself. That he should have regarded the inquiries of the analytics as propædeutic in character, and should have held that those who assume to discuss problems of first philosophy ought to have made themselves acquainted with the general theory of proof, is intelligible, and more than this significance cannot, we think, be assigned to the passage in the *Metaphysics*, on the ground of which the logical inquiries have been classed as the general, common introduction to the whole system.[1] For the close connection between the analytical researches of the *Organon* and the inquiry into essence or being as such forbids us to accept, in any strict sense, a separation of these as forming distinct and independent sciences. To metaphysics is assigned the consideration of the principles of proof, and the kind of inquiry making up first philosophy is described by Aristotle in a fashion which assimilates it most closely to the researches of the analytica. That which is left undecided by the Aristotelian classification is the relation of the logical inquiries to the organic whole of which first philosophy is the main or sole part.[2] To obtain any fresh light we must turn to the consideration of indications supplied by Aristotle as to the nature of the inquiries grouped under the head *Analytics*.

9. (*c*) Such indications are unfortunately most scanty. As we probably have not the *Metaphysics* in its full extent, actual or contemplated, the want of a clear separation between the inquiries belonging especially to first philosophy and those appropriate to the analytical researches may be due in part to the deficiency of our materials. There are, however, two lines of separation discernible, from which some useful inferences may be drawn. What we call the logic of Aristotle, *i. e.*, the treatises making up the *Organon*, is roughly divisible into three parts:—(1) the formal analysis of syllogism and its allied types of reasoning, with the more particular discussion of the elementary parts of reasoning=the proposition; (2) the theory of scientific proof and definition (apodictic); (3) the theory of probable arguments, or of reasoning based on currently received opinions and leading to conclusions more or less probable (dialectic). Certainly for Aristotle there was no such distinction between the first and the remaining two parts as would in any way correspond to the modern separation of general or formal logic from the theory of knowledge, or material logic; the three parts in conjunction make up one body of doctrine. Now dialectic is very specially indicated as being of a formal character, *i. e.*, as dealing with no special matter, but with κοινά, opinions, or types of opinions, common to all sciences.[3] Apodictic, we may assume, is in like manner the formal study of what constitutes knowledge strictly so-called, the nature of the principles on which knowledge rests, the special marks distinguishing it, and the method by which knowledge is framed. But in every body of doctrine we may distinguish, according to Aristotle, three things,—the genus or class of objects with which the demonstration is concerned, the essential or fundamental attributes, qualities of these objects, which are to be demonstrated of them, and, thirdly, certain common axioms or principles of demonstration, not themselves demonstrable, and not entering as integral parts into the demonstration, but lying in the background as security for the reasoning carried out by thought employing them. Can anything corresponding to these three facts be discovered, if we assume for the moment, what certainly is not explicitly stated by Aristotle, that analytic constitutes a special body of doctrine? The genus or class about which the doctrine is concerned can only be reasoning itself, either as apodictic or dialectic, and the latter for a special reason may be left out of account; ἀπόδειξις, then, is the matter concerning which the doctrine is put forward. But ἀπόδειξις is a form of knowledge, that is to say, subjective. The properties, therefore, of apodictic science can only be made clear if we consider on the one hand the objective counterparts of necessity and universality in thought, and on the other hand the nature of universality and necessity of thought itself. The common principles or axioms, finally, can only be such presuppositions as are made in apodictic or reasoning generally respecting thought in its relation to fact, as grasping or apprehending reality. The consideration of such axioms, it has been already seen, pertains to first philosophy. Analytics then would appear as an independent doctrine, holding of first philosophy on the one

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[1] *Metaph.*, iv. 1005b, 2. See Zeller, *Ph. d. Gr.*, ii. 2 (3d ed.), p. 184, *n.*; Rassow, *De Definit. Not.*, 46, 47,; Schwegler, *Comment. zur Metaph.*, iii. 161; and *contra*, Prantl, *Gesch. der Logik*, i 137. Zeller maintains the view that Aristotle intends to indicate the place occupied by the analytics in his general scheme of philosophy.

[2] On Aristotle's use of the term λογικός and its allies, see (in addition to Waitz, *Com. in Organ.*, ii. p. 353-55) Schwegler, *Commentar zu Ar. Metaph.*, vol. iv. p. 48-51.

[3] See *Anal. Post.*, i. 11; *Rhet.*, i. 1, and in many passages. Cf Heyder, *Method. d. Arist.*, p. 343.

hand, both in regard of the common axioms and in regard of the attributes of being, by which it is a possible object of science, and on the other hand referring to the subjective treatment of thought, whether in relation to principles or to fact generally.

A very similar result may be obtained if we follow out a line of distinction indicated in more than one portion of the *Metaphysics*.[1] Separating the modes in which being is spoken of into four—(1) τὸ ὂν κατὰ συμβεβηκός; (2) τὸ ὂν ὡς ἀληθὲς καὶ τὸ μὴ ὂν ὡς τὸ ψεῦδος; (3) τὸ ὂν κατὰ τὰ σχήματα τῆς κατηγορίας; (4) τὸ ὂν δυνάμει καὶ ἐνεργείᾳ—Aristotle excludes the second from the special researches peculiar to first philosophy, the study of being as being, but neither excludes it from general consideration in metaphysics as a whole, nor handles it at length, deferring it rather for more detailed treatment. A comparatively clear account, however, of what is understood by him under the head of being as truth and non-being as falsity may be extracted from the various passages referred to, and little doubt can remain that being so regarded is in a peculiar sense the matter of analytical (*i. e.*, logical) researches.

Being as truth and non-being as falsity refer to and rest upon combination and division of the elementary parts of thought. For truth and falsity have no significance when applied to things, but only to the connection of thought which is dominated by the one principle of non-contradiction. Nay, thinking has not even immediate and direct reference to being as such, but only to being as the existent, as qualified, or quantified, or modified in some other way (*i. e.*, according to the categories), and it is in its very essence the conjunction or unifying of elements. What cannot be conjoined, as, *e. g.*, the notions of elementary facts themselves, are not either true or false, and are not matters of thought. Thought thus moves in a definite sphere, that of the combinable or separable, the correspondence of conceptions with real relations, and has its limits on the one hand in the elementary data apprehended by intellect (νοῦς=reason), and on the other hand in the infinite sea of particular, accidental qualifications of things (συμβεβηκότα). The possibility of contradictory assertions (for true and false judgments together make up the contradiction, τὸ δὲ σύνολον περὶ μερισμὸν ἀντιφάσεως) is the distinguishing mark of thought. Now it is this very possibility that lies at the root of all the analytical researches. Not, indeed, that one can assume for Aristotle a view which has appeared in later logical works, that all forms of logical reasoning are to be deduced from the principle of contradiction. Quite the reverse. The common axioms underlie all processes of proof, direct or indirect, but they do not enter into or form part of proof. Nothing can be deduced from them; but their authority can be appealed to against any one who refuses to allow a conclusion reached by a correct syllogism from true premises.[2] (The nerve of logical proof would thus lie in the disjunctive proposition; either this conclusion is to be granted or the principle of contradiction is denied.) Now the analytical researches are in especial the treatment of combination and separation in thought. For even the syllogism may be regarded as only a complex judgment or synthesis, and in the exposition of the forms of combination and separation we shall find a complete system extending from the unproved principles and exhibiting the methods according to which thought proceeds towards the determination of the essential properties of things or the discrimination of various heads under which the transitory and accidental attributes may be advantageously classed.

So far then as one can judge, the matter of Aristotle's analytical researches may be expressed as the concrete nature of thought, characterized by its fundamental attribute, the possibility of contradiction, correlated with the real system of things, and having as its end the realization of systematic knowledge, *i. e.*, the adequate subjective interpretation of being.

10. The indication that the analytics have to do with being as conceived by thought, conducted under the general axiom of non-contradiction and expressed in language, requires to be filled up by a more detailed treatment of the Aristotelian theory of thought in relation to being. Upon the characteristics assigned to thought or knowledge in this special relation, must depend the general nature of the Aristotelian logic, the determination of the scope of logical treatment, and the essence of logical method. For from a quite similar statement regarding the province within which logic moves totally diverse conclusions might be drawn respecting the precise function of logical method. One might have either a formal doctrine or *technic*, or a real methodology, either an attempt to evolve logical principles from the axiom of contradiction, or a development of the laws according to which thought, necessarily acting under the said axiom, proceeds towards the construction of knowledge. The history of logic clearly shows how differently the matter of the analytics may be viewed. For one of the possible conclusions, that logic is a technic or quasi-mathematical exposition of formal relations, has been accepted as the undoubted result of Aristotle's teaching, and has so prevailed as to make itself the current conception.[3] The other, the view of logic as theory of the method of scientific thought, has been cast entirely into the background, so far as logical doctrines are concerned, and, if allowed at all, has been regarded as foundation for a species of applied logic, an appendix to the other.

11. Not much aid is afforded directly by any classification or division of the books now collected together as the *Organon*. As above noted, the *Prior* and *Posterior Analytics* with the *Topics* form one connected whole, while the *Categories* and the *De Enunciatione* stand apart as isolated treatments of special problems, not organically or necessarily part of the research. The genuineness of both these treatises has been doubted (see ARISTOTLE, vol. ii. p. 452), and it is not improbable that both are redactions of Aristotelian material, perhaps drawing from other lost writings of Aristotle, perhaps based on oral teaching, by some Aristotelian scholar. A summary view of the contents of the other books will be found at vol. ii. p. 453.

12. The logical researches as a whole manifest a strong unity, and at the same time refer to one fundamental opposition, that between *apodictic* and *dialectic* reasoning.[4]

The opposition between apodictic and dialectic is in the Aristotelian system the development of that which had already played so important a part in Plato and Socrates, the distinction between science and opinion. Knowledge in the strict sense had there presented itself as the generalized notion referring to being in its very essence, and resting on thought or reason. Opinion is the quasi-knowledge of the particular, referring to that which is not being but only accident, and resting on sense or imagination. In the Platonic method this distinction had come forward as the underlying basis for the opposition of philosophy and sophistical rhetoric; in Aristotle a much more precise formulation is given of the characteristics of the two opposed forms of thought, and the connection between opinion or dialectic and rhetorico-sophistical discussion is made more concrete and profound. Dialectic, with Aristotle, is the system resulting from the attempt to reduce to rule or generalize modes of argument which rest upon current received doctrines as principles, which move within the region of interests about which current opinions *pro* and *con* are to be found, and which terminate not in the decisive solution of a problem but in clearing the way for a more profound research, or at least in the establishment of the thesis as against an opponent. Dialectic, then, has no special province; it deals with κοινά or ἔνδοξα, and its methods are perfectly general. On the one hand, as being the application of reasoning, it refers to and employs the specific types of reasoning, syllogism and induction; on the other hand, as being applied to matters of opinion, and borrowing its principles from current floating dicta about matters of common interest, the types of reasoning tend in it to assume special forms resembling those employed in rhetoric (which is a kind of offshoot from dialectic—the application of dialectic to political principles). The province of dialectic being thus essentially vague, the matters about which dialectic reasoning is concerned being of the most fluctuating character, there must be, for Aristotle, the greatest difficulty in determining, *per se* and apart from the opposition to apodictic, what is the character of dialectic syllogism and induction. Nor can it be said that the interpreter of Aristotle has an easy task in the endeavor to discover what precisely is dialectical reasoning and in what way the forms which are assumed to be common both to apodictic and dialectic come to have any application to the fluctuating mass of current opinions. It is comparatively simple to say apodictic and dialectic differ in this, that the one rests on principles essential, necessary, seen to be true, while the other proceeds from data which are merely received as credible and as containing probable, received opinions on a subject about which there may be difference of view; and it may be added that in the one we reach conclusions which are essential, in which the predicate is necessarily and universally true of the subject, while in the other the conclusion remains, like the data, credible merely, and is, at best, only one of the probable answers to a question. But there remains the difficulty, which is certainly not cleared up by any direct statement from Aristotle—of what nature is the syllogistic inference that applies to material of this kind? what is the *nervus probandi* in a dialectic syllogism? There are two possible views—either that the principle of syllogistic inference is purely formal, deducible from the characteristic of thought as either affirming or denying in reference to a particular subject, and therefore capable of application either to probable or to necessary matter, or that the syllogism is explicable only as a form in which knowledge is established, and is applicable but *per accidens*, as one may express it, to probable matters. Under this second view, the possibility and reality of syllogistic inference would be traced to the correlative peculiarities of human thought and of the nature of the objects of thought, and it would follow that in strictness there is no dialectic syllogism. Such a conclusion at first sight appears to stand in sharp opposition to quite emphatic utterances of Aristotle, but if we suppose, for the sake of example, that a dialectic syllogism were framed, we should readily discern that the link of connection between data and conclusion, the *nervus probandi*, as it may be called, does not in fact differ from that involved in the apodictic syllogism. The merely probable character of the data prevents the conclusion from having a higher value than mere likelihood, but does not affect the chain of inference, which proceeds on assumptions identical with these involved in apodictic. Aristotle is chary of any examples of dialectic syllogism, and indeed, if one considers that all forms of modality are investigated in the general analysis of syllogism, it becomes difficult to see what specially distinguishes dialectic inference. It is not to be denied, however, that the investigation of the grounds for the coexistence of dialectic and apodictic is incomplete in Aristotle, as it confessedly is in Plato.

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[1] *Metaph.*, vi. 4, v. 29, ix. 10. *Cf.* Schwegler, *Com.*, iii. 241, iv. 29 *sq.*, 186; and Brentano, *Bedeutung des Seienden nach Arist.*, 21 *sq.*

[2] *Cf.* generally *Anal. Post.*, i. 14.

[3] *Cf.* Brandis, *Gr.-röm. Phil.*, ii. 373–75.

[4] The most important treatments of the principles and details of the Aristotelian logic, which are here drawn upon freely, are (1), *instar omnium*, that of Prantl (*Gesch. d. Logik*, i. pp. 87–346); (2) that of Brandis, *Aristoteles*, pp. 148–484, and *Aristotelisches Lehrgebäude*, pp. 12–62 (in which there is sharp criticism of Prantl's view); (3) that of Grote, *Aristotle*, vols. i. and ii., pp. 1–184 (most patient and accurate, but tending continuously to minimise the speculative element); (4) that of St. Hilaire, in his essay *De la Logique d'Aristote*, 2 vols., 1838, and in his translation of the *Organon*; (5) that of Biese, *Phil. d. Arist.*, i. 44–319. Trendelenburg's *Elementa Logices Aristoteleæ*, Waitz's edition of the *Organon*, and Ueberweg's *System der Logik* contain much of value. Mr. Poste's translation of the *Post. Anal.* and *Sophis. Elenchi*, Mr. E. Wallace's *Outlines of the Phil. of Aristotle*, and Mr. Magrath's *Selections from the Organon* will also be found of service.

Unless, then, it can be shown beyond possibility of question that Aristotle does lay down purely formal rules for syllogism, rules deducible simply from the fundamental axiom of thought—and the evidence on which such a view is based will be examined later—we do not obtain much light from the opposition between dialectic and apodictic. More important results, however, are gained when we consider the Aristotelian doctrine of genuine knowledge, of ἀπόδειξις, for, among the numerous elements that here fall to be noted, some are of quite general import, and apply to the whole process of the formation of knowledge.

13. Apodictic knowledge generally is definable through the special marks of its content. It deals with the universal and necessary, that which is now and always, that which cannot be other than it is, that which is what it is simply through its own nature. It is the expression of the true universal in thought and things, τὸ καθόλου. Further, as a method, ἀπόδειξις is characterized by the nature of its starting point, and of the connecting link involved, as well as by the peculiarity of its result. It rests upon the first, simplest, best known, unprovable elements of thought, the πρῶτα καὶ ἄμεσα, which are not themselves in the strict sense matters of apodictic science, which are ἀναπόδεικτα. In all the intermediate processes of scientific proof there is involved generally this dependence upon previously established principles, and, when apodictic is taken in its ultimate abstraction, these previously established principles are seen to be the prior, ultimate elements, assumptions in thought about things, as one may provisionally describe them. The peculiar connection involved is simply what we understand by the principle of syllogism. No syllogism is possible without the universalizing element, the καθόλου, and knowledge in its essence is syllogistic.[1] The conclusion of the syllogism in which essential attributes are attached to a subject is the concretion or closing together of the two aspects of all thought and being, the universal and particular.[2]

The fuller explanation of apodictic thus refers us to three points of extreme importance in the Aristotelian theory of knowledge, the precise nature of the καθόλου which presents itself as the characteristic feature of ἀπόδειξις, the relation of fundamental and universal in things on which the possibility of ἀπόδειξις is founded, and the forms of thought through which the universal and particular factors are subjectively realized. The three are most closely connected, and as they involve the main difficulties of the Aristotelian philosophy as a whole, a general treatment of them is indispensable. First then of τὸ καθόλου, the characteristic term in the explanation of knowledge. This notion is essentially double-sided. On the one side it is the universal of empirical knowledge, the generic or class universal—it is τὸ κατὰ παντός; on the other hand, it is the root or ground of the empirical universal—it is τὸ καθ' αὑτό καὶ ᾗ αὐτό,[3] that which is in, for, and through itself, the essential. Now the essential, καθ' αὑτό, is, in the first place, either that which enters into the being and notion of a thing as a necessary prerequisite (for example, *line* is a necessary element in the being and notion of triangle), or that which is the necessary basis of an attribute (*e. g.*, *line* in reference to *straight* and *curved*), or in the second place that which is as subject only and not as predicate, or finally that which is *per se* the cause or ground of a fact or event.[4] Thus the function of thought (of apodictic) is the exposition with reference to a determined class of objects of all that necessarily inheres in them, on account of the elementary factors which determine their existence and nature. Real things, individual objects, are the basis of all knowledge, but in these individuals the elementary parts, causally connected, and leading to ulterior consequences, form the general element about which there may be demonstrative science. Thought which operates upon them does so, as we have already seen, under the peculiar restriction of its very nature, as the subjective realization of the notion of things, and the principles expressing this restriction, the logical axioms, may be appealed to if demonstration be opposed groundlessly, but these axioms do not enter into the process of demonstration. "When the apodictic process has attained its end, that is, when all the universal propositions relating to a given class, with insight into the necessary character of the predication in each case, have been gathered up, then the καθόλου of knowledge in respect to that class has been realized."[5]

14. Probably the example of apodictic which Aristotle bears chiefly in mind is mathematical science, and in his treatment of the characteristic marks of this doctrine most of the peculiarities of apodictic occur. In mathematical science abstraction is made of the material qualities of the things considered, of those qualities which give to them a place as physical facts, but the abstracta are not to be conceived as entities, self-existing. They are not even to be conceived as existing only in mind, as ideal types; they truly exist in things, but are considered separately (ἐξ ἀφαιρέσεως). The first principles of mathematical science are few and definite, and the procedure is continuously from the simple and absolutely more known to the concrete and relatively more known. As in proof generally, so in mathematical demonstration, an essential quality (συμβεβηκὸς καθ' αὑτὸ) may be proved of a subject, and yet such quality may be still accidental, *i. e.*, not predicated of the subject on account of its generic constituent marks, but capable of being deduced from the constituent mark of that which enters into the subject, as, *e.g.*, a given figure's exterior angles are equal to four right angles. Why? Because it is an isosceles triangle. Why has an isosceles this property? Because it is a triangle. Why has a triangle? Because it is a rectilineal figure. If this reason is ultimate, it completes our knowledge, καὶ καθόλου δὲ τότε.[6] Thus the range of mathematical proof extends from the πρῶτα, the original definitions, which at the same time assume the existence of the things defined, through the determinations καθ' αὑτά to the qualities (συμβεβήκοτα), which can be shown to attach to their subjects, to be in a sense καθ' αὑτά, while a continuous series of middle notions, concerning which there cannot be much ambiguity, effects the transition. Moreover, in mathematical science, one can see with the utmost evidence the correlation of reason and sense, which will presently appear as a fundamental factor in Aristotle's general theory of knowledge. The πρῶτα are not to be conceived as innate or as possessed before experience. They

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[1] *Cf. Topics*, pp. 164a, 10.

[2] See specially *Anal. Pr.*, 67a, 39 *sq.*, and compare the elaborate note of Kampe, *Erkenntnisstheorie des Aris.*, p. 220 (also p. 84). Grote, (*Aristotle*, i. p. 263a) remarks: "Complete cognition (τὸ ἐνεργεῖν, according to the view here set forth) consists of one mental act corresponding to the major premiss, another corresponding to the minor, and a third including both the two in conscious juxtaposition. The third implies both the first and the second." The connection between this and the Aristotelian doctrines of νοῦς in its relation to αἴσθησις will not escape attention.

[3] *Anal. Post.*, 73b, 26, καθόλου δὲ λέγω ὃ ἂν κατὰ παντός τε ὑπάρχῃ καὶ καθ' αὑτὸ καὶ ᾗ αὐτό. See *Index Aristotelicus*, s. v., pp. 356–57, and on καθ' αὑτό compare Heyder, *Method. d. Arist.*, 310 n., and Bonitz, *Com. in Met.*, pp. 265–66. On the distinction between καθόλου and γένος, see Bonitz, *Com. in Met.*, p. 299, 300; Zeller, *Ph. d. Gr.*, ii. 1, p. 205, 206.

[4] *Cf.* Prantl, *Ges. d. Logik*, i. 121, 122, who has rightly placed the function of καθόλου in the foreground.

[5] Prantl, i. 126.

[6] *Anal. Post.*, i. 24, 86a, 2.

are seen or envisaged, intuited in perception by νοῦς, and induction here as elsewhere is the process by which perceptions are gathered together for the reflective and intuiting action of νοῦς. In the mathematical individual, more evidently than in any other case, is visible the union of thought and sense. The demonstration which employs a diagram does not turn upon any properties of the diagram which are there for sense only, not for reason, but upon the general elementary relations contemplated in thought.[1] In mathematical development, that which is potentially contained in the ὕλη νοητή on which mathematical thinking operates is brought forward into actuality by the constructive processes through which the proof is mediated, and the potential knowledge contained in the intuition of mathematical elements becomes actual through the process of constructive thought.[2]

Finally, the relation of pure mathematical reasoning to that found in sciences generically one with mathematics, *e. g.*, optics, astronomy, harmonics, etc., furnishes an interesting example of the relation between reasoning based on fact and on causal ground.[3]

15. The process of ἀπόδειξις generally and of mathematical demonstration in particular has brought into clear light the prominent characteristic of knowledge according to the Aristotelian view. Knowledge must always be regarded from two sides, as having relation to the universal, and as bearing upon the particular.[4] It is in itself the union of the general and the particular, of the universal and the individual. This fundamental notion of knowledge is not only the integral element in the Aristotelian theory of science, but also the guiding principle in his scientific method.[5] In all cases we require to keep in mind the necessary correlation of the particular facts and the general grounds, the multiplicity of effects and the unity of cause. The one element is not apart from the other. Universals as such are of no avail either as explanations of knowledge or as grounds of existence. Particulars as such are infinite, indefinite, and incognizable. Only in the union of these, a union which objectively regarded is the combination of form and matter, of potentiality and actuality, of genus and ultimate difference, subjectively is the combination of the data of sense, imagination, and intuitive faculty of reason, is knowledge possible. And the methods by which knowledge is formed in us regarding things exhibit the same twofold aspect. Syllogism as the form of the process from generalia to the determination of attributes of the individual subject, induction as the method of procedure from the vaguely apprehended individuals to the generalia or principles, alike, when analyzed, exhibit the conjunction of the universal and particular.

16. In each branch of knowledge there are involved the specific genus or class, the attributes concerning which there is to be demonstration, and the common axioms or principles. Each branch, moreover, implies special principles, ἴδιαι ἀρχαί; there is no all-comprehensive science from which truths are to be deduced, and from the common maxims alone nothing can be inferred. Ἀπόδειξις involves principles, and starts therefore of necessity with what may be called definitions. Yet definitions are at the same time the final result of apodictic demonstration, and the original assumptions may be pushed farther and farther back till they appear as the πρῶται καὶ ἄμεσοι προτάσεις which are only apprehended by νοῦς. From this distinction between knowledge as completed and knowledge as in process of formation, as from the distinction between sciences of the same genus as more or less general (*e. g.*, geometry and optics), there follow the distinctions between propositions necessary and propositions true ἐπὶ τὸ πολύ, between proof of fact and proof of essence, between deduction and induction, between syllogism as generic form of all proof, and the special type of syllogism in which completed knowledge is expressed. We are thus enabled to reconcile what seem at first sight discrepancies in the Aristotelian doctrine,—as, *e. g.*, the insistance upon induction as furnishing the principles of reasoning (τὰ καθόλου) coupled with the attempt to show that induction too is a kind of syllogism, the explanation of proof as involving essence, coupled with the admission of syllogisms of fact; the treatment of propositions as necessary and contingent in themselves, coupled with the distinction between ἐπιστήμη and δόξα. In all forms of knowledge there is the twofold aspect, that which turns upon the essential connections, and that which refers to the isolated facts wherein such connections make their appearance. Syllogistic as formal analysis of what is common in all knowledge is one part of the all-comprehensive theory of knowledge, an integral but not a self-existing part.[6]

17. The general idea of the Aristotelian analytic thus obtained does not require to be supplemented by any detailed survey of the logical system into which it is evolved, but a brief summary of the most important points and indication of the relation in which the parts stand to the whole may be of advantage.

The simplest form of knowledge, that in which being as true or false is apprehended, is the judgment. The consideration of the judgment is therefore the first part of the analytical researches. Here Aristotle distinguishes more accurately than any of his predecessors (indeed for the first time with accuracy) between subject and predicate as integral parts, symbolized by the noun and verb, and signifying the relations for us of things as appearing under the schemata of the categories. The material basis of the judgment, as one may call it, is the thing as an object of possible knowledge, *i. e.*, the thing as individual (and therefore as involving matter and form, the particular and the general), as qualified, specifically, in time, space, quantity, and relation, and existing as one mode in the universal nexus of potentiality and actuality. These metaphysical forms, and, specially, the deep-lying modes of potentiality and actuality, reflect themselves in the forms whereby subjectively knowledge is realized in us, and the resulting knowledge is conditioned partly by them, partly by the modes in which intellect as a reality is developed in us. The proposition has necessarily a reference to them, and thus alongside of formal distinctions between universal, particular, singular, and indefinite judgments we have the distinctions between necessary, contingent, and possible, which appear partly as given qualities of the judgment, partly as representing differences in the conditions of knowledge, partly as referring to differences of subjective apprehension.

The essence of the judgment as the apprehension of truth or falsehood consists in its twofold aspect as affirmative and negative, the former of these in a sense prior and better known, but the latter no less necessary, and both referring to objective relations of things. The affirmative and negative character of judgments, the essential ἀντίφασις of human thought, is further defined in reference to (*a*) the quantitative distinctions already recognized (the doctrine of logical opposition), (*b*) the distinctions of necessary, contingent, and possible, which are rightly regarded as real matters *about which* the assertion is,[7] and (*c*), consequent on this, the opposition of modal judgments.[8]

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[1] *Cf.* the passage from *De Memor.*, p. 450, quoted by Brandis, *Aristoteles*, p. 1183,—συμβαινει γὰρ τὸ αὐτὸ πάθος ἐν τῷ νοειν και ἐν τῷ διαγράφειν· ἐκεί τε γὰρ οὐθὲν προσχρώμενοι τῷ τὸ ποσὸν ὡρισμένον εἶναι τὸ τριγώνον, ὅμως γράφομεν ὡρισμένον κατὰ τὸ ποσόν· και ὁ νοῶν ὡσαύτως, κἂν μη ποσὸν νοῇ, τιθεται πρὸ ὀμμάτων ποσόν, νοει δ' οὐχ ᾗ ποσόν. ἂν δὲ ἡ φύσις ᾖ τῶν ποσῶν, ἀόριστον δε, τιθεται μὲν ποσὸν ὡρισμένον, νοεῖ δὲ ᾗ ποσόν μόνον. *Cf.* also *Met.*, vii. 10 and 11. Aristotle's view strongly resembles, in this point at least, that of Kant.

[2] See *Metaph.*, ix. c. 9, p. 1051a. Some interesting remarks on the process of mathematical construction and its relation to syllogistic proof will be found in Ueberweg's *System der Logik*, § 101, p. 273.

[3] See generally *Anal. Post.*, chap. 13. Of Aristotle's views on mathematics the best expositions seem to be those of Biese (*Ph. d. Arist.*, ii. 216–34), Brandis (*Aristoteles*, pp. 185–89, and *Aristot. Lehrgebäude*, 7–11), and Eucken (*Methode, d. Arist. Forschung*, pp. 56–66).

[4] *Cf.* specially *Anal. Pr.*, ii. 21.

[5] This is excellently put by Eucken, *op. cit.*, pp. 44–55.

[6] The passages in which an apparently formal view of logical relations is expressed are mainly the following:—*Topics*, i. chap. vi. (in which the fundamental logical forms of definition, genus, property, and accident are explained by reference to the coincidence of the spheres of subject and predicate in a proposition); *Anal. Post.*, i. chap. 26 (συλλογισμός ἐστιν ὃς ἂν οὕτως ἔχῃ ὥστε ἢ ὅλον πρὸς μέρος ἢ μέρος πρὸς ὅλον ἔχειν); *Anal. Post.*, ii. 3 (ἑτέρου δὲ ἑτέρα ἀπόδειξις, ἐὰν μὴ ὡς μέρος ᾖ τι τῆς ὅλης. τοῦτο δὲ λέγω, ὅτι δέδεικται τὸ ἰσοσκελὲς δύο ὀρθαῖς, εἰ πᾶν τρίγωνον δέδεικται· μέρος γάρ· τοδ' ὅλον); *Rhetoric*, i. 2, § 19. The general treatment of syllogism in *Anal. Pr.*, i. 4, as apparently resting on the principle of subsumption or logical substitution, has no precise bearing. But the use of the term ὅλον by Aristotle is not to be regarded as identical with its use by later logicians, and it is not rashly to be assumed that in Aristotle's view the only logical relation is that between genus and species. The distinction between extent and intent, on which later writers have laid stress, is never suffered in Aristotle to become a distinction in kind; the two elements, extent and content (κατὰ παντὸς and καθ' αὑτό), are always involved, and the difference is only in the process by which our knowledge is formed. Probably the relations of extent and content would never have been severed from one another had it not been for the error, almost a necessary failing in the attempt to treat formal logic systematically, of regarding notions and judgments as completely formed and defined products apart from the reasoning in which they appear (see, for a diametrically opposed view, Hamilton, *Lectures on Logic*, ii. p. 266).

[7] On this account the *modality* is affirmed not to attach to the copula; thus the opposite of "it is necessary-to-be," is "it is not necessary-to-be," and not either "it is necessary-not-to-be," or "it is not-necessary-to-be."

[8] There are obscurities in Aristotle's doctrine of modals, which remain even after Prantl's laborious treatment (*Ges. d. Logik*, i. 104–82). A careful survey is given in Rondelet, *Théorie logique des propositions modales*, 1861. The definitions of ἐνδεχόμενον and δυνατόν, which have given rise to much diversity of opinion (*cf.* Prantl, i. 167 *sq.*, as against Waitz, i. 376, and Bonitz, p. 387) are excellently dealt with by Ueberweg, *Logik*, § 69.

Propositions as integral parts of knowledge turn upon the ultimate relations of things known. The distinctions between first principles and deduced truths, out of which the theory of proof is developed, themselves rest upon those distinctions which have been already noted in treating of apodictic. Syllogism as the form by which the general and particular elements are mediated and conjoined is therefore of universal application, and may be analyzed formally.[1] The various modes in which syllogistic inference, pure or modal, the main types to which these modes may be reduced, their relations to one another, and the general laws implied in them are worked out in a fashion which does not admit of any brief statement. The conclusion unites the elements which in isolation appear in the premises, and is, in a sense, the complex or organic whole unfolded in the syllogistic form. To every syllogism three things are necessary, the presence of a positive element, universality in one of the premisses (resting, as above shown, on the recognized property of all proof as involving a general fact), and *consequence*, or necessary connection between conclusion and premisses. Now from this third element there follow certain interesting deductions. The necessity of consequence rests on the very nature of syllogistic thought, and if each syllogism be taken as it stands, as a simple unit, no further inquiry is needful. But the character of the premisses in themselves may be taken into account, and we then discover that syllogism proceeds continuously on the assumption that the general law of syllogistic proof is in the special case realized. It need not be in fact realized. We may have premisses in themselves false, from which a true conclusion is reached, and the falsity of the premisses only becomes apparent when they are themselves treated as conclusions of a possible syllogism, and so the regress made towards ultimate principles. Syllogistic form, in short, is the hypothetical application of the general rule of necessary connection between ground and consequent. If A (the premisses), then B (the conclusion). Quite possibly, then, we may have, in syllogistic form, conclusions drawn from premisses not ἀναγκαῖα but only ὡς ἐπὶ τὸ πολυ. Science and opinion (δόξα) are equally sources of propositions or premisses. If formal consequences be united with real uncertainty of matter, there arises a syllogism in character dialectical. Were the real uncertainty overlooked, the syllogism would be sophistic in character. Dialectical reasoning, then, dealing with the stage beneath science, may be of service, not only for practice in distinguishing true and false, but as bringing the particulars of each branch of knowledge into closer relation with the first principles special to that branch.[2] For wherever the particular element as such, the transitory and material, is present, there room is left for opinion, and reasoning is possible, not of the particular as such, but in so far as the particular manifests an underlying universal.[3] The processes of dialectic reasoning thus resemble very closely those modes by which the empirical detail, the region of given fact, is treated, viz., induction, example, use of signs and probable indications. For the universal has always its empirical side, and the complete process of scientific proof is a final result for which the way may be prepared by treatment, according to scientific form, of the empirical fact. There are syllogisms of fact as well as syllogisms of reason or ground, and the reason or ground becomes apparent through knowledge of the fact. Occasionally indeed the fact and ground are so immediately connected that transition from one to the other may be at once effected, but generally this is not the case.

Of these intermediate forms of reasoning, the only one calling for comment is induction, of the nature of which something has already been said. The obscure chapter in which the formal analysis of induction is undertaken, a chapter which has much exercised the ingenuity of commentators,[4] presents difficulties of varied kinds. An opposition is indicated between syllogism and induction, yet induction is treated as a kind of syllogism; that is, freely interpreted, induction is so analyzed as to show that in it, also, there is the union of general assumption and particular detail which is characteristic of syllogistic reasoning. Further, Aristotle seems to waver between induction as a kind of inference, through which we arrive at general principles, and as a species of proof, and his teaching is therefore perplexed by the want of some clear statement regarding a difficulty in the theory of induction, which is still far from perfect solution. For, according to Aristotle, induction as such, starting from the particulars of sense, and proceeding by comparison of similar cases and enumeration of all the similarly constituted members, never, even when the enumeration is complete, attains to probative force.[5] It is still a syllogism of fact, not of ground or reason; there is a distinction of kind between the survey of empirical detail, even when complete, and the assertion of causal connection between the characteristics of the class and its deduced properties.[6] Thus, perception of the law (τὸ καθόλου) from induction is a kind of new element in the process; it is recognition *by means of* the empirico-critical survey which is the essence of induction.[7] Induction makes clear only, and does not prove.[8] If we interpret according to more modern phraseology, this peculiarity may be expressed as the distinctive feature of inductive research based on facts or effects. We do not regard the inquiry as terminating in the establishment of a law until it is possible to reverse the process and show that from the surmised cause the effects do actually follow. Otherwise we have a conclusion of "coexistence" merely—an empirical rule or generalization. If, bearing in mind these sources of difficulty, and also the correlation which for Aristotle always obtains between empirical details and grounds of reason, we consider the example given in the obscure chapter before us, some light may be cast on the exposition there given. The example selected is one touched upon by Aristotle in other two passages, in the treatise *De Partibus Animalium*, and in the *Post. Anal.*, ii. 18.[9] As regards the first of these, reference is desirable only to bring out the fact that causal nexus is the καθόλου in question; the second is of the utmost importance as clearing up what has always seemed an obscurity in the account of the inductive syllogism. In the chapters 16–18 of *Anal. Post.*, ii., Aristotle considers the relation of cause and effect as the essential basis of proof, and he points out with much clearness the difference between the fact as cause of knowledge and the cause as ground of existence and proof. In some cases cause and effect are so united, so reciprocate, that we may infer from one to the other. But the doubt arises, may there not be more than one cause for any given attribute, in which case all such inferences from effect must become problematical. Aristotle's solution is remarkable, both in itself and in its bearing on the inductive syllogism. Suppose the attribute β is found in all individuals of a class A, and also in individuals of class B, C, etc. In order to discover the cause, investigations must be carried on until we have a defined number of classes, A, B, C, etc., in all of which β is found, and which comprehend all cases of the presence of β. Then that which is also common to A, B, C, etc., may be regarded as the cause of β, say, *e. g.*, an attribute α. If this attribute α be really the cause of β, it will enter into its definition; it will be its definition. There might, however, be a connection of α and β of this universal and reciprocating kind, and yet α might not be the cause in question; it might be only a fact from which β could be inferred; the real cause γ, which gives rise to α, lies in the background. Characteristic of causation, then, is constant reciprocal conjunction of facts. Even if it be admitted, then, that there may be more causes for a phenomenon than one, it will yet be true that each of these causes will be manifested in one class of phenomena where there will be the universal reciprocating coexistence that is characteristic of the relation in question. Thus the attribute longevity observable in quadruped animals and in birds may be due to different causes, *e. g.*, to absence of gall in the one case, to predominance of solid, dry matter in the other. But in each case there will be a definite species characterized by the constant conjunction of the cause and the causatum; the whole class long-lived animals and the class gall-less animals will coincide.

Turning now to the chapter on inductive syllogism, we find induction defined as inference through the minor that the major belongs to the middle. Here evidently major and middle are regarded not as determined by form only but naturally distinct, and we must assume that by middle term is to be understood the ground or reason of the attribute (major term) characteristic of a defined species or group (the middle term). Were our knowledge complete and scientific, we should be able to express this in apodictic form:—whatever animal has no gall is long-lived; man, horse, mule, etc., are animals having no gall; therefore they are long-lived. The progress of knowledge, however, may be from the empirical details. We may have given to us the fact of the attribute, long-livedness, in the group of animals, man, horse, etc., and discover that these long-lived animals are also wanting in gall. If then, in accordance with the rules above sketched, there can be discovered a reciprocating relation between want of gall in animals and long-livedness, if we can constitute a class distinguished by conjoint presence of gall-lessness and longevity, we have the basis for an inductive proof. We may infer therefrom that gall-lessness is, *in this species*, the cause of longevity. Such a reasoning is founded on particulars given, and as the coexistence is given, the conclusion seems to be immediately drawn; there does not appear to be mediation or use of a middle term; nevertheless the middle term is implied, not in the supposition that the two classes reciprocate, but in the transference from empirical coexistence to causal nexus.

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[1] In this sense only can we recognize the distinction between Aristotle's *Technik* and his idea of *Apodiktik* on which Lange (*Logische Studien*, 1880) has laid so much stress. What underlies Aristotle's treatment must never be thrown out of account.

[2] *Topics*, i. 2, §§ 3–6.

[3] On this distinction *cf.* Kampe, *Erkenntnisstheorie d. A.*, pp. 252, 253; Heyder, *Method d. A.*, p. 322.

[4] *Anal. Pr.*, ii. 23. *Cf.* Whewell, *Camb. Phil. Soc. Trans.*, vol. ix., 1856; Hamilton, *Lectures*, ii. 358–62; Grote, . pp. 268–74; Heyder, 216–26; Kampe, 189–92.

[5] On induction and recognition of similarity, see *Topics*, i. chap. 18, p. 108b, 7 *sq.*; viii. chap. 1, § 14, and chap. 8, § 1 (in these last similarity is viewed as being wider in scope than the basis of induction). That induction implies a complete enumeration, see *Anal. Pr.*, ii. chaps. 23, 24; *Anal. Post.*, ii. chap. 7, § 1. That induction even when complete is not demonstrative, see *Anal. Post.*, i. chap. 5.

[6] On this distinction see mainly *Anal. Post.*, ii. 13, where a very fine description of deductive and inductive proof occurs.

[7] Compare the passages above noted, and see the curious expression used in the discussion regarding the relation of universal and particular in *Anal. Pr.*, ii. 21, p. 67a, 22 *sq.*

[8] *Anal. Post.*, ii. 5, p. 91b, 33, οὐδὲ γὰρ ὁ ἐπάγων ἴσως ἀποδείκνυσιν, ἀλλ' ὅμως δηλοῖ τι.

[9] *De Part. Anim.*, iv. 2. *Cf.* Hamilton, *Lect.* iv. p. 355, n. On *Anal. Post.*, ii. 16–18, see the valuable summary by Grote, i. pp. 366–68.

Aristotle's mode of stating this argument has presented so many difficulties of interpretation that various emendations have been proposed. Grote, *e. g.*, who has not apprehended why the class long-lived animals should be taken universally,—"we are," he says, "in no way concerned with the totality of long-lived animals,"—suggests an emendation, which makes the essence of the inductive reasoning turn upon the extension of what we know regarding some gall-less animals to all of that class. But this is not the inductive step according to Aristotle. Induction has not to prove or assume that α and β, found coexisting in some members of a species, coexist in all of them; Aristotle takes this universal coexistence for granted as the basis of the argument. The inductive step is the transference from this universal coexistence to causal nexus. Apodictically, we should say, if α is the cause of β, then all A which possesses α possesses β; thus reasoning from cause to causatum. Inductively we say, all A which possesses α has β; therefore α is the cause of β.[1]

Induction, as dealing with particulars, starting with the sense data, and resting upon the more evident fact in order to point towards the essential ground or reason, is therefore more persuasive, more palpable, more adapted for popular inquiries, and relatively more apparent. Syllogistic proof, on the other hand, is more stringent, and more efficacious in establishing a scientific conclusion or position.

Aristotle's mode of dealing with induction, in so far at least as any specific process is designated by that term, seems on the surface to diverge widely from modern logical theory, and we look in vain in his analytical researches for consideration of the methods of observation and experiment which has come to be recognized as the essential portion of a doctrine of inductive reasoning. Yet it may fairly be argued that in modern theories the term induction is used with great laxity, so as to cover either all processes connected with scientific method or some one special feature of scientific reasoning, and that the difference between the Aristotelian and modern views lies mainly in the matter, not in the form, of the process. For there are numerous hints in Aristotle respecting scientific procedure,[2] and, if we consider what is peculiar to modern views, we shall find that it consists mainly in the increased fulness and complexity of our fundamental scientific notions, a fulness and complexity resulting from long-continued scientific research. Our modern logic of induction has profited mainly by the general advance of scientific method, and tends to increase as these methods, by constant contact with facts, become more refined and accurate. The additional cautions or limitations which we now introduce into our statement of the principles of inductive research concern not so much the form of inductive proof as the character and modes of obtaining evidence which is to satisfy the canons or rules of proof. Such limitations become apparent only through actual scientific progress, not by analysis of the form of scientific proof.

18. To Aristotle, as has been above said, proof is essentially syllogistic or deductive in character. Not every syllogism is an apodictic proof, but all proof is syllogistic. For proof or adequate knowledge is reference of effects to their causes, and the cause is the general element, τὸ καθόλου, which forms the middle term in apodictic proof. Now proof by means of the cause or reason implies the existence of the cause; the inquiry why a thing is is useless unless we know or assume that the thing is. If it exists, then the cause or reason of its so existing is that which gives it a definite character or position; it is, in technical phraseology, the form of the thing. But the form of the thing, regarded apart from the material, accidental element essential to its concrete existence, is that which we express in a definition. Proof and definition are thus most closely connected. The *terminus* to which proof tends, not realized in all cases of proof but certainly in the most perfect, is the definition, and, besides, if we closely examine proof, and find that ultimately we can force back the chain of middle terms up to certain ultimate, primary universals, disclosed by νοῦς, and that the nature of these primary universals is stated in their definition, we see further that definition is connected with proof as the *terminus* from which proof starts. The exposition of definition is thus the crowning portion of Aristotle's theory of apodictic method.[3] In it we have brought into close, though not explicit, relation, the fundamental notions on which his logic rests,—the notions of the essence, universal, genus, and specific difference. Definition, as concerned with that which is involved in demonstration, the ground or reason, is in cases where the reason and consequent are separable the sum of the demonstration; it is the compressed statement of the connection between the subject and the attribute demonstrated of it, *i. e.*, in a syllogism of the first figure, the major term.[4] Frequently a definition merely states the demonstrated attribute in relation to its subject, without indicating the rational link.[5] Such definitions, however, are defective, just as the

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[1] The following is the relative portion of chap. 23 of bk. ii. of *Anal. Pr.*:—"Now induction and syllogism through induction is the process of concluding by means of the minor term that the major term is predicable of the middle" (that is to say, of concluding from given facts that an attribute found in all of them is the effect of some other attribute also found in all of them). "For example, if B be the middle term, A and C the extremes, we show, by means of C, that A is predicable of B; for this is the inductive process. Thus, let A be long-lived; B, those wanting gall; C, individual long-lived, as man, horse, mule. Then A is predicated universally of C" (that is to say, the attribute A is found in all the examples before us), "for also that which wants gall is long-lived;" (that is to say, as a given fact, gall-lessness and longevity in the species, group; before us coexist). "B, wanting gall, thus is predicated universally of C. If then B and C be reciprocating, if C do not extend beyond the middle term" (that is, if we do not find other animals than the long-lived animals enumerated which also are devoid of gall), "it is necessary that A should be predicated of B. For it has been shown previously that if two terms are predicable of the same third, and if the extreme reciprocate with one of these, then the other of those predicates will be predicable of that with which the first reciprocated; but it is necessary to know that C is the complex of all the individual cases." The last sentence is extremely hard to interpret. The expression τὸ ἄκρον occurring in it is generally the technical word for major term, but as in the syllogism before us the major term is one of the predicates, this signification would seem to contradict the words πρὸς θάτερον αὐτῶν. Hamilton reads τὸ μέσον, which makes the argument intelligible and coherent with the passage apparently referred to in δέδεικται πρότερον, viz., *Anal. Pr.*, ii. 21, p. 68a, 21–25. Probably Aristotle uses τὸ ἄκρον here as equivalent to C, the ἄκρον through which the induction proceeds. According to the view taken above, the essence of the Aristotelian induction does not at all lie in the universalizing of C, but in connecting in one proposition the attributes B and A found to coexist in the group C. There is thus in one sense no middle, for cause is not reached; in another sense there is, for C is the material link connecting A and B. Aristotle then might naturally use ἄκρον for C, and assimilate the process of induction to a syllogism in which there was reciprocation of terms. In fact, however, induction regarded after his fashion results merely in the constitution of a group or class characterized as possessing two attributes in common.

[2] See, for example, the discussion in *Topics*, i. 17–18; ii. 10–11, on similarity; in the *Post. Anal.*, i. 13, on deductive and inductive methods; in *Post. Anal.*, ii. 13, on the formation of definition; and in *Post. Anal.*, ii. 12, 14–18, on the relation of cause and effect.

[3] It does not seem necessary here to consider in detail the peculiarities of apodictic as these are laid out in the first book of the *Post. Anal.*, nor to deal with the doubts raised regarding definition and proof in the first chapters of the second book. The substance of these difficult chapters can be readily summarized. If definition be taken as a finished result, it seems to stand in no relation to proof, and indeed it is hard to discover how it comes about at all. For definition supposes that which is implied in proof, the existence of the thing defined, and, moreover, it is in a special sense a unity, containing no distinction of subject and predicate, whereas such distinction is of the very essence of a demonstrated proposition. Neither in province, nor in method, nor in result, do definition and proof coincide. All this follows, however, from an abstract separation of the form or essence of the thing defined from the concrete nature of the thing. The essence is not to be taken apart; the definition does not preexist as a given fact. The essence is the reason of the fact, and is only discoverable when there is the recognized distinction of fact and reason of the fact. We must consider definition in the same manner as being involved in and resulting from the genesis of scientific knowledge.

[4] ἀπόδειξις θέσει διαφέρουσα, *Anal. Post.*, i. 8, p. 75b, 31.

[5] συμπέρασμά τι ἀποδείξεως, *ibid.*

conclusion of a syllogism, if taken *per se*, is defective.[1] A genuine definition is the statement of the essence, which in mediated notions is the cause or middle term of the demonstration, in immediate notions is directly assumed.[2] A merely nominal definition or explanation of what a name signifies is but a preparatory stadium in the progress towards real, genetic definition.

Definition, then, like demonstration, rests on the essential or rational ground, the notion of the thing. The rational ground or notion has its empirical aspect; it determines a class, and thus, just as in demonstration we may have forms of reasoning based primarily on the empirical details, so in framing definitions we may proceed from the empirical class, and may formulate rules for defining which bear special reference to the genus or body of individuals. In such procedure there is always involved the general idea of the essence or notion as the determining universal, and without this general idea the subsidiary methods, induction and division, do not yield scientific definition.

To frame a definition, then, *i. e.*, to discover the elements whose combination as an essential unity makes up the notion of the things defined, we select the predicates belonging to the things in question, but also attaching to other species of the same genus. The combination of such predicates which is not found in any other species, which is, therefore, reciprocable with the essence or form of the species, is its definition. The definition, therefore, contains the genus and the specific attribute (or combination of attributes). Of these elements, the genus is the least important; the truly essential factor is the specific difference, and in order that our definition should be ultimate, we must follow out the line of specific difference by which a genus may be divided until we reach a final, irreducible characteristic or group of characteristics, constituting a lowest species (or natural kind, if one were to employ a term made current by J. S. Mill). The systematic following out of the specific differences is logical division; the critical comparison of points of similarity in species of the same genus, so as to obtain a higher generality, has no special title accorded to it, but it resembles the Socratic and Platonic induction (συναγωγή). Division proceeds on the oppositions actually found in nature: and, though, doubtless, the division by dichotomy has formal advantages, it has not, as a process of real cognition, any supreme value. The negative as such is the inconceivable, and presents nothing for cognition.[3] And division is not dependent on exhaustive knowledge; it is not necessary that, in order to recognize A as distinct from B, we should know the whole universe of possible objects of cognition. A and B may be recognized as identical or distinct in essence, even though they at the same time possess distinct or identical accidental marks. Knowledge, in other words, turns upon the essential, not upon the numerical universal.[4] It is only needful, then, that in the systematic process of indicating the elements of definition, all must be included that concerns the essence, that the order must be strictly from determining to determined (or from more abstract or general to more concrete or special), and finally that the enumeration be complete. The final division or species reached is the notion of the thing, and its expression is the definition.

19. The analytical researches thus manifest themselves as a real theory of knowledge and as forming an integral part of the Aristotelian system. Logical relations are throughout conditioned by the characteristics of the Aristotelian metaphysical conception, and the distinction of the formal or technical from the real in cognition has no place in them. No point is more frequently insisted on by Aristotle than the impossibility of deducing any scientific principles or results from the fundamental axiom of thought, the law of non-contradiction. In the Aristotelian system this axiom appears simply as the generalized expression for the peculiar characteristic of thought, its potentiality of truth or falsehood. Such potentiality accompanies thought throughout, and is the mark of its subjective character, but the actuality of thought is something quite distinct, and is only realized through the various processes whereby the world of fact is apprehended. Beyond a doubt knowledge has a general aspect and there is thus possible a general theory of knowledge, but this is not to be regarded as merely a development from the fundamental axiom of thought. It is the general statement of what constitutes actual cognition, and thus refers on the one hand to the ultimate properties of that which is to be known, on the other hand to the qualities of knowledge as a subjective, though not the less real, fact. For to Aristotle subjective has not the sense which it may be said to have assumed in modern logic, mainly through the Kantian analysis. The activity of thought which realizes itself in the consciousness of the individual is not a mere formal process of apprehension, mirroring or depicting reality that is totally distinct from it. It is a reality, one aspect or phase of the total sum of things, and its development is a real process correlative with the development inherent in things as a whole.

At the same time it is impossible to overlook the difficulties which attach to the Aristotelian conception, and the consequent obscurities or perplexities in his logical researches. To remain always true to the fundamental conception of thought as one factor or phase in things, to trace its form in such a mode as never to lose sight of its essential correlation to the development of reality, is in itself the hardest task for any thinker, and presupposes a more completed metaphysic than is to be found in Aristotle. Some of these difficulties may be briefly noted, as they form the turning points of certain later doctrines. The judgment or proposition is taken as the initial, the simplest phase of the activity of thought, and so as having the simplest relation to things. But the distinctions of things which are subjectively seized in the judgment are too much regarded as given facts, and Aristotle is thus involved in a difficulty respecting the import, the truth or falsity, of the judgment. The presence of this difficulty is specially discernible when he attempts to deal with the temporal reference in the judgment, with the doctrine of opposition, and with the nature of modality. Thus, he notes that the verb, the essential part of the predicate, has a temporal significance, but he also notes that in universal judgments there is no reference to any specific time, and also that the copula, the verb *is*, has no existential meaning. He is thus driven to the enunciation of a view, common among recent logicians, that the judgment is a reflective or critical act pronouncing on the truth or falsity of a contemplated separation or conjunction of facts, while, on the other hand, the very contemplation of conjunction or separation has appeared as the essence of the judgment. So, in dealing with opposition, he distinguishes contradictories from contraries, and is inclined to refer the second to the given nature of facts, wherein extreme oppositions of members falling under the same genus are presented. Modality, likewise, he treats confusedly, for the assignment of the modal relations to the predicate does not sufficiently determine their place in a theory of judgment, nor explain the relation in which they stand to the judgment as the simplest activity of thought.

Further, in dealing with the quantity of judgments, Aristotle is perplexed by his own theory of what constitutes generality. He is compelled to throw together universal judgments of a totally distinct kind,—empirical and rational, as one may call them,—and though the underlying view that empirical universality is the expression of, and is dependent on, rational connection is made sufficiently clear in the doctrine of proof, it is not carried out to its consequences in the doctrine of judgment. Finally, to note only the crowning difficulty, the theory of proof and of definition turns upon the nature of the essential connection of attributes in a subject, but the explanation of essence is precisely the lacuna in the system. Indications of a theory of essence are not wanting, but it does not seem possible so to unite them as to form a consistent whole. The greatest obscurity still hangs over the fundamental part of the system, the nature of the πρῶτα which are apprehended by νοῦς, of the specific relation of attributes καθ' αὑτὰ to their subjects, and of the ἴδιαι ἀρχαί from which particular sciences start. That the προτάσεις ἄμεσοι, so frequently adduced as integral parts of proof, are analytical judgments[5] cannot be accepted without such qualifications as to render the use of such a term misleading; but what their precise nature is remains in the Aristotelian system undetermined.

Logic from Aristotle to Bacon and Descartes.

20. The long history of philosophic thought from Aristotle to the beginning of the modern period furnishes no new conception of logic so complete and methodical as to require detailed treatment, but exhibits alterations in special doctrines, additions, and new points of view numerous enough to account for a certain radical change in the mode of regarding logic which is, for our present purpose,

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[1] *De Anima*, ii. 2, p. 413a, 13 *sq.*

[2] ὁ δὲ τῶν ἀμέσων ὁρισμὸς θέσις ἐστὶ τοῦ τί ἐστιν ἀναπόδεικτος.

[3] Just as the ὄνομα ἀόριστον is said to have no significance save as the summary of a proposition, while a negative proposition has significance only in regard to the corresponding positive.

[4] The reference is to a theory advanced by Speusippus; see Prantl, i. 85. Aristotle here touches on a logical problem which has troubled many logicians. It is the same difficulty that arises when the question of plurality of causes is considered.

[5] As Zeller will have it; see *Ph. d. Gr.*, ii. 2, 191, *n.* Doubtless Aristotle does define an essential attribute as being one contained in the subject or one of which the subject notion is an integral part, but this relation of *entering into the definition* is not to be identified rashly with the modern view of the analytical relation of subject and predicate.

the only interesting feature. This change may perhaps be expressed not inaccurately as the tendency towards formalizing logic. Gradually logical researches came to have their boundaries extended in one way by the introduction of new matter, and narrowed in another by restriction of logical consideration to one special aspect of knowledge. Much in the history of this movement still remains in obscurity, but the general result is sufficiently clear. The periods into which the historical development of logic throughout this long interval may be naturally divided, with their main characteristics, are the following: (1) *The Peripatetic School*, represented by Theophrastus and Eudemus, following in the main the Aristotelian tradition, but deviating in certain fundamental respects, and on the whole treating the matter of logical research as though it were separate from and independent of the theory of knowledge as a whole. To this school is due the distinct recognition of the hypothetical and disjunctive proposition and syllogism, and the more complete enumeration of the possible valid modes of categorical reasoning. In both cases the additions are made to turn upon purely formal considerations. The hypothetical and disjunctive judgments are treated as given varieties, to be discerned in ordinary language and expression, not as resting upon any fundamental distinct principle or activity of thought.[1] The addition of five indirect moods to those recognized by Aristotle as belonging to the first figure proceeds on the purely formal ground of difference in position of the middle term in the two premisses. (2) *The Epicurean and Stoic Logics*. Of these the Epicurean presents no points of interest. The Stoic logic, on the other hand, is the first example of a purely formal doctrine based on and associated with a thoroughly empirical theory of cognition. In essence the Stoic doctrine is identical with that of Antisthenes, above noted, and it is interesting to observe that, under the purely nominalist theory, logic becomes almost identical with the doctrine of expression, or rhetoric. The theory of naming, and that of the conjunction of names in propositions, are the fundamental portions of the body of logic. Naturally the Stoic logicians tended to increase the bulk of logic by introducing numerous distinctions of language, and by signalizing varieties of judgment dependent on varieties of verbal expression. (3) *The acceptation of Logic among the Romans*. Here there must be distinguished the quasi-rhetorical logic, such as is found in Cicero, which is altogether Stoic in character, and the Aristotelian logic, as developed by Boetius with the additions of the later commentators. In Boetius one notes specially the technical or formal character of the treatment, which was of special importance historically, from the fact that the earlier scholastic writers derived their main knowledge of logic from certain of the treatises of Boetius. (4) *The Scholastic Logic*. On the details of the scholastic logic it is not necessary to enter, but there must be noted the following points as of interest in determining what may well be called the current conception of the Aristotelian logic in modern times. The earlier scholastics, in possession of but few of Aristotle's writings, added nothing of importance to the body of logical researches, and the permanent subject of discussion, the nature of universals, did not, through any of its solutions, affect the treatment of logical doctrines. The introduction of the body of the Aristotelian writings was contemporaneous with the introduction of the Arab writings and commentaries into western Europe, and there grew up therewith a more developed treatment of what may be called the psychological element of logic. The logic of the later scholastics is characterized by two points of interest, historically unconnected, but having a natural affinity,—the one, the introduction of an immense mass of subtle distinctions, mainly verbal, making up the body of the *Parva Logicalia*, the other, the influence of the nominalist conception of thought.[2] The peculiarity of the nominalist view is the severance of immediate apprehension from discursive thought, the assignment of all matter of knowledge to the one, and of all form to the other. But form, under this conception of discursive thought, can be found only in the generalizing function of signs or names: accordingly the fundamental processes of logical thought are regarded as so many modes of application of names. The later nominalist logicians were thus naturally led to the expenditure of immense subtlety and diligence on the thorny problems of the *Parva Logicalia*, while at the same time the peculiar inner difficulty of the theory became apparent as its consequences were worked out. (5) *The Reaction against Aristotelianism and the Humanist Modification of Logic*. Little of positive value for logical theory is offered by the numerous works representing this stage of historical development. Valla, Agricola, and Vives, with much good criticism in general spirit and detail, present a rhetorico-grammatical logic that resembles most closely Cicero's eclectic reproduction of Stoicism. Ramus, the only logician of the period with historic renown, contributes really nothing to the history of logic, his innovations consisting mainly in the omission of the most valuable portions of the genuine Aristotelic logic, the insertion of practical and interesting examples, and finally rearrangement or redistribution of the heads under which logical doctrine was expounded. The Ramist school, most numerous and flourishing, produced no logical work of the first importance.[3]

The net result of this whole period was the severance of a certain body of doctrine, formal in character (the theory of second intentions), from theory of knowledge generally, and from all the concrete sciences. The boundaries and even the functions of this doctrine remained unfixed, for difference regarding fundamental points of extra-logical theory led to difference in mode of treatment, as well as to difference in conceptions of the end and value of logic.

Logic of Bacon and Descartes.

21. Modern reform of logic, by which may be understood the attempt to place logical theory in a more close and living relation to actual scientific method, begins with Bacon and Descartes. To both the scholastic logic presented itself as the essence of a thoroughly false and futile method of knowledge. Neither had the acquaintance with the genuine Aristotelian system requisite in order to distinguish the elements of permanent value from the worthless accretions under which these had been buried, and, as a natural consequence, the views of both have a far closer resemblance to the Aristotelian doctrine than might be imagined from the attitude of opposition common to them. Both thinkers were animated by the spirit of reformation in science, and both emphasize the practical end of all speculation. For both, therefore, logic, which to neither is of high value, appeared to be a species of practical science, a generalized statement of the mode in which intellect acquires new knowledge, in which the mind proceeds from known to unknown.[4] But such a conception of logic is, if the expression be permitted, formal; that is to say, the actual province of logic is not determined thereby, but awaits determination from the further idea of the nature of knowledge and the ultimate constitution of that which is to be known. When this point is reached, a radical divergence presents itself between the views of Descartes and Bacon, consequent on which appears a radically divergent statement of the main processes and methods of logical theory.

To Descartes the ideal of cognition is the mathematical, that in which from assured and distinct data we proceed by strict sequence of proof to determine accurately and completely the nature of complex phenomena. Such an ideal, extended so as to embrace knowledge as a whole, dominates the whole of the Cartesian speculation, and, as in the case of the Socratic doctrine of knowledge, is the ground of the Cartesian doubt. Perfect certainty, *i. e.*, clearness and distinctness of principles, logical consecutiveness of deduction from them, and exhaustive enumeration of details—such are the characteristics of completed knowledge. There follow naturally therefrom the main processes of knowledge:—*intuition*, by which the simple data and axioms are apprehended; *induction*, or exhaustive enumeration of the elementary factors of any phenomenon; *deduction*, or determination of the complex as the necessary result of the combination of simple factors. To the processes of induction and deduction, when viewed more generally, the titles analysis and synthesis may be given.[5] On other portions of logical theory Descartes does not enter, and the text-books of the Cartesian school, even the celebrated Port Royal logic, do little more than expound with some freshness such of the older material as seemed capable of harmonizing with the new conception.

Two things only require note in respect to the Cartesian logic, apart from its freshness and completeness; the one is the obscurity which hangs over the nature of intuition; the other is the step in advance of the scholastic logic effected in the assimilation of deduction to synthesis. As regards the first, the criteria laid down by Descartes, viz., clearness and distinctness, are unsatisfactory and ambiguous. It is evident that he implied under these clear and distinct recognition of *necessity* in the data or principles, but the nature of this necessity is never made clear.[1] As regards the second, it was of importance to signalize, as against the scholastic view, that the universal in thought or reasoning was not only of the nature of the class notion, that genera and species were not the ultimate universals, but were themselves secondary products, formed by reasoning and based upon essential connection of facts. In this Descartes was but returning to the genuine Aristotelian doctrine, but his view has all the advantage derived from a truer and more scientific conception of what these connections in nature really are.

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[1] The nature of hypothetical inference and its law are recognised with the greatest distinctness by Aristotle. From his theory of essence as causal nexus, any distinction of kind between an apodictic (categorical) syllogism and a hypothetical of the type contemplated by later logicians was impossible and needless.

[2] The first of these is no doubt, as Prantl has labored to prove, Byzantine in origin, but it still remains doubtful whence the Eastern logicians draw. The most probable source is the Stoic writings.

[3] See note C, p. 812.

[4] Comp. *Princip.*, *Phil.*, *Pref.*; *De Aug. Sc.*, bk. v. chap. 1, 2.

[5] See *Regulæ ad directionem ingenii*, Nos. 2, 3, and especially 7. The celebrated rules of speculation (*De Methodo*) are only a more popular statement of the same processes.

22. What is peculiar in the logic of Bacon springs likewise from the peculiarities of the underlying conception of nature. The inductive method, expounded in the *Novum Organum*, is, however, only part of the Baconian logic, and, since it is commonly regarded as being the whole, a brief statement of what Bacon included under logic may here be given.

Viewing logic as the doctrine which deals with the use and object of the intellectual faculties, Bacon divides it (in this approximating somewhat to the extended division of the Stoic logicians) into (1) the art of inquiry or invention, (2) the art of examination or judgment, (3) the art of memory, and (4) the art of elocution or tradition. The third and fourth divisions are unimportant; the first and second might be called respectively the theory of the acquisition of knowledge and the theory of evidence or proof. The art of inquiry is subdivided into the art of the discovery of arts and the art of the discovery of arguments. The second of these Bacon regards as identical with the *Topics* of the Greek and Roman dialectic, and therefore as of comparatively slight value. Of the first there are two main branches:—(A) *Experientia Literata* and (B) *Interpretatio Naturæ*. The art of judgment has two subdivisions:—the examination of methods of reasoning—induction and syllogism—which resembles the older analytic; and the examination of errors of reasoning—whether these be sophistical, *i. e.*, the logical fallacies of the older doctrine, or errors of interpretation to be removed by careful criticism of scientific terms, or arising from erroneous tendencies of the mind (the doctrine of *idola*)—which resembles the older treatment of *Elenchi*.

The peculiarity of the Baconian logic, then, must be sought in the processes included under the art of discovering arts or knowledge. Among these the syllogism is not included. It is a process with no practical utility; it involves premisses of which the truth is simply assumed, and consequently its conclusions can have no validity beyond that of the premisses; it affects to determine the particular from the general, but in fact nature is much more subtle than intellect, and our generalizations, which are but partial abstractions, are quite inadequate to afford exhaustive knowledge of the particular; it throws no light upon the essential part of cognition as a process in formation, viz., the method by which we are to obtain accurate notions of things, and judgments based on these notions. Moreover, the deductive or syllogistic procedure favors and encourages the tendency to rash generalization, to the formulation of a universal axiom from few particulars, and to the uncritical acceptance of experience. If syllogism exist at all, there must be a prior process, that of generalizing by rigid and accurate methods from experience itself. Syllogism is not entirely worthless. It is of particular service in some branches of science (*e. g.*, the mathematical), and generally may be employed so soon as the principles of a science are well established; but it is a subordinate and secondary method.

The art of discovery, then, is the method of generalizing from experience. What this method shall be depends entirely on the thinker's conception of experience. Now Bacon's conception is perfectly definite. Observation presents to us complex natures which are the results of simpler, more general forms of causes. From the complex phenomena these forms are to be sifted out by a methodical process of analysis and experiment. A general proposition is one stating the connection between complex natures and their simple forms or causes; it is therefore the result of a graduated process. No doubt there may be generalizations based only on an ingenious comparison of the complex phenomena as they are presented to us; such a process Bacon calls *Experientia Literata*, and the maxims recommended for it much resemble the ordinary methods of experiment, but truly scientific knowledge is only to be obtained by the complete inductive method. The characteristics of this inductive method follow at once from the nature of the object in view. The form which is sought can be detected only by examination of cases in which the given complex effect is present, in which it is absent, and in which it appears in different degrees or amounts. By a critical comparison of these cases we may be able to detect, and, were the enumeration exhaustive, we must infallibly detect, by process of exclusion or elimination, a phenomenon constantly present when the effect is present, absent whenever the effect is absent, and varying in degree with the effect. Such a phenomenon would be the *form* in question,—the cause of the given fact or attribute. Exhaustive enumeration is, of course, an ideal, and therefore the method of exclusion can never be perfectly carried out, but all additional aids have significance only as supplying in part the place of exhaustive enumeration. We may, on the basis of a wide examination, frame a first generalization (*first vintage* as Bacon metaphorically calls it), and proceed to test its correctness by carrying out the critical comparison with it in view. Or we may, under the guidance of our leading principle, take advantage of certain typical cases presented by nature, or force cases by experiment in such a way as to supersede the enumeration. There are *prerogative* instances, critical phenomena, helpful in discovery of the cause of a phenomenon. Of other *adminicula*, or aids to induction, only the titles are given by Bacon, and it would be hazardous to conjecture as to their significance.[2]

The Baconian logic, then, or at least what is peculiar to it, is thoroughly conditioned by the peculiarities of the Baconian metaphysic or conception of nature and natural processes. As to the novelty of the logic, this to us does not appear to lie in the mere fact that stress is laid upon induction, nor do we think it correct to assign to Bacon the introduction of the theory of induction as an integral portion of logic. But it consists in the new view taken of what constitutes the universal in thought, a view which may be inadequate, but which colors and affects every process of thought, and therefore every portion of logical theory. It is but a consequence of Bacon's narrow view of the essence of syllogism that he should set induction in opposition to deduction, and regard syllogism as of service only for communication of knowledge. His inductive methods are throughout syllogistic in this respect, that they, like all processes of thought, involve the combination of universal and particular. Experience is interpreted, that is to say, viewed under the light of a general idea or notion.

Logic on the Basis of Psychological Empiricism.
Locke, Hume, Mill, Condillac.

23. The universal element in thought which is recognized by Bacon as present received from him no special treatment. His theory of the nature of knowledge offered no explanation of the origin, significance and validity of the notions involved in inductive procedure. The *Essay on the Human Understanding*, which carries out in the domain of inner experience the practical tendency of the Baconian method, supplied from the point of view of individualism the metaphysical theory common to both, a certain psychological theory of the universal element in knowledge, and thereby afforded a new foundation for logical doctrines. The *Essay* contains, in an unsystematic fashion, much that bears directly on logic (*e. g.*, the whole discussion on names, the classification of the signification of judgments, the criticism of syllogistic argument), but of more importance than these detached and direct portions is the general principle which underlies the whole view of human knowledge. This principle is briefly that of psychological genesis. All the complex facts of knowledge are regarded as mechanical compounds due to the coherence of simple data, the facts of inner and outer sense. The method of Locke is that which underlies and determines all the logical work of one very important school of logicians.

It is not needful to enter into details of Locke's own contributions to the foundation of logic. But it may be pointed out that from his position there were two possible lines of development. In his view the primitive impressions, the facts of inner and outer sense, were in themselves primitive facts of cognition; they were cognitions (it is the very essence of Locke's method to identify a simple impression of sense with the knowledge of a simple sense fact). The processes of abstraction, comparison, i. e., judging and reasoning, were exercised upon their data, and these products were, in consequence, of a secondary and, so to speak, artificial character. It was natural that a thinker who identified impression of sense with knowledge of a sense fact should maintain that the secondary formations of thought (general ideas, general propositions, syllogism) were not indispensable for cognition; that we could and did reason from particulars to particulars. At the same time Locke admitted the secondary processes as having actual existence, and in one important case (that of the judgment of coexistence, with which may be taken the idea of substance and of real relation) seemed to allow that in judgment something was added to the primitive data. It was possible, then, for development from Locke's position to proceed either by offering an explanation of the added elements, which should be in stricter harmony with the fundamental doctrine of psychological genesis, or by throwing them entirely out of account and concentrating attention on the primitive data as the only materials of cognition. The first is the line taken by Hume, which finds its logical completion in Mill; the second is the line taken by Condillac.

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[1] His ultimate standard is, no doubt, necessity for a thinking subject. Whatever is so connected with the existence of the thinking being that without it this existence is incomprehensible is necessary. But to apply this ideal to any proposition save the first, the *Cogito ergo sum*, is for Descartes the fundamental difficulty of his philosophy.

[2] *Nov. Org.*, ii. 21. In addition to prerogative instances there are mentioned—supports of induction; rectification of induction; variation of the investigation according to the nature of the subject; prerogative natures; limits of investigation; application to practice; preparations for investigation; ascending and descending scale of axioms.

Hume has an easy task so long as he merely subjects Locke's position to negative criticism; for the added elements, the ideas of substance, relation, cause, etc., are clearly inept and defenceless when the facts to be linked by them are already contemplated as so many completed, isolated cognitions. But where connectedness of cognition is in question, and where some explanation is demanded of the relations which seem to supply the universal rule in thinking, Hume's task is not so simple, and his final answer that these relations are psychological growths or products of association is neither satisfactory in itself nor quite in keeping with other portions of his doctrine. In Hume, however, we find the first thorough-going attempt to construct a theory of knowledge on the basis of psychological empiricism or individualism, and the first contributions to a doctrine of inductive proof as portion of this more comprehensive theory. Briefly, so far as logic is concerned, Hume offers as explanation of the universal in thought association of ideas, but does not treat of logic specially or in detail.

The complete statement of the theory of knowledge from the psychological point of view is that contained in Mill's *System of Logic*.

The aim of that work is the exposition of the theory of knowledge. Now knowledge, the term being taken in a wide sense, is characterized by one quality mainly, viz., evidentiary force. For every item entering into the sum of our beliefs at any moment, immediate perception being discounted, there may be reasons advanced, adequate or inadequate. The exposition of the relations between beliefs and their evidence or ground is logic, and logic is thus in one sense formal, inasmuch as the relations of evidence and belief are general, not dependent on the special nature of the facts believed, and in another sense real, in that knowledge is conceivable only in strictest relation to the things known.

Now, the exposition of the general nature of grounds of belief is in fact identical with a theory of the universal element in thought or cognition, and this theory is the essential portion of Mill's logic. It being assumed that the facts with which knowledge is concerned are minds, bodies, states of consciousness, and the relations (coexistence, sequence, similarity) among these states, and that propositions express, therefore, existence, coexistence, sequence, or resemblance, on what is based any inference going beyond a present perception? The propositions which make up cognition, strictly so called, are not mere expressions of momentary states; they are expressions of belief regarding the more or less constant relations of facts. They are, in fact, conclusions. The theory of proposition and of reasoning is one. On what, then, do such conclusions rest?

The warrant for any conclusion based upon experience, and referring to experience itself, can be found only in experience or in some principle furnished by experience. It may be shown that evidence for a conclusion is adequate, if we can compare this evidence with the kind of evidence on which a wider conclusion, frequently or constantly verified, rests. This comparison of particular evidence with more general evidence is the preliminary answer furnished by Mill. But what is the general evidence referred to, and what is the principle founded on it? The general evidence is the repeated experience of constancy of connection among groups of phenomena, and the principle founded on it is that of the existence of uniformity or rather of uniformities in nature. The evidence and the principle are purely psychological in character; that is to say, repeated experience, beginning with familiar cases and extending itself as time goes on, produces, by the natural laws of association, an assured belief that phenomena as a whole, or at least in the main, are connected together in constant, uniform, invariable modes. Such a belief, once established, serves as an ultimate criterion of proof, as an index for research. We proceed in our investigations in the light of this principle, and the tests by which we estimate the validity of evidence for any particular inference as to uniformity are generalized statements deducible from it. So soon as our evidence is of such a character that, in the case before us, either the inference of uniformity is warranted or the general principle must be held not to apply to this particular case, we have proof as cogent as experience can afford.

The universal in knowledge, then, is this naturally formed assumption regarding the course of nature. The logic of knowledge is the exposition of the modes in which evidence is obtained, of the tests by which its validity is estimated, and of the forms in which evidence and conclusion are connected.

The characteristic features of the subordinate processes of proof are at once deducible from this fundamental view. For if the simplest form of inference be, psychologically, the transition effected by association from one particular case to another resembling it, and if the essence of proof consist in comparison of the evidence for any one conclusion with the type of evidence for the general assumption regarding nature (or at least a wider portion of nature), it is evident that syllogism, in the ordinary acceptation of the term (in which it implies a concrete general proposition, a particular subsumed thereunder, and a conclusion), is neither a primitive form of inference nor a valid mode of proof. Doubtless we do in reasoning employ general propositions in order to express the determination of some particulars belonging to the same class, but the general proposition is itself a conclusion, resting on evidence of the kind above described, and the essence of syllogistic reasoning is not the subsumption of a particular under a general in which it is included, but the expression of belief that the evidence for the general proposition is adequate to cover all the particular cases, including those which have not been taken into account in formulating it. The major premiss of a syllogism is the record of a previous induction, and the syllogistic process, bringing forward a new case, is a valuable method for testing the adequacy of the previous generalization. As to generalization itself, the basis is evidently to be sought in experience, apprehended by observation and experiment. Did experience present to us isolated phenomena, i. e., phenomena so arranged that enumeration of the elementary constituents, whether antecedents or consequents, were possible, then our inductive procedure must be regulated by those canons or axioms which express the kind of evidence already referred to as establishing uniformity. These canons or axioms, however, are, like the Baconian method of exclusion, tests for an ideally perfect experience, and they, therefore, only lie in the background of actual scientific procedure, which has to employ other processes, both of inference and of proof. For, if we can in no way obtain more than a knowledge of the coexistence of facts, we are unable to bring our evidence into conformity with the inductive canons, save in the ideal instance in which absolutely exhaustive experience both of positive and negative cases is possible. Inferences as to law or uniformity of coexistence must here be based on numerical calculation of probability, and the conclusions present themselves in the peculiar numerical form appropriate to propositions of probability. Further, if the phenomena under investigation be complex, so that the canons of neither observation nor experiment are immediately applicable, the process of investigation must of necessity be the combined method of analysis and synthesis: analysis, aided by hypothetical conjecture, formulating such general laws of elementary factors as are known or presumed to exist in the case in question; synthesis, combining these laws and calculating with greater or less numerical exactness, according to the nature of the matter, the probable combined effect,—the whole tested by critical comparison of the calculated result with the actual phenomena. Here, as one can see, syllogistic procedure appears in its true scientific aspect as the form of thought by which we pass from the simple to the more complex, from the elementary essence or cause to the complex accident or effect. The elementary causes, no doubt, have no more cogent evidence than that which can be afforded by experience viewed in the light of our psychological assumption of uniformities; nevertheless the whole procedure of scientific investigation is recognized as being essentially of the type sketched in somewhat imperfect outline by Aristotle.

So far, then, as the logic of Mill is concerned, and apart from the undeniable richness and completeness of knowledge with which the various processes are treated, we note but one fundamentally new feature, namely, the explanation offered of the universal element through which alone perceptions are raised into cognitions, through which alone reasoned knowledge is possible. It is the only explanation possible on the basis of psychological individualism; its value, and therefore the value of the systematic deductions from it, must depend on the accuracy and coherence of the psychological or metaphysical theory on which it is founded.

24. It was possible, however, to proceed by another route from the position taken up by Locke. If it be held that the elementary impressions, mechanically regarded as somehow arising in mind, are in themselves cognitions, then it is possible to view them as containing in themselves all possible cognition. In other words, we may confusedly identify the proposition that knowledge does not extend beyond the field of experience with the very different proposition that the only items of knowledge are the isolated impressions which appear to make up experience. If this identification be accepted (and the conception involved is precisely that underlying all consistent nominalism from Antisthenes downwards), then the only processes requiring to be taken into account are those whereby clearness and distinctness are introduced into our (possibly) vague perceptions. For these processes analysis is an adequate title. All knowledge, *i. e.*, whatever is characterized by clearness, definiteness, consequence, is the analysis of what is given in isolated perceptions. Each perception is itself and is only itself; no judgment is possible save that of identity. In other words, if there be judgment at all, it can consist only in the assertion that the unanalyzed perception is identical with that into which it is analyzed, and as each perception and each analytic portion of a perception may be signified by an arbitrary sign (name or other hieroglyphic), judgment is essentially an affair of naming, a declaration that different names are identical or belong to the same perception. Reasoning is simply the transition from one identity to another,—a more developed result of analysis. Scientific or real knowledge is an accurately framed system of signs, *i. e.*, a collocation of signs which expresses precisely the results of the analysis of complex perceptions. Logic, under this doctrine of knowledge, is merely a statement of the various modes in which analysis is carried out, of the ways in which names are applied, and of the forms in which names are combined. Such is the theory of logic presented by Condillac.[1]

Logic on the Basis of Metaphysical Psychology. Leibnitz and Herbart.

25. One development from the psychology of Locke has thus appeared as an extreme formalism, which, if carried out consistently, must needs assume the aspect of a numerical or mechanical system of computation.[2] It is remarkable that a very similar result was reached by Leibnitz, a thinker who proceeded from a quite opposed psychological conception. The similarity is due to the presence in both theories of a certain abstract principle, intimately though not necessarily connected with the respective psychologies. In place of the single perception which, in Condillac's logic, is the element to be analyzed, there appears in Leibnitz's view the single consciousness of the monad (see LEIBNITZ, p. 422); in both cases, however, knowledge is assumed to exist there implicitly and to stand in need only of evolution. The methods by which this evolution is to proceed form for Leibnitz the substance of a new and all-comprehensive science, "Scientia Generalis," of which the older logic is but a part.

The characteristics of Scientia Generalis are at once deducible from the two general principles which in Leibnitz's view dominate all our thinking,—the law of sufficient reason and the law of non-contradiction. It must contain a complete account of the modes in which from data conclusions are drawn, and in which from given facts data are inferred, and since the only logical relations are those of identity and non-contradiction, the forms of inference from or to data must be the general modes of combination of simple elementary facts which are possible under the law of non-contradiction. The statement of the data of any logical problem, and the description of the processes involved in combining them or in arriving at them, are much assisted by, if not dependent on, the employment of a general *characteristic* or symbolic art.

The fundamental divisions then of Scientia Generalis, so far at least as its groundwork are concerned (for Leibnitz sometimes includes under the one head all possible applications of the theory), are (1) the synthetical or combinatorial art, the theory of the processes by which from given facts complex results may be obtained (of these processes, which make up general *mathesis*, syllogistic and mathematical demonstration are special varieties); (2) the analytic or regressive art, which, starting from a complex fact, endeavors to attain knowledge of the data from whose combination it arose.[3]

Of the nature of the second portion only a few brief indications are contained in the logical tracts and in detached utterances in the larger works of Leibnitz. When complex combinations are presented, or, in the most general form, when the investigation has to start from experience, from truths of fact, the work of analysis is endless; the regress to conditions is practically infinite. Determination of the necessary data cannot in such a case possess more than probable value, but the probabilities may be estimated according to the rules laid down in the progressive or synthetic art.[4] The logic of probability is thus recognized as an integral portion of the logical system.

Of the first art, the logical calculus in particular, a somewhat clearer and fuller outline is given.[5] The logical calculus implies (1) the statement of data in their simplest form, (2) the assignment of the general laws under which combination of these data is possible, (3) the complete exposition of the forms of combination, (4) the employment of a definite set of symbols, both of data and of modes of combination, subject to symbolic laws arising from the laws under which combination is possible. In the *Fundamenta Calculi Ratiocinatoris* and the *Non-inelegans Specimen Demonstrandi*, something is effected towards filling up the first, second, and fourth of these rubrics, but in no case is the treatment exhaustive. The simple data, called characters or formulæ, are symbolized by letters, relations of data by a somewhat complicated and varying system of algebraic signs; for the calculus, or set of operations exercised upon relations given so as to produce new formulæ, no comprehensive system of symbols is adopted. Formulæ, relations, and operations take the place of notions, judgments, and syllogism. The general laws of combination of data are stated without much precision. Leibnitz recognizes the law of substitution, notes also what have been called the laws of reduplication and commutativeness, but, in actual realization of his method, employs indifferently the relation of containing and contained or the relation of identical substitution (æquipollence). No attempt is made to develop a complete scheme of possible modes of combination.[6]

At the root of Leibnitz's universal calculus, as of Condillac's method of analysis, and generally of nominalist logic, there lies a peculiar acceptation of the abstract law of identity. That a thing is what it is,—that knowledge of a thing is a single, indivisible, mechanical fact, susceptible only of explication or of expanded statement,—this is the principle dominating logical theories which in other respects may differ widely. Insistence upon this aspect of knowledge or of the object known is the ground for assigning to thought a function purely analytic, which is the very keynote of nominalism. It is not hard to see, however, that so to view the law of identity is to abstract from all the conditions of actual thinking and knowing, and to throw into the assumed simple fact all the complexity which is afterwards to be discovered in it by analysis. The knowledge of a thing is not to be explained in this abstract or mechanical fashion. Truth does not consist in the empty recognition that *a* is *a*, and in the repetition of this unimportant fact, but in the knowledge of the nature of *a*, a knowledge which essentially consists in relating *a* to its intellectual conditions, in assigning to it a place in the intelligible world. The identity of the thing with itself is a mere aspect of the complex process whereby the thing is cognized. It hardly requires to be pointed out that the minor forms of the same fundamental view, the various attempts to express the essence of a judgment as the assertion of identity, are open to the same objection. They take an abstract view of the judgment, and regard as the essential fact that which is but an accessory or adjunct or consequence. Difference, to put it in the briefest fashion, is no less essential to a judgment than identity.[1]

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[1] See *Langue de Calcul; Art de Penser;* and *Logique. Cf.* Laromiguiere, *Leçons de Philos.*, i. pp. 5–43; and Robert, *Les théories logiques de Condillac*, 1869.

[2] Such as is hinted at by Hobbes, and as is carried out in the various works of Professor Jevons.

[3] Leibnitz sometimes includes these two under the head of "Ars Inveniendi," and places alongside of this, as first part of Scientia Generalis, "Ars Judicandi," a division resembling that appearing in Bacon; but the "Ars Judicandi" may be thrown out of account.

[4] *Op. Ph.*, pp 397, 398; *cf.* generally pp. 84, 93, 848.

[5] See specially *Op. Ph.*, pp. 92–114; also the tract "De Arte Combinatoria," *Op. Ph.*, pp. 6–45.

[6] It is interesting to note that Leibnitz signalizes the distinction between the logical and mathematical senses of a whole, and between the distributive and the collective meaning of quantity; that he emphasizes the function of the particular judgment as the negation of its opposed universal; and that he approximates to some modern modes of formulating the judgment (*a* is *b*, *e. g.*, he would express as $a = ab$, or *ab* is; no *a* is *b*, as *ab* is not).

26. The view of logic put forward by Herbart, from a metaphysico-psychological basis resembling that of Leibnitz, agrees in so many respects with that of Leibnitz, although containing no reference to the idea of a logical calculus, that it may be placed under the same head. Logic, according to Herbart, is a purely formal doctrine; it has to do only with the modes by which clearness, distinctness, and system are introduced among our ideas. Logical forms, then, the notion, judgment, and syllogism, are not to be regarded as having any metaphysical reference; they are not even to be explained psychologically; they stand on their own footing as explanatory processes exercised about the representations which, under their own natural laws, fill up consciousness, coming and going within the sphere of apperception. According to this view the whole province of knowledge is excluded from logic, and it is assumed that knowledge is somehow given, mechanically, without the co-operation of processes, if not identical with, yet strongly resembling, those recognized as logical. Herbart does not succeed in vindicating an independent place for a purely formal logic.

The Kantian Logic.

27. The critical method, which has so influenced general philosophy that all later speculation refers more or less directly to it, has at the same time profoundly modified all later conceptions of the sphere and method of logic. From the Kantian philosophy there spring directly the three most important modern doctrines of logical theory,—that which, with many variations in detail, regards logic as a purely formal science, the science of the laws of thought or of the laws under which thought as such operates, and of the forms into which thought as such develops; that which, likewise with many variations, unites logical doctrines with a more general theory of knowledge; and finally that which identifies both logic in the narrower sense and theory of knowledge with an all-comprehensive metaphysic.

It is matter of history that the critical system was developed mainly from the basis of the Leibnitzian logical and metaphysical theories, and it is likewise matter of history that Kant, even in the speculative work which was to so large an extent antagonistic to these theories, remained under the influence of some of their cardinal possessions.[2] In particular the view of logical thought as purely discursive, analytic in character, a view never by Kant harmonized with his general system, is a relic, most significant for the development of his logic, from the Wolffian reproduction of Leibnitz's philosophy. This historic basis is not to be lost sight of in attempting to acquire a clear idea of the special place and function assigned by Kant to logical theory.

But a brief reference to the general result of the critical philosophy will suffice to introduce the more special treatment of the Kantian logic. Knowledge, or real cognition, which is analyzed in the *Kritik* in reference to its origin and validity, appears, when subjectively regarded, as a compound of intuition and thought, of sense and understanding. The isolated data of sense experience do not in themselves form parts of cognition, but are only cognized when related to the unity of the conscious subject, when the subject, as it may be put, has consciousness of them. This reflex act, resembling in some respects Leibnitz's apperception, or process of uniting in consciousness, is an act *sui generis*, not to be mechanically conceived or explained. Only through its means do representations become cognitions. The forms in which the synthetic act of understanding is carried out are, as opposed to the intuitive data on which they are exercised, discursive or logical in character. Essentially they are judgments: all acts of understanding are judgments, and, as judgments, they imply a general element with which the particular of sense is combined, and in the light of which the particular becomes intelligible. In ultimate analysis it appears that no particular, whatever be its empirical character, can become an intelligible fact save when determined through some specific act of understanding, through combination with some specific notion or general element. Combination of particular and general is thus the very essence of understanding, the mark of knowledge as such. In every item of cognition the same elements may be discerned as necessarily present. The consideration of the ultimate modes of intellectualization, of the series of acts by which understanding subsumes the particular, draws the particular into the unity of cognition, may be called in a large sense logic. If the consideration be specially directed to the mode in which, by means of this combination, knowledge arises, and therefore include discussion of the wide problem regarding the relation between understanding and objectivity in general (the matter of knowledge taken generally), the special title transcendental logic may be used. But if, concentrating attention solely on the kind of operation implied in understanding, we endeavor to lay out fully the modes in which understanding proceeds in the construction of knowledge, making abstraction of all inquiries regarding the origin, worth, significance of knowledge itself, the consideration is of a more general character, and may receive the title of general logic.[3]

The understanding, then, like everything else, works according to laws, the laws of its own nature. If we abstract from all that may characterize the matter considered, and take into account solely the laws according to which understanding must act, we may construct a purely formal doctrine, a theory which is rational both in matter and in form, for the matter consists of the laws of reason, and the form is prescribed by the very nature of reason,—a demonstrative theory, for nothing can enter therein which cannot be shown to have its ground in reason,—a complete theory, for although the matter of thought is infinite and infinitely varied, the modes in which the understanding must operate if unity of cognition is to result, are finite and capable of exhaustive statement,—and a theory developed from its own basis, standing in no need of psychology or metaphysics, but deducible from the mere idea of understanding as that which introduces unity into representations, whether given (empirical) or *a priori* (pure).

Were this the only determination of the province of logic given by Kant, the question which at once arises as to the possibility of any such independent doctrine would receive an easy solution. For it is evident that logic, as a theory of the form of thought, could consist only of a portion of the more general doctrine, by whatever title that be known, in which the nature of understanding as synthetic activity is unfolded. The distinction on which Kant lays stress between matter and form, a distinction employed by all subsequent writers of his school, is ambiguous and misleading. If by matter be meant the particular characteristics of the things thought about, in which sense we might speak of judgments of physical, chemical, grammatical matter, and so on, then to say that logic does not take this into account is perfectly inept. If logic be a philosophic discipline at all, a theory in any way concerned with thinking, it is at once evident that it can in no way deal with the specialties of any particular science. But this distinction between matter and form is by no means identical with another, lying in the background, and too frequently confused with the first,—the distinction of understanding as a faculty *per se* with its own laws, deducible from its mere notion, and understanding as the concrete real act of thinking. What Kant calls the mere idea of understanding, and what in other writers of his school appears as a definition of thought, is really nothing but a reference to what has presented itself in the wider inquiries of the *Kritik* as the complex nature of the synthetic activity of understanding. Kant himself never attempts to deduce from the notion of understanding the varied characteristics of logical forms, and his followers,—*e.g.*, Hamilton,—when they are consistent, start from concepts as expressing the bare notion of thought, and regard all other forms of thought as combinations of concepts.

But Kant does introduce another element into his treatment of the province of logic, one not original to him, but of the utmost importance for later developments from his point of view. He inquires what kind of relations among the elements of thought can form the matter of logical treatment, and defines these as two in number—(1) formal consequence, (2) non-contradictoriness. By formal consequence we are to understand the relation between a conclusion and its premisses, no inquiry being raised as to the truth or validity of the premisses. By non-contradictoriness we are to understand that, logically, notions, judgments, or reasonings can be subjected to treatment only in regard to the absence of explicit contradiction among the factors entering into them. Thought, which introduces unity and system into experience, must certainly introduce formal consequence and preserve analytic truth or correctness. Formal logic, then, treats only of these formal qualities of all products of thought.[1]

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[1] Much of the confusion which reigns supreme in many modern works on logic is doubtless attributable to a confusion between the nature of the judgment and the result of a judgment. The result of a judgment is always an increased richness of the subject notion; the subject unqualified and the subject qualified by the predicate are doubtless identical; but it would be absurd to say, therefore, that the function of the judgment is the assertion of this identity.

[2] See article KANT, vol. xiii. pp. 859,862.

[3] It does not seem necessary to advert more in detail to the divisions and subdivisions of logic drawn out in the *Kritik*, pp. 86-93 (Hartenstein's ed., 1868).

The detailed treatment of logic, so far as that can be gathered from the very brief summary (*Logik*, *Werke*, iii. 269–340), shows with the utmost clearness how impossible it was for Kant to deduce the forms and relations of thought from the mere notion of understanding, even when coupled with the principles of formal consistency and consequence. Assuming that understanding is the discursive faculty, the faculty of cognizing the many particulars through the one concept or notion, Kant deals first with concepts (Begriffe) as general or discursive representations. He is careful to avoid an error into which many of his followers have fallen, that of regarding Begriffe in a mechanical fashion as a specific kind of Vorstellung, distinguished only by containing a few of the marks making up the single intuitions. He rightly notes that cognition proceeds by subsuming the particulars under the common element contained in them, and that the generality of the concept thus rests upon the relation in which it stands, as reflective ground of cognition, to the particulars. The characteristics of concepts, as possessing extent and content, are treated briefly, after the fashion familiar in the more detailed logics of his school. It is, however, when the doctrine of judgment is reached that the difficulties of his position appear with greatest distinctness. Judgment is defined "as the representation of unity in the consciousness of distinct representations, or the representation of the relation of these, in so far as they make up a concept."[2] But the essential element in the definition—the unity of consciousness or unification of differences in a notion—is thus left so vague and undetermined that it is impossible to deduce from it any classification or any peculiarities of judgments, and possible indeed to proceed on two quite distinct lines of research. The expression, indeed, refers to that which is the fundamental fact in the critical system, the existence of conditions under which only it is possible for detached data of experience to become objects of knowledge for the single conscious subject; and, had Kant been true to the principles of his system, it would then have been necessary to base any classification and treatment of judgment on the enumeration of the functions of unity in conscious experience. In the *Kritik*[3] emphasis is laid upon the function of unity as the essence of the judgment, but it is a well-known historic fact that Kant makes no attempt to justify in its details the enumeration of such functions on which its divisions rest. His followers in the field of logic,[4] misconceiving the real relation of form to matter, interpreted the unity involved in the judgment as being a merely quantitative relation between given notions.[5] There is here involved a twofold error, which has exercised a most pernicious influence on the fortunes of logical theory. For, in the first place, so to view judgment is implicitly to proceed from the assumption of notions as given elements of knowledge, the relations of which are to be discovered by comparison or analysis of what is contained in them. The notion as empirically given thus becomes the fundamental fact; all other forms of thought, judgment, and syllogism are regarded as merely the mechanism by which the content of notions is evolved. Such a doctrine puts out of sight the peculiarities of the notion as the product of thought only, inevitably compels a distinction between what we may call the real processes of thinking whereby notions are formed and the elaborative processes by which notions when formed may be treated, and by regarding notions as simplest data, leads back to the old nominalist doctrine according to which all thinking is but the compounding and separating of simple elements.[6] And, in the second place, there is involved in all this the underlying prejudice, which it was the very business of the critical system to destroy, the attempt to treat knowledge, and thought, which is an integral part of knowledge, in a purely mechanical fashion. The Kantian analysis for the first time in the history of philosophy brought into clear light the essential peculiarity of knowledge, the reference of all the manifold details of experience to the unity of the thinking subject. Such reference, and the modes in which it expresses itself, are not to be conceived mechanically, nor can we regard the products of thought, the notion, judgment, and reasoning, in the same fashion in which, with but partial success, we treat, in psychology, the representations or reproductions in idea of actual fact. The essence of thought, the unity in difference of objects known and subject cognizing, is that which constitutes in its several modes the peculiarity of notions, judgments, and reasonings. The notion is simply the work of thought, looked at, if the expression be allowed, statically. There is no single psychical product, to be treated by the method of observation which is applied in psychology to sensations and ideas, which can be called the notion. Mental facts, which rightly or wrongly psychology deals with after its mechanical fashion, present themselves in a new aspect when they are regarded as parts, or rather as organic elements, in cognition. If we endeavor to apply the abstracting, isolating method of observation *ab extra* to them, doubtless only mechanical, abstract, and external relations will manifest themselves as obtaining among them, and there may thus be deduced a mass of abstract formulæ expressing relations of agreement and disagreement, total or partial coincidence, confliction, intersection, or co-existence and sequence, which have abstract truth, but are in no way adequate to express the genuine nature of thought.

Kant himself proceeds, as was said, by simply assuming, as somehow given, the cardinal forms of unity in consciousness, and distinguishing form of judgment from matter by the apparently simple difference between matters united and form of uniting, draws out the types of judgment under the familiar rubrics of quality, quantity, relation, and modality. The same assumption of distinctions only to be given by the higher researches of transcendental logic is manifested in his treatment of reasoning, the deduction of one judgment from others. Three main types of such deduction are signalized:—(1) deductions of the understanding, in which the conclusion follows simply from change in the form of the given judgment; (2) deductions of reason, in which the necessity of the deduced proposition is shown by reference to a general rule under which it falls; (3) deductions of judgment, in which the conclusion is reached by the treatment of given experience in reference to a general rule of reflection upon experience. Under the first of these fall the familiar forms of immediate inference; under the second, syllogism in its three varieties, categorical, hypothetical, and disjunctive; under the third, inductive and analogical reasoning. The understanding, if one may interpret Kant freely, is the process by which the worth of what is given is fixed and determined; it moves not beyond the given fact, and can therefore subject the fact to no other than formal transformation. The determining judgment or reason is the expression of the fundamental fact in knowledge that all experience is subject to general rules or conditions; there must therefore be a determination of the particular by the general; there must be ground for subsuming the particular and the universal. The forms of such subsumption and determination of the particular by the general are syllogisms. Syllogism therefore is the mode in which the essence of cognition is made explicit. The reflective judgment is the expression of the tendency to treat the contingent details of this or that given experience after the analogy of the general rule that all experience is subject to intellectual determinations. This analogy does not necessitate the specific determination of the particular by any specific universal, but serves as general directrix in experiential researches. It is sufficiently evident that a remodelling of the older logical doctrine such as this rests upon a wider and more comprehensive philosophical view of knowledge as a whole, that such distinctions cannot flow from either of the principles previously indicated as those on which the formal conception of logic rested, and, finally, that the logical aspect of these distinctions is formal in the only true sense of that word, viz., in that the treatment is of necessity general, applicable to all or any thinking.

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[1] Two at least of the followers of Kant have worked out the system of logic from this point of view,—the one, Twesten, in his *Logik, insbesondere die Analytik* (1825), the other, the late Professor Mansel, in his *Prolegomena Logica*. Mansel, recognizing the distinction between the two modes of determining formal logic, adopts the second, and is therefore led, in consistency, to define logic, not as the science of the laws and forms of thought, but as the science treating of formal thought, or of the formal element in the forms of thought. In other words, he recognizes that the statement of the forms of thought must be introduced into logic *ab extra*, from psychology or what not, and that logic, accepting these, has to consider the formal element (non-contradictoriness) in them. It is well to have the doctrine brought thus to its ultimate issue, for it is thence apparent that there is no independent science called logic, but simply one comprehensive precept, which may be called logical, viz., avoid contradictoriness in thought. Illustrations of the ways in which contradictoriness manifests itself may be offered, and a useful logical praxis may thus be afforded, but these do not make up a science or theory.

[2] *Logik*, § 17.

[3] *Analytik*, § 19.

[4] See specially the treatment of judgment by Esser (*Logik*, §§ 56 and 61), and Jakob (*Log. u. Met.*, §§ 189, 194, 201, 202), where the division of judgments into categorical, hypothetical, and disjunctive flows from a quite arbitrary and artificial principle.

[5] See Twesten, *Logik*, §§ 51–57, and 61; Hamilton, *Logic*, i. 230 *sq.* It may here be remarked that Hamilton's mode of translating the relative sections of Krug and Esser, his main authorities for the details of the Kantian logic, clearly shows that he did not attach any special significance to the phrase, unity of consciousness. In his view, the unity implied in the judgment A is B was the union of A and B in the notion of a given totality or whole—A being part of B in one aspect, B being part of A in another. This relation of whole and part is quite un-Kantian.

[6] It is by this course that the curious phenomenon of an algebraic or symbolic logic springing from the Kantian groundwork has come about. The same result follows, indeed, from any view of thought as merely exercised *about* facts which are already in themselves completed cognitions. Whether we call these notions (with Hamilton) or *πρῶτα* (with Antisthenes) or elementary data (with Leibnitz) or simple apprehensions (with the nominalists), the result is the same.

28. As in the Kantian system there were placed, side by side, two diverse conceptions of logical system, that of transcendental logic and that of formal logic, without any adequate link of connection between them, so from the Kantian position there diverged two quite distinct schools of logic, the transcendental or metaphysical, and the formal. As regards the second of these, but little requires to be said. The great body of logical treatises written from the Kantian formal point of view contain nothing of interest. In them the traditional logic is handled under the rubrics supplied by the Kantian general philosophy, with more or less of purifications from needless detail, according to the acuteness or insight of the writers, with more or less of deviation from the Kantian lines. In but few cases did the real difficulty, that of assigning to formal logic an independent plan and method, lead to a radically fresh treatment.[1]

The Kantian transcendental logic, being an analysis of the conditions under which objectivity in general becomes possible material for cognition, is in a special sense a new theory of thought. For thought is the process mediating the unity of the ego and the multifarious detail of actual experience; and only through thought, the universal, are objects so determined that they are possible matters of knowledge for a conscious subject. As determinations of objects, the pure elements of thought may be called notions, while the realization of notions in conscious experience is the judgment, wherein the universal of thought and the particular of sense are synthetically united, and the systematization of experience is the syllogism. Notion, judgment, and syllogism are thus, in the transcendental logic, no bare, abstract forms, but have as their content the pure determinations of objectivity in general. They cannot be conceived mechanically, as mere products differing only in degree of generality and abstractness from the ideas, and connections of association which appear as due merely to the psychological mechanism of the human consciousness. They are the essential forms of the ultimate synthesis through which knowledge becomes possible, and thus express in their organic system the very nature of thought, *i.e.*, of the thinking subject. In the Kantian doctrine, however, as it developed itself historically, there are various points of view which disturb the harmony of the system as thus sketched. Two in particular require special notice, as from these the later attempts at a complete revision of logical theory have taken their origin. (1) Throughout the Kantian work there appears a constant tendency to regard the ego, or central unity of self-consciousness, as merely abstract, as related mechanically, not organically, to the complex of experience in which its inner nature is unfolded. This tendency finds expression in various ways. Thus the synthesis, which has been shown to be the essential feature of cognition, is regarded as on its subjective side a union of intellectual function and receptivity of sense, and the contributions from either side are viewed as somehow complete in themselves.[2] Knowledge, in accordance with this, might be considered to be the mechanical result of the combination or coherence of the two, a combination which in the last resort must appear to the conscious subject as contingent or accidental. (2) Knowledge, the systematic union of universal and particular in experience, is thought as containing in some obscure fashion a reference to the most real world, the realm of things in themselves, and therefore as being, in antithesis thereto, strictly subjective. The processes of thought, by which unity is given to experience, thus manifest themselves as limited in scope, and as being the very ground or reason of the restriction of knowledge to phenomenal in opposition to noumenal reality.[3]

The presence of these two difficulties or perplexities in the Kantian system, which are, indeed, at bottom but one, led to revision of transcendental logic in two directions. The one line proceeded from the analysis of knowledge as the product of intellectual function and receptivity, and, uniting therewith metaphysical conceptions of varied kinds, culminated in a doctrine of cognition which, retaining the distinction between real and ideal as ultimate, endeavorod to show that the forms of the ideal, *i.e.*, of thought, and the forms of reality were parallel. Logic, under this new conception, appeared as a comprehensive theory of knowledge, the systematic treatment of the modes in which thought, conditioned by its own nature and by the nature of the reality upon which it is exercised, develops into knowledge, *i.e.*, of the modes in which a representation of things characterized by universality and evidential force is obtained. On the whole this is the position assigned to logic by Schleiermacher, whose view is followed in essentials, though with many variations in detail, by a large and important school of logical writers.[4]

The second direction may be characterized generally as the attempt to develop fully what is involved in Kant's conception of thought as the essential factor of cognition. Any opposition between metaphysics as dealing with the real and logic as dealing with the ideal element in knowledge appears, in this view, as a mere effort of false abstraction. The very nature of reality is its nature in and for thought. The system of pure determinations of objectivity, which Kant had imperfectly sketched, is not to be regarded as a piece of subjective machinery, because it expresses the inmost conditions of intelligence as such. Nothing is more real than the ego, than intelligence or thought. Transcendental logic, or logic which is at the same time metaphysic, is the only discipline to which the title logic by right belongs. For it contains the complete system of the forms in and through which intelligence is realized. The notion, judgment, and syllogism are doubtless forms of thought, but they have their definite content. They are the modes in which the forms of objectivity are realized for intelligence, and are thus at once abstract and concrete. The so-called formal logic is a mere *caput mortuum*, a descriptive study of some few types of the application of thought to matters of experience. On the whole this is the view of logic developed through Fichte (and in part Schelling) by Hegel, and the Hegelian system shall here be regarded as its complete and only representative.

Logic as Theory of Knowledge.

29. The position assigned to logic as theory of knowledge and the range of problems included in it are determined by the general philosophic view of the distinction between the reality to be apprehended by thought and the subjective nature of thought itself. There may be, therefore, numberless variations in the mode of treating logic with general adherence to the one point of view.[5] In the *Dialektik* of Schleiermacher, for example, the fundamental characteristic is the attempt to unite some portious of the Kantian analysis of cognition with Spinozistic metaphysic. Knowledge is regarded as the complex combination of intellect, the formative, unifying, idealizing faculty, and organization or receptivity of sense. The generality or common validity of cognition rests on the uniform nature of organization and on the identity of all ideas in the one ideal system. The objective worth of cognition is referred on the one hand to the determined connection between the real universe and the organization through which the individual is part of the real order of things, on the other hand to the ultimate metaphysical parallelism between the system of ideas and reality. The primary forms of knowledge, notion, and judgment, distinct from one another only as being knowledge viewed now as stable now as in process, correspond to the ultimate elements of the real,

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[1] Generally, the formal logician is compelled simply to take the processes of thought as determined in psychology or metaphysics or what not, and to consider certain aspects of them. His science has, therefore, no independent place, and no method of development. Independence may be striven after, either by attempting to develop all processes of thought and their logical peculiarities from an initial definition of thought solely, or by combining with this definition the view that non-contradictoriness is the one logical quality, and thus assigning to logic the discussion of the conditions of non-contradiction in thought. Of the first, Hamilton may be taken as the type; of the second, Twesten, Mansel, and Spalding.

[2] See vol. xiii. pp. 861, 862.

[3] It is unnecessary to consider what exactly was Kant's teaching on either of these points, or what the significance of the relative doctrine may be in his system. It is sufficient, for the historical purpose in hand, to indicate the apparent tendency of his work, for from this the later developments take their rise.

[4] See, for an enumeration of the more prominent members, Ueberweg's *Logik*, § 34, a work which itself is an admirable exposition from the same point of view.

[5] It appears an historic error to identify the point of view here referred to with the Aristotelian. The notion of a parallelism between the forms of reality and the forms of knowledge is too definite to be covered by the mere expression, whether in Aristotle or in Plato, of the doctrine that knowledge is knowledge of being.

the permanent force or substance and its variable manifestations. Syllogism and induction, with the subordinate processes of definition and division, analysis and synthesis, are technical modes of the development of notions and judgments, modes by which inchoate notions are rendered definite, by which incomplete judgments are rendered complete.[1]

That there is much valuable and suggestive material in this mode of regarding logic is undoubted, and in the discussion of isolated forms of knowledge, such as judgment, it is always desirable that there should be kept in mind the reference to the ultimate character of objectivity. But the whole point of view seems imperfect and open to such objections as will always present themselves when a principle is not carried out to its full extent. It may, for propædeutic purposes, be desirable to separate the handling of logical forms from metaphysic, but such separation cannot be ultimate. The system of forms of reality to which the forms of knowledge are assumed to correspond must in some way enter into knowledge, and they cannot enter in as an absolutely foreign ingredient, to which knowledge has simply to conform itself. For, if so, these metaphysical categories would be discoverable only by an analysis of concrete knowledge, and they would remain as inferences from the nature of cognition, not as data directly known. The cardinal difficulty which appears in all treatments of logic from this point of view is that of explaining how there comes to be known an objective system of things with characteristic forms or aspects, and it is not hard to see that the acceptance of a reality so formed is but a relic of the pernicious abstraction which gave rise to the Kantian severance of knowledge from noumenal reality.[2] In short the position taken by Schleiermacher and his school, as final standing ground, is but an intermediate stage in the development of that which lay implicit in the critical philosophy.

Moreover, it is hardly possible to assume this point of view without tending to fall back into that mechanical view of knowledge from which Kant had endeavored to free philosophy. If there be assumed the severance between real and ideal, it is hardly possible to avoid deduction of all that is characteristic of the ideal order from the observed or conjectured psychological peculiarities of inner experience. The real appears only as ultimate point of reference, but in no other way determines the form of knowledge. The characteristic relations which give content to notions, judgments, and syllogisms are deduced psychologically.[3] In the long run, it would no doubt be found that the real key to the position is the belief, more or less expressed, that the systematic view of thought as comprehending and evolving the forms of reality is an unattainable ideal,—that metaphysic, to put it briefly, is impossible. To some extent this is the position taken by Lotze, whose cautious and ever thoughtful expositions are invariably directed to the elucidation of the real *nodi*, the real roots of perplexity or incompleteness of doctrine. In his view logical forms are the modes in which thought works up the material, supplied in inner experience by the psychological mechanism of the soul, in conformity to the ultimate presuppositions with the aid of which alone can harmony, or ethical and æsthetic completeness, be gained for our conceptions of things. But with this doctrine, which approaches more clearly than any other of the type to the metaphysical logic, there is coupled the reserve that any actual point of view from which the development of these presuppositions, their rational explanation, might become possible is unattainable. Our confidence in these is finally of an ethical character, and depends upon our conviction of the ethical end or purpose of all the surroundings within which human life and character is manifested. In logic as in metaphysic we must content ourselves with more or less fragmentary treatment.[4]

Logic as Metaphysical.

30. To understand the peculiarities of this, the final conception of logic, we must take into account the ultimate view of knowledge as that in which thought and reality are united, and of philosophy generally as the attempt to develop the whole system of these abstract determinations of thought by which coherence and intelligibility are given to knowledge. In it there is carried out to the full extent Kant's idea of thought as the ultimate germ of intelligibility.

In the critical system, as we have seen, the fundamental idea was continuously disturbed by the intrusion of doctrines which possessed significance only when the problems were treated from a quite opposed point of view. Thus the abstract separation of conscious experience, regulated according to the conditions of the unity of thought, from a supposed realm of reality involved the consideration of the subject as one portion or item of a mechanical whole. In other words, the Kantian system proved itself unable to unite in a comprehensive fashion the two ideas of thought as the universal in experience and of thought as the activity or mode of realization of the individual subject. The central point of view, that which refers all in experience to the unity of thought, was continuously departed from, and as a natural consequence the various forms or modes of thought were treated, not in relation to their ultimate unity, but as isolated facts, to be dealt with by principles resting on a totally opposed doctrine. It is the essence of the Hegelian method to keep continuously in view the concrete unity and totality of thought, to treat each special aspect or determination as an integral portion of an organic whole, a portion which must prove itself unintelligible and contradictory if regarded apart from its relations to the whole, and so to avoid these mechanical separations and abstractions which had proved fatal to the Kantian doctrine. In the development of a method which rests upon and endeavors to retain so comprehensive a point of view, there must of necessity be much that is tentative and imperfect. Differences of opinion regarding the main stages in the development, regarding the particular content of any one stage, are quite compatible with adhesion to the general principle of the whole.[5] But from this point of view only can justice be done to those forms of thought which have always been regarded as the special material of logical treatment; from any other, the treatment must be partial, fragmentary, and, so to speak, external. Thus, notion, judgment, and syllogism are not, in this view, treated as merely subjective modes in which the individual consciousness apprehends and works up the material of experience, but as higher, more developed, and therefore richer forms of the determinations of thought in and through which intelligibility of experience is acquired. The whole system of these determinations of thought, the categories, is the matter of logic; the realization of them in subjective experience, or the treatment of the successive phases of consciousness in which abstract thought comes to be recognized in and by the individual, is the matter of the philosophy of spirit, of which psychology is one portion. Doubtless the logical treatment may be led up to by tracing the modes in which the full consciousness of the determinations of thought as the essence of reality is attained, but such introduction is propædeutic merely, and within the logical system itself the starting-point must be the simplest, least definite of those categories whereby for spirit the realm of fact becomes intelligible.

The nature of the opposition between this view and that of the ordinary logic, which in the main rests upon the principle of individualist psychology, that the content of knowledge is derived *ab extra*, from an entirely foreign world of fact, will become more clear if there be considered specially the treatment which under the two methods is given to the notion. Notions, in ordinary logic, are regarded as products formed from the data supplied by presentative and representative experience, and the mode of formation as generally conceived is a continuous process of critical comparison, recognition of differences, similarities, and grouping of like facts. Not only, then, does the notion present itself as relatively poor and meagre in content, a kind of attenuated individual, not only are the only characteristics presented to the operation of thought mechanical and external, but the final product appears as a mere subjective abbreviation of what is given in experience. In the process, however, even as it is ordinarily conceived, there is more involved than is apparent on the surface. The individuals subjected to the abstracting and generalizing activity of thought are *qualified* individuals, *i. e.*, individuals viewed as determined in their own nature and in respect of thought by a whole network of relations, which when stated abstractly are really of the nature of categories. They are individuals only for a unifying intelligence which views them under diverse aspects, and these aspects are the blank forms of intelligibility, which it is the very function of logic to consider in system. Moreover, the purely formal acceptation of the notion as a mere mental hieroglyphic or sign stands in sharp contradiction to the view which as a rule accompanies it, and which, for the most part, receives explicit statement in a so-called applied logic or doctrine of method, that in the notion is contained the representation of the essence or truth of reality. It is impossible to retain with any consistency the merely arithmetical or numerical doctrine of the notion, as containing fewer marks than the individual, of the genus as characterized by a less number of attributes than the species, and so on. Underlying all genuine knowledge, all classification, and therefore all formation of notions, is the tendency towards the subordination of parts to a law which determines them. The generic attributes are not simply the points of agreement, but the determining characteristics, and the notion of a thing is the explicit recognition of its nature as a particular manifestation of a universal law.

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[1] Perhaps the most complete treatment of logic from this point of view is that of George, *Logik als Wissenschaftslehre*, 1868. Ueberweg, dissenting from Schleiermacher's view of syllogism and the systematic processes of reasoning, lays out more fully what in his view are the aspects of reality corresponding to the typical forms of knowedge. Trendelenburg endeavors to fill up the gap between real and ideal by emphasizing the community of character between motion, as the ultimate reality, and constructiveness in knowledge, the central activity of the ideal.

[2] Thus we find in Schleiermacher (*Dial.*, §§ 132-34) that the ultimate difference of ideal and real is accepted as simple datum. In Ueberweg (*Logik*, § 8 and *passim*) there is continuous reference to an inner order of things, the forms of which are the metaphysical categories, but the actual treatment is altogether independent of these forms, and we may conjecture that, in the last resort, Ueberweg would have explained the characteristics of logical thinking by reference rather to the psychological mechanism than to a supposed nature of things (see *Logik*, §§ 40-42), and thus approximated to the position of Beneke rather than to that of Schleiermacher.

[3] This tendency, which appears in Schleiermacher and Ueberweg, and indeed in all the logics of that school (George's *Logik*, *e. g.*, is hardly to be distinguished from psychology), is prominent in Beneke. It is curious to note a precisely similar result in the logical theory of Mr. H. Spencer. Mr. Spencer supposes himself to be throughout referring to the nature of reality, but in fact all that is specific in the forms of reasoning developed by him is of psychological origin (see *Pr. of Psych.*, ii. §§ 302-9).

[4] Lotze's whole view of the genetic connection of the forms of thought is peculiar to himself, and deserves separate treatment.

[5] Hegel himself fully recognizes the tentative character of the numerous divisions and classification of the categories of thought which make up the substance of the *Logik*, and desires that too much stress be not laid on the formal side of his exposition (see *Logik*, i. 29).

Thus even within the limits of the ordinary logic there are problems which force upon it the reconsideration of the view which regards the notion as merely a mechanically formed psychical fact. Knowledge, no doubt, is only realized subjectively, in and through psychical facts, but the treatment of it in its nature as knowledge and the treatment of its psychical aspect are *toto genere* distinct. The metaphysical doctrine which keeps consistently in view thought as the essence of knowledge in its own nature has therefore to contemplate the notion in strictest relation to thought, as one mode in which objectivity as such is apprehended; made intelligible, and, in a very special sense, as the mode in which the nature of thought is made explicit. Thus the notion can only appear as uniting and comprehending under a new aspect these intellectual determinations whereby things are related to one another in a cognizable system.

The special characteristic of the Hegelian logic, the methodical principle of development of the determinations of thought, requires for its full elucidation a longer treatment than is compatible with the scope of a general sketch. But it seems necessary to add a word respecting certain difficulties or objections which apply, not specially to the methodical principle of Hegel's logic, but generally to the idea of a logic which is at the same time metaphysic or a treatment of ultimate notions. These objections may be variously put, according to the special point of view assumed by the critic, but they are in the long run dependent on one mode of interpretation of the fundamental antithesis between being, or reality, and thought. For whether we say that it is confusion to identify thought-forms with relations of fact, that it is unphilosophical to assume that being of necessity conforms to thought, that thought is purely subjective and knowledge the system of forms in and through which the subjective is brought after its own nature to an adequate representation of objective fact, or point to phenomena of perception as showing that even adequate correspondence, not to speak of identity, between subjective and objective must be matter of discussion, or lay stress upon the procedure of science as negativing the preliminary assumption of the logico-metaphysical assumption, we but express in varied ways a fundamental interpretation of the opposition between reality and knowledge. We assume an initial distinction, the grounds and precise nature of which are never made clear. For the antithesis between thought and reality is an antithesis in and by means of conscious experience, and is not to be comprehended save through conscious experience. If, indeed, we start with conscious experience as a mechanically formed *tertium quid*, something which arises out of the correlation of an unknown subject and an unknown object, we may certainly retain, as an ever-recurring and insoluble problem, the possibility of cognizing either factor *per se*. But the problem arises not from the antithesis but from our way of reading or interpreting it. Opposition between subjective thinking and the real world of fact, slow, tentative, and imperfect development in individual consciousness of knowledge which contains in essential relation the opposed elements, distinction therefore of the metaphysical or real categories which determine the nature of object as knowable from the ideal or logical categories which express more specifically the fashion in which the knowable object is reduced to the subjective form of cognition, are not only perfectly compatible with, but are strictly reasoned conclusions from, the ultimate doctrine that in thought alone is to be found the secret both of knowing and of being. To bring against this doctrine the continuous complaint that it assumes an identity which, if it can be proved at all, at least demands proof, is to misunderstand the very notion of identity which plays so important a part in the objection. Not even in the most judicious and thoughtful critics of metaphysical logic, in Lotze for example,[1] does one find a sufficiently careful distinction between a mere question of nomenclature (*i. e.*, whether we shall restrict the title *logic* to the portion of general system which deals with notions, judgments, and syllogism, while reserving for metaphysics all the other inquiries) and the question of theoretical importance, whether there remains over and above the difference between the more immediate determinations of thought and its more complex or reflective modes an essential difference in knowledge between thought and reality. In less careful critics the oversight simply leads to the contention that we shall always repeat the problem of knowing and being as insoluble, and shall view knowledge as a mechanical, subjective product.

Many of these objections doubtless result from a very simple fact, more than once alluded to in this article. Particular distinctions, apparently the most elementary, frequently involve and are unintelligible apart from a developed, though not necessarily consistent or well grounded, conception of things in general. Thus the emphasis laid upon thought as essentially subjective, as being merely the system of operations whereby the individual brings into order and coherence in his own experience what is furnished *ab extra* through the natural connection in which he is placed to the objective world, seems at first sight the most simple and direct consequence of the actually given distinction between the individual as one natural unit and the sum of things comprehending him and all others. But, on analyzing more closely the title for applying to philosophical problems a view which is that of practical life, and doubtless legitimate and necessary within that sphere, we readily become aware of a whole series of speculative assumptions implicit in that view, and possibly without any adequate justification. At all events, whether or not the view be ultimately defensible, and in the same form in which it is at first assumed, it is unphilosophical to start in the treatment of a difficult and important discussion from principles so ambiguous and undetermined. The practical difference between the individual agent and the external sphere within which his individual operations are realized, and which is therefore treated by him, from his point of view, as external, throws no light *per se* on the nature of the ultimate relation between the individual thinker as such and the world within which his thought is exercised. The confusion between ultimate distinctions and practical points of view is productive of most pernicious consequences not only in logic specially but in philosophy at large.

Criticism of the Chief Logical Schools.

31. It will probably be now apparent that determination of the nature, province, and method of logic is, and has always been, dependent on the conception formed as to the nature of knowledge. Discussions regarding the precise definitions of logic are not mere analytical disputes regarding the best mode of expressing in terms the nature of a subject sufficiently agreed upon; variations in the treatment of particular portions of logical discipline do not arise from more or less accurate discrimination of the nature and relations of given material; nor are differences in respect to the amount of logical matter to be considered mere expressions of difference as to the range of the same fundamental principles. The grounds for divergence are much more deeply seated, and, looking back upon the historical survey of the main conceptions of logical science, it seems quite impossible to hope that by comparison and selection certain common points of view or methods may be extracted, to which the title of logical might beyond dispute be applied. The logic, as one may call it, of each philosophical theory of knowledge is an integral part or necessary consequence of such theory; and its validity, whether in whole or in part, depends upon the completeness and coherence of the explanation of knowledge in general which forms

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[1] See his *Logik* (1843), pp. 10, 11, and *Logik* (1874), bk. iii, chaps 4, 5.

the essence of that theory. Any criticism of a general conception of logic, or special application thereof, which does not rest upon criticism of the theory of knowledge implied in it must be inept and useless. It is not possible to include such expanded criticism in an article like the present; there remains therefore only one aspect of these various logical schemes which may be subjected to special and isolated examination, viz., the inner coherence of each scheme as presented by its author. Naturally such an examination can be applied only to views which imply the separate existence of logic as a body of doctrine developing into system from its own peculiar principles. When it is a fundamental position that logic as such has no separate existence, but is one with the all-comprehensive doctrine or theory of the ultimate nature of cognition, it is not possible to criticise such conception of logic separately; criticism of logic then becomes criticism of the whole philosophical system. In most of the views brought before us, however, a special place has been assigned to logic; it is therefore possible to apply internal criticism to the more important of these general views, and to consider how far the pretensions of logic to an independent position and method are substantiated.

From the foregoing remarks it will also have become apparent that a general classification of logical schools, as opposed to the reference of these to ultimate distinctions of philosophical theory, is impossible. A distribution into formal (subjective), real (empirical, or, as certain German authorities designate it, *Erkenntnisstheoretisch*), and metaphysical conceptions of logic is rather confusing than helpful. For the formal logics of the Kantian writers, of Hamilton and of Mansel, are distinct, not only from one another, but from such equally formal logics as those of Hobbes, Condillac, Leibnitz, Herbart, Ulrici, Boole, De Morgan, and Jevons. Logic as theory of knowledge presents quite special features when handled by Mill, or by Schleiermacher, Ueberweg. Beneke, and Wundt. And it cannot even be admitted that the threefold classification affords room, without violence, for the Aristotelian logical researches. There are no points of agreement and difference so unambiguous that by their aid a division can be effected.[1]

32. Few conceptions of logic contain, with so little real ground, such professions of completeness and independence as that developed in the writings of the Kantian school.[2] According to this view, logic is a pure science, having as its special material the form of thought, demonstrative in character and with theorems capable of complete deduction from the elementary principles contained in the very notion of form as opposed to matter of thought. But when one comes to the examination of the system itself, one finds (*a*) that the notions of form and matter are much too stubborn to lend themselves readily to analysis, and that explanations of what exactly constitutes form fluctuate between a merely negative definition (whatever is not treated in any other science, philosophical or otherwise) and a psychological deduction from the assumed nature of thought;[3] (*b*) that the really important factor in determining the contents of logical science is psychology, from which much more is borrowed than the mere preliminary definition of thought; (*c*) that demonstrative character rests entirely on an abstract interpretation of the laws of identity and non-contradiction; (*d*) that throughout the whole system there is not a trace of development, but merely the reiterated application of the law of identity and contradiction, or of some confused distinction between form and matter, to logical products, the notion, judgment, and syllogism, whose nature, characteristics, and distribution are arbitrarily excepted from psychology or general criticism or what not. Thus, in the majority of cases, logicians who simply followed the lines indicated by Kant introduced into their system, without any criticism, the fundamenal distinctions contained in the *Kritik d. reinen Vernunft*. The fourfold scheme of quantity, quality, relation and modality was applied without hesitation, though in varied and always artificial fashion, to notions;[4] judgments were accepted as being categorical, hypothetical, and disjunctive in kind, though the differences are altogether foreign to the logical principle applied; and generally no attempt was made to do more than treat in an abstract fashion some aspects of a procedure of thought determined in all its phases by extra-logical considerations. The inevitable result of such a treatment was the undue preponderance given to the doctrine of notions, which, being viewed after the fashion of Kant as given, completed products, appeared as the ultimate units of thought, to be combined, separated, and grouped together in all the higher processes. The peculiarities of the logical system which is commonly associated with the name of Sir W. Hamilton spring entirely from this view of notions. For, if notions be regarded as the elements of thought, then the judgment which elaborates them can only present itself as the explicit statement of immediate relations discernible among notions. These immediate relations reduce themselves, for Hamilton, to one,—the quantitative relation of whole and part,—and, attention being concentrated on the extensive reference of concepts, the eightfold scheme of propositional forms is the natural consequence. To such a scheme the objections are manifold. It is neither coherent in itself, nor expressive of the nature of thinking, nor deduced truly from the general principle of the Hamiltonian logic. For it ought to have been kept in mind that extension is but an aspect of the notion, not a separable fact upon which the logical processes of elaboration are to be directed. It is, moreover, sufficiently clear that the relation of whole and part is far from exhausting or even adequately representing the relations in which things become for intelligence matters of cognition, and it is further evident that the procedure by which types of judgment are distinguished according to the total or partial reference to extension contained in them assumes a stage and amount of knowledge which is really the completed result of cognition, not that with which it starts, or by which it proceeds.[5]

The utility of basing logical theorems on psychological premisses, a method involved in the procedure of most expositions of formal logic, may well be matter of doubt. For psychology, as ordinarily conceived, has certainly close relations with logic, but in aim and in point of view is distinctly opposed or at all events subordinate to it. The psychological investigation of thought, if carried out consistently, must take one of two forms, either that of description, in which thought, like any other mental fact, is regarded *ab extra* as that upon which attention and observation are to be directed,—in which case therefore any relations of thoughts among themselves must be of such an external nature as can be presented in the field of observation; or that of genesis, development, in which the subjective processes of mind are viewed as forms of the one great process whereby knowledge is realized in the individual consciousness. Investigations from the first point of view are diametrically opposed to the logical treatment of thought, for in the latter the essential feature, the reference in the subject, with his mental forms, to an objective order within his experience is entirely wanting. Such investigation is abstract; it proceeds upon and remains within the limits of a distinction drawn in and for conscious experience, a distinction the grounds, significance, and modes of which require to be treated by a larger and more comprehensive method. Investigations from the second point of view are subordinate to logic in the wider sense, for the treatment of the subjective processes therein is illuminated and determined by the general principles regarding the nature and meaning of conscious experience which it is the sole function of logic to bring forward and establish. The psychology which Hamilton generally has in view is that commonly called empirical, and with his conception of it the two sciences, logic and psychology, are really one.

33. A possible exit from the difficulties or assumptions of the current Kantian logic may be sought by following out and consistently applying the hint contained in Kant's distinction of analytic and synthetic thought, analytic and synthetic truth. It may be said that all thinking involves the fundamental laws of identity and non-contradiction; that in these laws only is to be found the characteristic and most general feature of thought; that in them only is the form, or element contributed by mind itself, to be detected. Logic would thus be regarded as the explicit statement of the conditions of non-contradictoriness in thought, as the evolution of the formal element in thought, and, since in analytic truth only can non-contradictoriness be discovered without material aid, as the theory of analytic

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[1] Nor are more detailed classifications, such as those of Rosenkranz (*Die Modificationen der Logik*, 1842), Prantl (*Die Bedeutung der Logik*, 1849), Rabus (*Neueste Bestrebungen*, 1880), of service, except when historical.

[2] Under this head Kant himself, for reasons above given, is not included; the writers referred to are named in Ueberweg (*Logik*, § 34).

[3] Mill's criticism on Hamilton's confused statements regarding forms (*Exam. of Hamilton*, 438–454), is perfectly applicable to the generality of the Kantian treatises on logic.

[4] See, *e. g.*, Krug, *Logik*, § 25 *sq. v.*

[5] The extension of a notion has no numerical or quantitative definiteness. To formulate the judgment as expressing definite amounts of extension, therefore, presupposes complete empirical survey of what, by its very essence, remains incomplete. This is specially noteworthy in the case of Hamilton's particular judgments. A judgment such as *only some A is all B* assumes total and perfect knowledge of the whole spheres of A and B. It is in the strictest sense of the word *universal*. Hamilton, it may be added, finds it completely impossible to work out a coherent doctrine of syllogism from the point of view taken in the treatment of the judgment.

thought. Such is the position assigned to logic by Tweston, Mansel, Spalding, and some others, and the consequences to which it inevitably leads are sufficiently interesting to require that some special examination should be given to it.

In the first place, then, it seems evident that the fundamental distinction implied, that between analytic and synthetic thought, is wrongly conceived. That analysis and synthesis are methods of cognition, differing in many important respects, is undoubted; but such difference lies in a sphere altogether alien to that within which the present distinction is to be sought. Analytic thought, as here conceived, is only to be understood when taken in reference to the judgment, and then also in reference to a peculiarity in the Kantian doctrine. Kant, emphasizing the principle that judgment is essentially the form in which the particular of experience is determined by the universal element of thought, but identifying this universal with a formed concept (resembling, therefore, a class notion), contemplated a class of judgments in which the predicate was merely an explication of the subject notion. Such judgments, had the matter been more fully considered, would have appeared as far from primary, and Kant has himself, in the most unambiguous language, indicated the correct view that analysis is consequent and dependent on synthesis,—that analytic judgments, therefore, are merely special applications of abstracting thought within a sphere already treated, handled, formed by thought. Mansel, too, whose views are generally acute if not profound, has signalized as the primitive unit of cognition the so-called psychological judgment, which is essentially synthetic in character. The logical judgment, in fact, about which his conception of logic centres, is recognized as a posterior act of reflection, directed upon formed notions, and is not in any way to be regarded as containing what is a common, universal feature of all judgments.

In the second place, even granting what cannot be maintained, that the process of thought is mere explication of the content of previous knowledge, and that the theory of logic has to do with a comparatively small and subordinate portion of cognition, there is in such a principle no means of development. We may take up in succession class-notions, judgments, reasonings, and in relation to each reiterate, as the one axiom of logic, that the constituent elements shall be non-contradictory; but such a treatment is only possible in relation to a material already formed and organized. The utmost possible value being given to such a view, logic, under it, could be but a partial and inchoate doctrine.

Finally, there is involved in the doctrine of analytic thought, and in the consequences to which attention will next be drawn, a peculiar and one-sided conception of identity or of the principle of identity as an element in thought. Historically this conception has played a most important part: it lies at the root of all nominalist logic from Antisthenes downwards, and has found metaphysical expression of the most diverse kinds. *That things are what they are* is the odd fashion in which a well-nigh forgotten English writer states what is taken to be the universal foundation of all thought and knowledge.[1] The representatives of things in our subjective experience, the units of knowledge, may be called notions, and, accordingly, that each notion should be what it is appears as the corresponding logical axiom. The whole process of thought is therefore regarded as merely the explicit statement of what each notion is, and the separation of it by direct or indirect methods from all that it is not. The judgment, essentially the active movement of thought, is reduced to the mere expression of the identity of a notion, and in truth, were the doctrine consistently carried out, Antisthenes's conclusion that the judgment is a fallacious and inept form of thought would be the necessary result. When such a conclusion is not drawn, its place is generally taken by much vague declamation regarding the limited, imperfect, and uncertain character of our knowledge, which is regarded as asymptotically approaching to the adequate determination of truth.

The conception which underlies this view is the abstract separation of thought from things which has been already noted, but the proximate principle is a deduction therefrom. Knowledge or thought is treated externally as a series of isolated units or parts, and the results of cognition —notions, judgments, and reasonings—are viewed as the constituent factors. Thus, *e.g.*, when it is said that a judgment is the expression of an identity, there are possible only two modes of explanation,—the one, that the identity referred to is that between the original notion (subject) as unqualified by its predicates and the same as qualified, in which case manifestly the result of the judgment is taken as being its constituent essence; the other, that the identity is that of the applicability of distinct names to the same fact, in which case we accept without further inquiry and exclude from logical consideration the processes of thought by which the application of names is brought about, and assume as being the procedure of thought itself that which is its consequence. Under all circumstances, difference is as important an element as identity in the judgment, and to concentrate attention upon the identity is to take a one-sided and imperfect view.[2]

34. So soon, however, as the real nature of thought has been thrown out of account as not concerned in the processes of logic, so soon as the law of non-contradiction, in its manifold statement, has been formulated as the one principle of logical or formal thinking, there appears the possibility of evolving an exact system of the conditions of non-contradictoriness. The ultimate units of knowledge, whatsoever we call them, whether notions or ideas of classes or names, have at least one characteristic,—they are what they are, and therefore exclude from themselves whatever is contradictory of their nature. They are combined positions and negations, that which is posited or negated being left undetermined,—referred, in fact, to matter as opposed to form. With respect to any article of thought, therefore, the only logical requirement is that it shall possess the characteristic of not being self-contradictory, and the only logical question is, what exactly is posited and negated thereby. Complex articles of thought viewed in like manner as complexes of positions and negations may have the same condition demanded of them and the same question put regarding them. A judgment and a syllogism, if narrowly investigated, will appear to be merely complex articles of thought, complexes of positions and negations. Proceeding from such a conception there may be treatments more or less systematic and fruitful. In the hands of Kantian logicians, such as Tweston, Mansel, Spalding, and the like, little is effected, for, as the forms of thought are accepted as given and as having their characteristics otherwise fixed (by psychology or critical theory of knowledge), the treatment resolves itself either into repetition, in respect to each, of the fundamental logical condition, or into the erection of a specific kind of thought (analytical) which has no other feature save that of correspondence with the said condition. But it is clear that restriction by any psychological or critical doctrine of thought is an arbitrary limitation. It is needful only to regard the operation of thought as establishment of positions and negations, and to develop, by whatever method, the systematic results of such a view. Hobbes's doctrine of thought as dealing with names and as essentially addition and subtraction of namable features, Boole's doctrine of thought as the determination of a class, Jevons's view of thought as simple apprehension of qualities,—any of these will serve as starting-point, for in all of them the fruitful element is the same. The further step that the generalization of the system of thought must take a symbolic form presents itself as an immediate and natural consequence.

35. By the application of a symbolic method is not to be understood what has been practised by many writers on logic—the illustration of elementary logical relations by numerical or algebraic signs or by diagrammatic schemata. The expression has the signification which it bears in mathematical analysis, and implies that the general relations of dependence among objects of thought, of whatsoever kind, in correspondence with which operations of perfectly general character are carried out, shall be represented by symbols, the laws of which are determined by the nature of these relations or by the laws of the corresponding operations. The mere use of abbreviations for the objects of treatment is not the application of a symbolic method;[3] but so soon as the general relations of, or general operations with, these objects are represented by symbols, and the laws of such symbols stated as deductions therefrom, there arises the possibility of a symbolic development or method of treatment, which may lead to more or less expanded results according as the significance of the sym-

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[1] John Sergeant. See *The Method to Science*, by J. S., 8vo, Lond., 1696, pp. 144, 145. This curious book contains much interesting matter.

[2] On Condillac's attempt to treat judgments as identities (or equations) some excellent remarks will be found in De Tracy, *Idéologie*, iii. 133–143, *cf.* Duhamel, *Des Méthodes*, i. 89–94.

[3] Thus one would not describe Aristotle's use of letters for the terms of his syllogisms, nor the current logical abbreviations of S, P, and M in like case, as being, in any true sense of the word, symbolic. On the subject generally, the instructive work of Mr. Venn (*Symbolic Logic*, 1881) should be consulted. Mr. Venn has not only in this work expounded the foundations and main theorems of Boole's logic with a care and skill that leave nothing to be desired, but he has, independently of many real contributions to logical analysis, put in its true light the nature of symbolic method in logic. He has rendered it impossible, even for the outsider, to complain that symbolic logic is an arbitrary application of mathematical method to logical material.

bolic laws is more or less general. Thus quantity, whether discrete or continuous, presents, as an aspect of phenomena, relations of a highly general kind, offers itself as object of operations of a highly general kind, and is therefore peculiarly the subject of symbolic treatment. Currently, indeed, the treatment of quantity is assumed to have the monopoly of symbolism, but such an assumption is not self-evidently true, and it is permissible to inquire whether matters non-quantitative do not present relations of such generality that they, too, can be symbolically dealt with. It is, however, a further question whether the generality of the relations and therefore the significance of the symbols in such cases, although subject to some special conditions not necessarily involved in the nature of quantity, do not spring from the fact that we treat the matters as quantities of a special kind, and so insensibly find ourselves applying quantitative methods. In other words, it remains to be investigated, after the preliminary definitions and axioms of any symbolic method have been laid down, whether the conception of thought with which we start, or a special feature distinctly quantitative in character, has been the truly fruitful element in after-development of the system.[1]

The first step in any symbolic logic must evidently be the determination of the nature and laws of the symbols, and, as these follow from the nature of the operations of thought, the first step is likewise a statement of the essential characteristic of thinking. As above noted, there have been adopted various modes of expressing this characteristic, and in some cases the mode adopted is not one from which any generally applicable symbolic rules of procedure could have followed.[2] Two only require here to be noted, as representing special views: first, that which proceeds from the idea of thought as essentially the process of grouping, classing, determining a definite set of objects by a mark or notion; and second, that which proceeds more generally from the conception of thought as consisting of a series of self-identical units, to be variously combined in obedience to the law of self-identity.[3] Adopting the first view, we find that processes capable of symbolic representation, by the customary algebraic signs of addition, subtraction, equivalence, multiplication, and division, have a perfectly general significance in reference to the combination, separation, equalization of classes, to the imposition and removal of restriction on a class; that to the symbols there can therefore be assigned a set of general laws; and that any peculiarity of the symbolic laws which differentiates them from the laws of like symbols in mathematical analysis is deducible from the notion of thought with which we started, and is consequently to be carried along with them in all the after development. Symbolic representation of relations of classes follows with equal directness from the general notion that by any such relation a new group is determined in reference to the original groups, or rather that the position or negation of a new group (or series of groups) is given, definitely or indefinitely, as the result of such a relation.

With the aid of the symbolic laws so reached, the logical problem as such may then be approached. Given any number of logical terms (*i. e.*, classes, or, as it may be better put, positions and negations) connected together by any relations, to determine completely any one in reference to the others, or to express any one in terms of the others. The symbolic procedure, expounded with marvellous ingenuity and success by Boole, may take various forms, and may be simplified by many analytical devices, but consists essentially in determining systematically how given positions and negations, definite or indefinite, combine with or neutralize one another. A more detailed account of these formal processes is beyond our limits.[4]

The first question which suggests itself in connection with Boole's symbolic logic is the necessity or advisability of retaining the reference to classes, or the description of thought as classification. Do the symbolic laws really depend to any extent on the logical peculiarities of class arrangement? Mr. Venn, who emphasizes this feature in Boole's scheme, has, however, done good service in leading up to a different explanation. The general reference to objects, which is also noted as implied in all Boole's formulæ, has nothing to do with the possible difference of conceptualist or materialist doctrines of the proposition, and, in fact, as all distinctions of thing and quality, resemblance and difference, higher and lower, subject and predicate vanish, or are absorbed in the more general principle underlying the symbolic method, phrases such as classification, extension, intension, and the like should be banished as not pertinent. Nay, the usual distinctions of quantity and even of quality either disappear or acquire a new significance when they are brought under the scope of the new principle. "What symbolic logic works upon by preference is a system of dichotomy, of x and not x, y and not y, and so forth."[5] In other words, quantitative differences require to find expression through some combination of the positions and negations of the elements making up the objects dealt with,[6] while the usual qualitative distinctions are merged in the position or negation of various combinations.

The whole phraseology then of classification and its allied processes seems needless when used to denote the simple determination of objects thought. The literal signs express, not "classes," but units, determined in and for thought as self-identical. For this reason then it appears that the view of the foundations of the symbolic methods of logic taken in Grassmann's *Begriffslehre* is more thoroughgoing, and more closely represents the underlying principles, than that involved in Boole's formulæ and expounded in detail by Mr. Venn.

Grassmann, as above stated, deduces logical relations as a particular class of the determinations necessarily attaching to all quantities (*i. e.*, determined contents of thought). Abstraction being made of all peculiarities which may be due to their special constitution, quantities exhibit certain formal relations when they are combined (added, subtracted, etc.). Each quantity is a unit of thought, a definite *positum*, and of such units there are but two classes, elements and complexes. Units of thought, which are self-identical, and therefore subject to the specific law that addition of each to itself or multiplication of it by itself yields as result only the original unit, are notions. The theory of notions, therefore, is the development of the general formal relations of units under the special restrictions imposed by their nature.[7]

There appears very clearly in Grassmann's treatment the essence of the principle on which symbolic logic proceeds. Thought is viewed as simply the process of positing and negating definite contents or units, and the operations of logic become methods for rendering explicit that which is in each case posited or negated. To apply symbolic methods, we require units as definite as those of quantitative science, and the only laws we can employ are those which spring from the nature of units as definite. Now it seems a profound error to reduce the whole complex process of thinking to this reiterated position of self-identical units. Undoubtedly if we start from any given fact of thought, as, *e. g.*, a judgment, and inquire what can be exhibited as involved in it, we have before us a problem of analysis, the solution of which must take form in a series of positions and negations, but our thinking is not therefore as a whole mere analysis. The synthetic process by which connections of thought among the objects of our conscious experience are established is not the mechanical aggregation of elementary parts. The relations which give intelligible significance to our experience are not simply those of identity and non-identity. It is an altogether abstract and external view of thought, resting in all probability on an obscure metaphysical principle,[8] that would treat it as in essence the composition and decomposition of elementary atoms, of πρῶτα, as Antisthenes would have called them. It has, indeed, been imagined that a symbolic logic might be developed which should be independent in all its fundamental axioms of any metaphysical or psychological assumptions, but this is an illusion. No logical method can be developed save from a most definite conception of the essential nature and *modus operandi* of thinking, and any system of symbolic logic finds it necessary, if it is to be complete and consistent, to adopt some such view as that above criticised, to regard thought as purely analytic, as dealing with compounds or units which are themselves highly complex products, only to be formed by a kind of thought not recognized among logical processes.[9]

36. Formal logic, then, in the ordinary acceptation of

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[1] An excellent note on symbolic logic will be found in Lotze, *Logik* (2d ed., 1880), pp. 256–59.

[2] Some of these, as, *e. g.*, Lambert's and Ploucquet's are noted and discussed by Mr. Venn (*Symbolic Logic*, xxxii.-xxxvi. and *passim*).

[3] The first is the view taken by Boole (and expounded with great fulness in Venn, as above); the second is that of the brothers Grassmann (in the *Formenlehre*, 1872, especially bk. ii., *Die Begriffslehre oder Logik*).

[4] Mr. Venn's work is here again invaluable. Jevons's *Principles of Science* and *Studies in Deductive Logic* should be consulted. Schröder's *Operationskreis des Logikkalculs* contains some very elegant and simple methods.

[5] Venn, as above, p. 162.

[6] Where this is impossible, as in the case of the truly particular or indeterminate judgment, symbolic methods encounter almost insurmountable difficulties.

[7] See *Die Begriffslehre oder Logik* (1872), p. 43. Schröder (*op. cit.*) follows Grassmann, though with the use of *class* phraseology.

[8] As above noted, p. 808.

[9] The same fact has been noted in regard to formal logic of the Kantian school, as *e. g.*, in Mansel's distinction of psychological and logical judgments.

that term, does not appear to furnish any adequate representation of the real process and method of thought. Any logical theory must of necessity be formal, *i. e.*, abstract or general, for it can consider only the general elements of thought, not specific knowledge in which are involved the finite, limited relations of one fact or class of facts to another. The distinction between logic and the sciences is therefore precisely that between philosophy in general and the sciences. Attempts have been made to include in logical analysis the treatment of scientific method, *i. e.*, to discuss as matter of logic the varied processes by which scientific results have been attained. It is true that logical consideration must extend to the notions through which scientific experience, like any other, becomes intelligible, and, in so far as scientific method is but the application of the laws of knowledge as a whole, it is a possible, nay necessary, object of logical treatment. But to include scientific methodology in particular, the consideration of the mechanical devices by which we strive to bring experience into conformity with our ideal of cognition, the discussion of methods of experiment and observation, under the one head logic is an error in principle, whether we view logic in its theoretical aspect or in reference to a special propædeutic aim. Generalizations on such topics are well-nigh worthless; they can have vitality and importance only when drawn in closest conjunction with actual scientific work. The theory of scientific method is either doctrine of knowledge treated freely or else the application of thought in connection with actual research and the ascertainment of the principles therein employed. In either case it is not susceptible of abstraction and isolated treatment.

37. There remains only, of the possible views noted, that which identified logic with the theory of knowledge, but which so defined theory of knowledge as to distinguish it from metaphysics. The designation of logic as theory of knowledge is one to which in words there can be no possible objection. It brings into the foreground what it has been the object of this article, by an historico-critical survey, to establish, that so-called logical laws, forms, and problems are hardly capable of statement, certainly incapable of satisfactory treatment, except in the most intimate connection with the principles of a theory of knowledge. To include, however, in the signification of this latter term a peculiar conception of the relation between thinking (knowing) and reality is at once to restrict the scope of logic and to place an arbitrary and, one would say, an ill-founded restriction on the kind of treatment to which logical problems may be subjected. If it be really the function of logic to trace the forms and laws of knowledge, that function is all-comprehensive, and must embrace in its scope all the fundamental characteristics of experience as known. But no characteristic of experience is more palpable than the distinction, drawn within conscious experience, between knowledge and reality. It is impossible then for a theory of knowledge to start with the assumption that these two exist separately, constituted each after its special fashion, but with a certain parallelism between them. In words one may refer for justification of the assumption to metaphysics, or to psychology, but, in fact, the problem so relegated to some other discipline is essentially a logical question, and the method of its solution exactly that which must be applied in the treatment of subordinate logical questions. Practical convenience alone can lead to any separation of the problems which under this view are referred in part to theory of knowledge and in part to metaphysics. Other and more serious difficulties of the view have been already commented on.[1]

38. In sum, then, the problems and the methods which compose logic in the strictest sense of that term seem to be one with the problems and methods of the critical theory of knowledge. No other title describes so appropriately as that of "logical" the analysis of knowledge as such, its significance and constitution, in opposition to the quasi-historical or genetic account for which the title psychological should be retained. The researches to which we would here assign the title "logical" undoubtedly include all that can supply the place of the older metaphysic, but in aim and method are so distinct that the same title cannot be borne by both. To assign so extensive a range to logical investigations enables us to see that the criteria by which at one time or another a narrower province was determined for logic are but partial expressions of the whole truth. The analysis of knowledge as such, the complete theory of the intelligible elements in conscious experience, does hold a special relation to all other subordinate branches of human thinking, whether philosophic in the ordinary sense of that term or scientific. According as one or other aspect of this relation is made prominent, there comes forward one or other of the various modes for settling the province of logic; but these partial conceptions prove their inadequacy when development is attempted from them, and within the systems constructed in accordance with them there is of necessity continuous reference to inquiries lying beyond the prescribed limits.

A certain analysis of some methods of ordinary thinking, based to a very large extent on language, and resembling in many respects grammatical study, has long been current in educational practice as logic, and to those whose conception of the subject has been formed from acquaintance with this imperfect body of rules and formulæ it may appear a violent and unnecessary extension of the term to apply it to the all-comprehensive theory of knowledge. The reasons, however, are imperative; and, as these would lead one to deny the right of this elementary practical discipline to the possession of the title, it is desirable to conclude by offering a single remark on the place and function of this currently designated logic.

Not much trouble is required in order to see that the ordinary school or formal logic can lay no claim to scientific completeness. Its principles are imperfect, dubious, and most variously conceived; it possesses no method by which development from these principles is possible; it has no criterion by which to test, the adequacy of its abstract forms as representations of the laws of concrete thinking. Accordingly it is handled, in whole and in detail, in the most distractingly various fashion, and were it indeed entitled to the honorable designation of logic the prospects of that science might well be despaired of. But in fact the school logic discharges a function for which exhaustiveness of logical analysis is not a requisite. It has a *raison d'être* in the circumstance that training to abstract methods must needs be a graduated process, and that, whether as a means towards the prosecution of philosophic study in especial, or as instrument of general educational value, practice in dealing with abstract thoughts must have value. Such elementary practice naturally bases itself on the kinds of distinction apparent in the concrete thinking of those to whom it is applied, and for this reason school logic not only connects itself with and is in a sense the development of grammar and grammatical analysis and synthesis, but may, to a limited extent, include reference to some of the simpler processes of scientific method. In all probability the discord observable among the ordinary treatises on school logic is due to the want of recognition of the true place which can thus be assigned to the subject treated. The doctrine has a propædeutic but not a scientific value.

Note A.

Histories of Logic.—No complete history of logic, apart from philosophy in general, exists; but of the Aristotelian logic, in its system and in its development throughout the ancient and mediæval epochs, we possess a most adequate history in Prantl's *Geschichte der Logik im Abendlande* (i., 1855; ii., 1861; iii., 1867; iv., 1870), extending to the close of the mediæval period.

The following are some of the more important contributions towards a history of logic, whether in independent works or in portions of systematic treatises: most of them, indeed, of small value:—Ramus, *Scholæ Dialecticæ*, bk. i. chaps. 1–8; Keckermann, *Systemæ Logicæ*, 1598; Gassendi, *Opera*, i. 35–66; Fabricius, *Specimen elenchicum historiæ logicæ*, 1699; Walch, *Parerga Academica* (1721), pp. 453–848; Darjes, *Via ad Veritatem*, appendix, 1755; Buhle, in *Commentat. Soc. Gotting.*, vol. x.; Fülleborn, *Beiträge z. Gesch. d. Phil.* (1794), pt. iv. pp. 160–80; Eberstein, *Gesch. d. Logik u. Metaphysik bei den Deutschen von Leibnitz bis auf gegenwärtige Zeit* (2d ed., 1794), useful as a survey of the Wolffian logics; Calker, *Denklehre* (1822), pp. 12–198; Bachmann, *System der Logik* (1828), pp. 569–644; Mussmann, *De Logicæ ac Dialecticæ notione historica*, 1828; Troxler, *Logik* (1830), vol. iii.; Sigwart, *De historia logicæ inter Græcos usque ad Socratem*, 1832; St. Hilaire, *De la Logique d'Aristote* (1838), ii. pp. 93–312; Franck, *Esquisse d'une histoire de la logique*, 1838; Reiffenburg, *Principes de logique*, 1839 (with bibliography); Trendelenburg, *Gesch. d. Kategorienlehre*, 1846; Blakey, *History of Logic*, and *Essay on Logic* (2d ed., 1848), with bibliographical appendix; Hoffmann, *Grundzüge einer Geschichte der Begriff der Logik in Deutschland von Kant bis Baader*, 1851; K. Fischer, *Logik u. Metaphysik* (2d ed., 1865), pp. 16–182, a valuable critique of some modern doctrines; Rabus, *Logik und Metaphysik* (1868), i. pp. 123–242, excellent; Ueberweg, *System der Logik* (4th ed., 1874), pp. 15–66, excellent critical account; Ragnisco, *Storia critica delle Kategorie*, 1871, 2 vols.; Rabus, *Die neuesten Bestrebungen auf dem Gebiete der Logik bei den Deutschen*, 1880: Harms, *Geschichte der Logik*, 1881; Venn, *Symbolic Logic*, 1881 (introduction, and pp. 405–444), a valuable contribution to the history and bibliography of the application of symbolic methods in logic. The only good bibliography of logic is that given by Rabus in his *Logik u. Metaphysik*, i. pp. 453–518. Some of the older lexicons, *e. g.*, Lipenius, *Bibliotheca Realis* (1685), *s. vv.* "Logica," "Organon," "Dialectica," contain great store of bibliographical references. A complete bibliography is a desideratum.

Note B.

Hindu Systems of Logic.—In almost all the Hindu systems of philosophy, as these are classified by the most recent authorities, indications are to be found of a more or less developed analysis of the process or method of reasoning, and therefore of a certain amount of logical theory. In two systems in particular the logical element is the most prominent feature. The *Nyâya*, or logical doctrine of Gotama, is in a very special sense the Hindu logic, while in the *Vaiseschika*, or Atomist system of Kanada, there are many expansions of or additions to the *Nyâya*, though the prevailing interest is not logical.

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[1] Above, p. 805.

The most accessible sources of information regarding the Hindu logic, Colebrooke's *Essays*, and Professor M. Müller's abstract (in the appendix to Archbishop Thomson's *Laws of Thought*), tend to mingle in an undesirable fashion what is special to the Nyâya doctrine, and what is added by Kanada and his followers. In order to appreciate the extent to which the analysis of reasoning has been carried in these early systems, it is advisable to restrict attention to the original exposition of the *Nyâya*.

The aim of Nyâya is the attainment of perfection, of bliss, through knowledge. But, to have knowledge in a systematic and complete fashion, it is requisite that the individual should know (or should be capable of organizing his knowledge in reference to) the sixteen great topics or heads of discussion. These, as enumerated by Gotama, are (1) proof; (2) the objects of proof; (3) doubt; (4) motive; (5) the illustration or example for discussion; (6) the final assertion; (7) the enumeration of the five members of the final assertion; (8) confirmatory argument; (9) the conclusion, the defined judgment; (10) the objection; (11) controversy; (12) deceptive counter argument; (13) apparent reason or sophism; (14) fraud or wilfully deceptive argument, ruse; (15) futile argument or self-contradictory counter argument; (16) conclusive refutation. Inspection of these at once shows that they represent stages in dialectic or in the process of clearing up knowledge by discussion. The generalia, *i.e.*, the kinds of proof, described as four in number—sense-perception, inference (either from cause to effect, from effect to cause, or from community of nature, *i.e.*, in a wide sense, analogy), comparison (analogy in stricter significance), tradition,—and the things about which proof may be exercised, under which a twelvefold division is given by Gotama, and enlarged in endless detail by his commentators, who introduce thereunder much of Kanada's system, are first laid down as the basis for the whole. Then follows (Nos. 3–6) the progress from doubt, which first calls for reasoning or proof, through motive, to position of the problem in the form of an example or case, and to the general assertion, as having valid grounds. The analysis of the grounds of assertion is then given, and here we have what corresponds more particularly to the syllogism as known to us. Five members are signalized:—(1) the thesis or proposition to be proved; (2) the reason, or intermediate ground by which the subject of the proposition is linked on to an explanatory principle; (3) the explanatory principle; (4) the application of this explanatory principle; (5) the statement of the conclusion as following from the application. Thus, in the example usually given—(1) *thesis*, this mountain is fiery; (2) *intermediate ground*, because it smokes; (3) *explanatory principle*, whatever smokes is fiery, as, for instance, a hearth; (4) *application*, therefore this mountain is fiery; (5) *statement of conclusion*, the mountain, then, is fiery, because it smokes. There can be no doubt that in this somewhat unsystematic arrangement we have the outlines of syllogistic argument. Considerable obscurity, however, rests over the third member, and it is only partially cleared up when we proceed to the next topic, which may perhaps be translated confirmatory argument. Here the essence of the argument appears to be a regress from the known mark to the fundamental quality from which it follows. Thus, *e.g.*, if it were said *the mountain is not fiery*, then the argument would be adduced, but *the mountain smokes*, and what is not fiery does not smoke. Apparently there is involved the assumption that the mark is a necessary consequence of the primary quality, but the exposition is obscure, and, doubtless, connects itself with the principles of causal connection recognized by Hindu thinkers. (See Williams, as below, pp. 73–4).

When the conclusion has thus been confirmed, when the negation of the ground has been shown to fail in explaining the observed fact, the thesis may be stated in an absolute and definitive form (topic 9). The remaining seven topics are then concerned with the discussion which may arise when an opponent brings forward objections to the conclusion. This he must do by positing his antithesis (10), whereupon issue may be joined (11). Should the adversary be unable to establish his antithesis, he may resort to deceit, bringing forward arguments, illogically arranged and devoid of force (12), which soon leads to the employment of sophisms (13) or merely apparent arguments, and even to deceitful ruses (14). Under these topics the *Nyâya* signalizes and discusses various well-known forms of fallacy. The destruction of all these fallacious arguments reduces the opponent to the employment of futile, irrelevant responses, which undermine his own position (15), and the exposure of which completes his discomfiture and reduces him to silence (16).

Expositions of this dialectic system are not yet available in such kind and amount as would enable one to do full justice to it. Evidently much patience and a very considerable knowledge of the current philosophical view would be requisite in order to appreciate at their true worth many apparently formal, and in some cases dubious, divisions. Of accounts which may be consulted the following seem the more important:—Colebrooke's *Essays on the Religion and Philosophy of the Hindus*, from which the expositions in Ritter (*Ges. d. Phil.*, iv. 382 *sq.*), Hegel (*Werke*, xiii. 161–167), and Cousin (*Histoire Générale*, Leçon ii.) are taken; Ward's *Account of the History, Literature, and Religion of the Hindoos* (4 vols. 1811; later editions, with title altered, in 1815, 1817, 1821); Windischmann, *Philosophie im Fortgang der Weltgeschichte* (1834), specially pp. 1895–1920; M. Müller, appendix to Thomson's *Laws of Thought*; Rosenkranz, *Die Modificationen der Logik* (1846), pp. 184–97; Williams, *Indian Wisdom*, pp. 71–88; St. Hilaire, articles "Indiens," "Gotama," "Nyâya," "Kanada," in the *Dictionnaire Philosophique*, and translation, with commentary, of part of Gotama's "Sûtras," in the *Mémoires de l'Académie des Sciences Morales et Politiques*, tom. iii.

Note C.

Ramus.—The logical theories of Ramus acquired for a brief period a factitious importance from their connection with the general revolt against Aristotelianism, and with the Protestant struggle against the Roman Catholic authority. In themselves they have no particular value, nor indeed much originality, and the exposition of them by their author, always rather literary than philosophic, adds nothing of strength or interest. In comparison with the Aristotelian analysis of the forms and methods of thinking, the few alterations of statement, and generally the thin residuum of logical theory, which characterise Ramist work, appear as singularly insignificant. Nor have any of the special peculiarities of the Ramist logic exercised influence on the history of logical doctrines. The keenness of the controversy which raged in so many of the centres of learning between the Aristotelians and the total or partial Ramists is explicable only as having reference to differences which were merely symbolized by the apparent difference in logical doctrine.

In the Protestant universities and seminaries generally the Ramist logic obtained, and for some time kept, a firm footing. In Scotland, through Melville, Buchanan, and the earl of Murray, who had been a pupil of Ramus, his system was installed as the orthodox staple of logical training, and such records as remain of Scottish university education during the troubled 16th century would undoubtedly exhibit the traces of this new movement. In England, Cambridge alone, always disposed to reject the authority of Aristotle, and generally more open to new ideas than the sister university, was a stronghold of Ramism, and, apart from special works of Ramist tendency, the influence of the new doctrine is discernible in the writings of more than one Cambridge alumnus. William Temple, a friend of Sir Philip Sidney, and an official of the university, published a volume of *Scholia in Rami Dialecticam*, 1591; George Downam, prælector on logic, wrote commentaries *In Petri Rami Dialecticam*, 1606; and Milton, in 1672, expanded the *Dialectica* in his *Artis Logicæ Plenior Institutio*. Marlowe's *Faustus*, and his *Massacre of St. Bartholomew*, show how familiar Ramist phraseology and the personality of Ramus must have been to an alumnus of Cambridge, while Bacon, with well-grounded objection to much of the Ramist method, expounds the system of logic with unmistakable reference to the Ramist principles and method of arrangement. There is a monograph on Ramus by Ch. Waddington with a good bibliography—*Ramus (Pierre de la Ramée): sa Vie, ses Écrits, et ses Opinions*, Paris, 1856—and a slighter work, mainly biographical, by Ch. Desmaze (*P. Ramus, Professeur au Collège de France: sa Vie, ses Écrits, sa Mort*, 1515–72, Paris, 1864). In Lipenius (*Bibliotheca Realis*, *s. v.* "Ramus") will be found a long list of writings for and against the Ramist logic. The history of the movement is also given in Buhle (*Gesch. d. neuern Phil.*, ii. 680–702), Tennemann (*Gesch. d. Phil.*, ix. pp. 420–42) Du Boulay (*His. Univer. Paris*, tom. iv.), Crevier (*His. de l'Univ. de Paris*, vol. v.), in Jo. Hermannus ab Elswich (*Schediasma de varia, Aristotelis in scholis Protestantium fortuna*, §§ 21–29), De Lannoy (*De Varia Aristot. in Acad. Paris fortuna*, cap. xiii.), and in Bayle (*Dictionnaire*, *s. v.* "Ramus"). (R. AD.)

LOGOS. This term is one of the most constant factors in ancient speculation. As it is double-sided, however, expressing both *reason* and *word*, the conceptions which it covers differ widely. Taken broadly the doctrine of the Logos may be said to have run in two parallel courses—the one philosophical, the other theological; the one the development of the Logos as reason, the other the development of the Logos as word; the one Hellenic, the other Hebrew.

1. To the Greek mind, which saw in the world a *κόσμος*, it was natural to regard the world as the product of reason, and reason as the ruling principle in the world. So we find a Logos doctrine more or less prominent from the dawn of Hellenic thought to its eclipse. It rises in the realm of physical speculation, passes over into the territory of ethics and theology, and makes its way through at least three well-defined stages. These are marked off by the names of Heraclitus of Ephesus, the Stoics, and Philo.

It acquires its first importance in the theories of Heraclitus. There it is intimately associated with the dominant ideas of a flux in all things, and of fire as the material substrate or primary form of existence. On the one hand the Logos is identified with *γνώμη* and connected with *δίκη*, which latter seems to have the function of correcting deviations from the eternal law that rules in things. On the other hand it is not positively distinguished either from the ethereal fire, or from the *εἱμαρμένη* and the *ἀνάγκη* according to which all things occur. In consistency with his hylozoic doctrine Heraclitus holds that nothing material can be thought of without this Logos, but he does not conceive the Logos itself to be immaterial. Whether it is regarded as in any sense possessed of intelligence and nsciousness is a question variously answered. But ere is most to say for the negative. This Logos is t one above the world or prior to it, but in the world d inseparable from it. Man's soul is a part of it. is *relation*, therefore, as Schleiermacher expresses it, reason, not speech or word. And it is objective, not bjective, reason. The process of transition between posites, in which all things are involved, is a process cording to orderly relations and definite measures, and e Logos is the eternal principle of this world-process ich shows itself in the form of a constant conflict tween opposites. Like a law of nature, objective in e world, it gives order and regularity to the movement of things, and makes the system rational.[1]

Between Heraclitus and the Stoics comparatively lit-e was done in developing a special Logos doctrine. ith Anaxagoras a conception entered which gradually iumphed over that of Heraclitus, namely, the conption of a supreme, intellectual principle, not identi-d with the world but independent of it. This, wever, was *νοῦς*, not Logos. In the Platonic and ristotelian system, too, the Logos appears. But it is bordinate to other more distinctive conceptions, and cks the definiteness of a doctrine. With Plato the rm selected for the expression of the principle to hich the order visible in the universe is due is *νοῦς* or *φία*, not *λόγος*. It is in the pseudo-Platonic *Epinomis* at *λόγος* appears as a synonym for *νοῦς*. In Aristotle, ain, the principle which sets all nature under the le of thought, and directs it towards a rational end, *νοῦς*, or the divine spirit itself; while *λόγος* is a term ith many senses, used as more or less identical with a umber of phrases, *οὗ ἕνεκα*, *ἐνέργεια*, *ἐντελέχεια*, *οὐσία*, *δος*, *μορφή*, etc.

With the Stoics, however, the Logos doctrine reappears in great breadth. It is a capital element in their stem. With their teleological views of the world hey naturally predicated an active principle in connecon with it, living in it and determining it. This ope-ative principle is called both Logos and God. It is onceived of as material, and is described in terms used qually of nature and of God. There is at the same ime the special doctrine of the *λόγος σπερματικός*, the eminal Logos, or the law of generation in the world, he principle of the active reason working in dead mat-er. This parts into *λόγοι σπερματικοί*, which are akin, ot to the Platonic ideas, but rather to the *λόγοι ἔνυλοι* f Aristotle. In man, too, there is a Logos which is his haracteristic possession, and which is *ἐνδιάθετος*, as long s it is a thought resident within his breast, but *προφορικός* hen it is expressed as a word. This distinction between ogos as *ratio* and Logos as *oratio*, so much used sub-equently by Philo and the Christian fathers, had been o far anticipated by Aristotle's distinction between the *ξω λόγος* and the *λόγος ἐν τῇ ψυχῇ*. The Logos of the Stoics is a reason in the world gifted with intelligence, nd analogous to the reason in man.[2]

In the period between the Stoics and Philo there are ew names of distinct interest in this connection. But n the Alexandrian philosophy the Logos doctrine ssumes a leading place, and shapes a new career for tself. The chief representative of this school is the Hellenized Jew, Philo (born about 25 B. C.). With him God is absolute and incorporeal perfection, apprehensible only by reason, and incapable of contact with matter. An intermediate agent, therefore, is affirmed, the Logos or idea of ideas. This Logos is not eternal in the sense in which God is eternal, but has its being from Him. It is His elder son, as the world is His younger. It resides with God as His wisdom, and is in the world as the divine reason. It is God's instrument in creation and in revelation. Both in the world and in man it is twofold. In man it subsists as the *λόγος ἐνδιάθετος* or immanent reason, and as the *λόγος προφορικός* or uttered reason. In the case of the world there is the Logos which has its residence with the archetypal ideas, and there is the Logos which appears in the form of many *λόγοι* or rational germs of things material. Philo's doctrine is moulded by three forces—Platonism, Stoicism, and the Old Testament. His Logos is the representative of the world to God as well as of God to the world. It is described as the "image of God" (*εἰκὼν θεοῦ*, i. 6) and the "archetypal man" (*ὁ κατ' εἰκόνα ἄνθρωπος*, i. 427), as the "son of God" and the "high priest" (*ἀρχιερεύς*, i. 653), as the "first-born son" (*πρωτόγονος*, i. 414), the "man of God" (*ἄνθρωπος θεοῦ*, i. 411), etc. It wavers all the while between attribute and substance, between the personal and the impersonal.

In the later developments of Hellenic speculation nothing essential was added to the doctrine of the Logos. Philo's distinction between God and His rational power or Logos in contact with the world was generally maintained by the eclectic Platonists and Neo-Platonists. By some of these this distinction was carried out to the extent of predicating (as was done by Numenius of Apamea) three Gods:—the supreme God; the second God, or Demiurge or Logos; and the third God, or the world. Plotinus explained the *λόγοι* as constructive forces, proceeding from the ideas and giving form to the dead matter of sensible things (*Enneads*, v. 1, 8, and Richter's *Neu-Plat Studien*).

2. The doctrine of the Logos in Hellenic thought thus remains substantially a doctrine of the Logos as reason. The other side, the doctrine of the Logos as word, belongs as essentially to Hebrew thought. The roots of this conception lie in the Hebrew Scriptures. The God who is made known in the Old Testament is one who reveals Himself actively in history. He is exhibited, therefore, as speaking, and by His word communicating His will. The word of the God of revelation is represented as the creative principle (Gen. i. 3; Psalm xxxiii. 6), as the executor of the divine judgments (Hosea vi. 5), as healing (Psalm cvii. 20), as possessed of almost personal qualities (Isaiah lv. 11; Psalm cxlvii. 15). Along with this comes the doctrine of the angel of Jehovah, the angel of the covenant, the angel of the presence, in whom God manifests Himself, and who is sometimes identified with Jehovah or Elohim (Gen. xvi. 11, 13; xxxii. 29–31; Exod. iii. 2; xiii. 21), sometimes distinguished from Him (Gen. xxii. 15, etc.; xxiv. 7; xxviii. 12, etc.), and sometimes presented in both aspects (Judges ii., vi.; Zech. i.). To this must be added the doctrine of Wisdom, given in the books of Job and Proverbs. As the Word of God is represented in the theocratic sections of the Old Testament as the creative principle of the world, so Wisdom appears with somewhat similar functions in these books. At one time it is exhibited as an attribute of God (Prov. iii. 19). At another it is strongly personified, so as to become rather the creative thought of God than a quality (Prov. viii. 22). Again it is described as proceeding from God as the principle of creation and objective to Him. In these and kindred passages (Job xv. 7, etc.) it is on the way to become hypostatized.

The Hebrew conception is partially associated with the Greek in the case of Aristobulus, the predecessor of Philo, and, according to the fathers, the founder of the Alexandrian school. He speaks of Wisdom in a way reminding us of the book of Proverbs. The pseudo-Solomonic *Book of Wisdom* (generally supposed to be the work of an Alexandrian flourishing somewhere between Aristobulus and Philo) deals both with the Wisdom and with the Logos. It fails to hypostatize either. But it represents the former as the framer of the world, as the power or spirit of God, active alike in the physical, the intellectual, and the ethical domain, and apparently objective to God. Points of affinity between the Hellenic and Hebrew conceptions are also seen in the books of Maccabees (see, *e. g.*, 2 Macc. iii. 38). In these instances, however, and even in Philo, the Hebrew elements are only partially grasped and appropriated. In the Targums, on the other hand, the three doctrines of

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Cf. Schleiermacher's *Herakleitos der Dunkle*, etc.; Bernays's *Heraclitea*; Gladisch's *Heracleitos und Zoroaster*.

[2] *Cf.* especially Zeller's *Phil. der Gr.*, 2d ed., vol. iii.; or Reichel's translation, *The Stoics, Epicureans, and Sceptics*.

the word, the angel, and the wisdom of God converge in a very definite conception. In the Jewish theology God is represented as purely transcendent, having no likeness of nature with man, and making no personal entrance into history. Instead of the immediate relation of God to the world the Targums introduce the ideas of the *Mêmrâ* (word) and the *Shechînâ*. This Memra, or, as it is also designated, *Dibbûrâ*, is an hypostasis that takes the place of God when direct intercourse with man is in view. In all those passages of the Old Testament where anthropomorphic terms are used of God, the Memra is substituted for God. The Memra proceeds from God, and retains the creaturely relation to God. It does not seem to have been identified with the Messiah.[1]

The Hebrew Logos and the Old Testament doctrine reach their climax in the prologue to John's Gospel. The three conceptions of the active Word, the Angel, and the Wisdom of God, which had been fused in the Rabbinical idea of a Memra, meet there in the final grandeur of the Word of God incarnate. The question of the *genesis* of the Johannine doctrine has been greatly debated. There is a remarkable similarity between John's terms and Philo's. But this is due mainly to the fact that John and Philo made use of the same inherited phraseology for the expression of their several doctrines. The Johannine doctrine is not derived from the Philonic. The Logos of Philo is distinctively reason; the Logos of John is Word. The one is metaphysical; the other is theological. In Philo the Logos is the divine principle that creates and sustains. In John the Logos who creates also redeems. In Philo the Logos hovers midway between the personal and the impersonal. In John he is a distinct personality. To Philo the idea of an incarnation of God is alien and abhorrent. The heart of John's doctrine is the historical fact that the Word was made flesh.

In many of the early Christian writers, as well as in the heterodox schools, the Logos doctrine is influenced by the Greek idea. The Syrian Gnostic Basilides held (according to Irenæus, i. 24) that the Logos or Word emanated from the νοῦς, or personified reason, as this latter emanated from the unbegotten Father. The completest type of Gnosticism, the Valentinian, regarded Wisdom as the last of the series of æons that emanated from the original Being or Father, and the Logos as an emanation from the first two principles that issued from God, Reason (νοῦς) and Truth. Justin Martyr, the first of the sub-apostolic fathers, taught that God produced of His own nature a rational power (δύναμίν τινα λογικήν), His agent in creation, who now became man in Jesus (*Dial. c. Tryph.*, chap. 48, 60). He affirmed also the action of the λόγος σπερματικός (*Apol.*, i. 46; ii. 13, etc.). With Tatian (*Cohort. ad. Gr.*, chap. 5, etc.) the Logos is the beginning of the world, the reason that comes into being as the sharer of God's rational power. With Athenagoras (*Suppl.*, chap. 9, 10) He is the prototype of the world and the energizing principle (ἰδέα καὶ ἐνέργεια) of things. Theophilus (*Ad Autolyc.*, ii. 10, 24) taught that the Logos was in eternity with God as the λόγος ἐνδιάθετος, the counsellor of God, and that when the world was to be created God sent forth this counsellor (σύμβουλος) from himself as the λόγος προφορικός, yet so that the begotten Logos did not cease to be a part of Himself. With Hippolytus (*Refut.*, x. 32, etc.) the Logos, produced of God's own substance, is both the divine intelligence that appears in the world as the Son of God, and the idea of the universe immanent in God. The early Sabellians (comp. Euseb., *Hist. Eccl.*, vi. 33; Athan., *Contra Arian.*, iv.) held that the Logos was a faculty of God, the divine reason, immanent in God eternally, but not in distinct personality prior to the historical manfestation in Christ. Origen, referring the act of creation to eternity instead of to time, affirmed the eternal personal existence of the Logos. In relation to God this Logos or Son was a copy of the original, and as such inferior to that. In relation to the world he was its prototype, the ἰδέα ἰδεῶν, and its redeeming power (*Contra Cels.*, v. 608; *Frag. de Princip.*, i. 4; *De Princip.*, i. 109, 324).

Literature.—In addition to the histories of philosophy (*e. g.*, those of Ritter, Ueberweg, Zeller, etc.), the commentaries on John's Gospel (Lücke, Godet, Westcott, etc.), and the systems of Biblical theology (Oehler, Schultz Immer, Weiss, etc.), the following writings deserve special notice:—Schürer, *Lehrb. der N.-T. Zeitgeschichte*; Hausrath, *Neu-Testamentliche Zeitgeschichte*; Heinze, *Lehre vom Logos in der griechischen Philosophie*; Soulier, *La Doctrine du Logos*; Gfrörer, *Philo*; Siegfried, *Philo*; Daehne, *Geschichtliche Darstellung der Jüdisch-alexandrinischen Religions-Philosophie*; Dorner, *History of the Development of the Doctrine of the Person of Christ*; Huber, *Philosophie der Kirchenväter*; Weber, *System der Alt-Synagogalen Palästinischen Theologie*; Grossmann, *Quæstiones Philoneæ*. (S. D. F. S.)

LOGROÑO, an inland province of Spain, the smallest of the eight modern divisions of Old Castile, is bounded on the N. by Burgos, Alava, and Navarre, on the E. by Navarre and Zaragoza, on the S. by Soria, and on the W. by Burgos. The area is 1945 square miles, with a population in 1877 of 174,425. It belongs entirely to the basin of the river Ebro, which forms its northern boundary except for a short distance near San Vicente, and is now navigable throughout the entire length of the province; its drainage takes place chiefly by the rivers Tiron, Oja, Najerilla, Iregua, Leza, Cidacos, and Alhama, all flowing in a north-easterly direction. The portion skirting the Ebro forms a spacious and for the most part fertile undulating plain, called La Rioja in its western part; but in the south Logroño is considerably broken up by offshoots from the sierras which separate that river from the Douro. In the east the Cerro de Lorenzo rises to a height of about 7725 feet, and in the south the Pico Santa Ines is upwards of 7380 feet. The mineral resources, which are believed to be considerable, are as yet undeveloped. The products of the province are chiefly cereals, good oil and wine (especially in the Rioja), fruit (except oranges and lemons), silk, flax, and honey. The industries, which are unimportant, include spinning and weaving. Logroño is traversed by the Ebro valley railway, which connects Miranda del Ebro with Zaragoza; on this line are situated all the towns of the province with a population exceeding 5000—Haro, Logroño, Calahorra, and Alfaro.

LOGROÑO, capital of the above province, is situated on the right bank of the Ebro, which is here crossed by a handsome stone bridge of twelve arches, dating from 1138; the surrounding plain is well cultivated and fertile, producing the rich Rioja wine. The city is the seat of the usual provincial authorities, civil and military. It has a theatre, and several hospitals and convents. The parish church claims great antiquity. The population in 1877 was 13,393; the trade and industries are unimportant.

The district of Logroño was in ancient times inhabited by the *Berones* or *Verones* of Strabo and Pliny, and their *Varia* is to be identified with the modern suburb of the city of Logroño now known as Varea or Barea. The place fell into the hands of the Moors in the 8th century, but was speedily retaken by the Christians, and under the name of *Lucronius* appears with frequency in mediæval history. Logroño was the birthplace of the painter Navarrete (el Mudo) and of Espartero; the latter died there on January 9, 1879.

LOGWOOD is a valuable dye-wood, the product of a leguminous tree, *Hæmatoxylon campechianum*, native of Central America, and grown also in the West Indian Islands. The tree attains a height not exceeding 40 feet, and is said to be ready for felling when about ten years old. The wood, deprived of its bark and the sap-wood, is sent into the market in the form of large blocks and billets. It is very hard and dense, and externally has a dark brownish-red color; but it is less deeply colored within. The best qualities come from Campeachy, but it is obtained there only in small quantity. A large export trade in logwood of good quality is carried on from Honduras and Jamaica, and inferior qualities are exported from St. Domingo, Martinique, Guadaloupe, etc. The wood was introduced into Europe as a dyeing substance soon after the discovery of America, but for many years (from 1581 to 1662) its use in England was prohibited by legislative enactment on account of the inferior dyes which at first were produced by its employment.

The coloring principle of logwood exists in the timber in the form of a glucoside, from which it is liberated as hæmaoxylin or hæmatin by fermentation. Hæmatoxylin was first isolated by Chevreul in 1810, and its constitution was subsequently investigated by Erdmann, who found it to have the formula $C_{16}H_{14}O_6$. It forms two crystalline hydrates, the principal combination being with three molecules of water. This hydrate, $C_{16}H_{14}O_6 + 3H_2O$, is a colorless body very sparingly soluble in cold water, but dissolving freely in hot water and in alcohol. By exposure to the air, especially in alkaline solutions, hæmatoxylin is rapidly oxidized into hæmatein, with the development of a fine purple color. The reaction consists in the elimination of two atoms of hydrogen, thus:—hæmatoxylin hydrate $(C_{16}H_{14}O_6 + 3H_2O) + O =$ hæmatein $(C_{16}H_{12}O_6 + 3H_2O) + H_2O$. This reaction of hæmatoxylin is exceedingly rapid and delicate, rendering that body a valuable laboratory test for alkalies. It is remarkable that the difference of two atoms of hydrogen between colorless hæmatoxylin and colored hæmatein is precisely that which exists between the white and the blue forms of indigo. By the action of hydrogen and sulphurous acid, hæmatein is easily reduced to hæmatoxylin.

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[1] *Cf.* the Targum of Onkelos on the Pentateuch under Gen. vii. 16, xvii. 2, xxi. 20; Exod. xix. 16, etc.; the Jerusalem Targum on Numb. vii. 89, etc.

Logwood is prepared for use by dyers, etc., in the form of chips and raspings, and as a solid brittle black extract. Chipped logwood is moistened with water and spread in thin layers till a gentle fermentation sets up, whereby, under the influence of liberated ammonia, hæmatoxylin is formed from the glucoside. By exposure to the air, through repeated turnings of the mass, hæmatein is developed from the hæmatoxylin, and the chips gradually become coated with the brilliant metallic green crystals of hæmatein. Logwood extract, largely used in calico printing, is obtained from oxidized chips and raspings by lixiviation, the solution being concentrated at as low a temperature as possible.

The principal use of logwood is for dyeing wool and woollen goods, on which it produces, with various mordants, shades of blue from a light lavender to a dense blue-black, according to the amount of logwood used. It is more employed in combination with other dyestuffs than as the sole tinctorial agent, the best and most permanent blacks on wool, known as woaded blacks, being first dyed blue in the indigo vat, and finished black with logwood and bichromate of potash. In calico-printing logwood is used to produce steam purples, for the production of which the calico is mordanted with stannate of soda, and printed with a strong solution of logwood extract thickened with starch. By steaming, the hæmatein of the logwood combines with binoxide of tin precipitated in the fibre, and thus develops a bright purple color. Logwood blacks, which are a standard product of print works, are produced by mordanting with iron liquor, passing the calico through a logwood solution, and developing and fixing the color by treatment with a weak solution of bichromate of potash. Logwood blacks assume a bright red tint by the action of dilute acids, a test by which they can readily be distinguished from aniline and other fast blacks. Logwood is also largely used in the preparation of Ink (*q. v.*), and to a small extent in medicine. The imports of logwood into the United Kingdom during the year 1880 amounted to 69,280 tons, the estimated value of which was £192,392.

LOHÁRDAGÁ, or Lohardugga, a district in the lieutenant-governorship of Bengal, India, between 22° 20′ and 24° 39′ N. lat. and 83° 22′ and 85° 56′ E. long., is bounded on the N. by Hazáribágh and Gayá, on the N. W. and W. by Mírzápur district and Sargújá and Jashpur states, and on the S. E. and E. by Sinhbhúm and Manbhúm districts. It comprises Chutiá Nágpur proper, and the Palámau subdivision. Chutiá Nágpur is an elevated table-land, forming the central and south-eastern portion of Lohárdagá district; its surface is undulating, and the slopes of the depressions lying between the ridges are cut into terraces covered with rice. Palámau, which forms the north-western portion of the district, consists on the east and south of spurs thrown off from the plateaus of Hazáribágh and Chutiá Nágpur, while the remainder of the tract is a tangled mass of isolated peaks and long irregular stretches of broken hills. The average elevation of Palámau is about 1200 feet above sea-level, but some peaks rise to over 3000 feet. This part of the district contains no level areas of any extent, except the valleys of the North Koel and Amánat rivers, to which rice cultivation is confined. The principal rivers of Lohárdagá are the Subarnarekhá and the North and South Koel. The entire district was probably at one time overgrown with dense forest, but the forest area has been continually dwindling, owing to the spread of cultivation and the practice of girdling the *sál* trees for resin.

The census of 1872 disclosed a total population of 1,237,123 (621,548 males and 615,575 females), spread over an area of 12,044 square miles; of these only 91 were returned as Europeans and 3 as of mixed race. The aboriginal element is very strongly represented—the Mundas numbering 163,051; Kols, 132,104; and Uráons, 151,810. The most numerous among the semi-aboriginal tribes are—the Bhuíyás, 45,008; Kharwárs, 33,573; Bhogtas, 33,452; and Dosádhs, 25,223. The Hindus number 741,952, and Mohammedans 58,211. The Christian population is larger than in any other Bengal district, except the metropolitan one of the Twenty-four Parganás. In 1872 the total Christian population numbered 12,781, of whom 12,687 were natives, nearly all belonging to the aboriginal tribes of Mundas and Uráons. Most of them are poor, but they possess considerable influence, and are rising in public esteem. The two missions are the German Lutheran and Church of England, which successfully work together side by side. The population is entirely rural, Ranchí town (12,086) being the only place with more than 5000 inhabitants. Rice forms the staple crop; other crops are wheat, barley, Indian corn, millets, peas, gram, oilseeds, *pán*, cotton, and tobacco, Opium cultivation was introduced in 1869, and in 1874–75 yielded 245 cwts. There are two small tea plantations. Mildew and blights occasionally attack the crops; droughts seldom affect any considerable area. The principal trading place is Garwá in Palámau. Stick lac, resin, catechu, silk cocoons, hides, oil-seeds, *ghí*, cotton, and iron are here collected for exportation; while rice and other food grains, brass vessels, piece goods, blankets, broad cloth, silk, salt, tobacco, spices, drugs, and beads are brought to market for local consumption. The manufactures consist of shell-lac, inferior articles of brass and iron work, coarse cloth, blankets, mats, baskets, rope, and rude pottery. Iron, lime, and soapstone are worked in small quantities; gold is washed by the poorer classes from the sands of the rivers. An important coal-bearing tract, known as the Daltonganj coal-field, covers an area of nearly 200 square miles, and lies partly in the valley of the Koel river, and partly in that of the Amánat. The net revenue of the district in 1870–71 was £29,900, and the expenditure £22,563. The schools in 1876–77 numbered 303, with 8088 pupils. The climate of the table-land of Chutiá Nágpur is said to be superior to that of any other part of India, except the lower ranges of the Himálayas. The hot weather extends over almost six weeks, commencing about the 20th April, but is never really oppressive. The rainy season lasts from the middle of June to about the first week in October. The principal diseases are malarious fever and rheumatism of a severe type.

LOIRE (Lat., *Liger*), the first of the rivers of France in length of course (626 miles) and extent of basin (44,979 square miles), has its headwaters in the great central plateau, and is considered to take its rise in the Gerbier de Jonc, in the department of Ardèche, at a height of 4504 feet above the sea,—though the Allier branch, which has its source about 30 miles west, in the department of Lozère, at the foot of Maure de la Gardille, 4668 feet above the sea, has an almost equal course. The two streams continue to run parallel till the upper Loire turns westward and is joined by the Allier in the neighborhood of Nevers. All the more important affluents of the upper and middle part of the Loire—as the Cher, the Indre, the Vienne, respectively 198, 152, and 231 miles in length—have their gathering grounds in the central plateau. In the north-east the basin of the Seine comes so close (at one place to within 6 or 7 miles) that the versant towards the Loire has hardly anything to contribute; and it is not till within 65 miles of the estuary that we find an important tributary, the Maine, bringing down the drainage of the Brittany plateau. At certain seasons the Loire is navigable for ships as far as Nantes (33 miles), for boats as far as La Noirie (other 518 miles), and for rafts as far as Retournac; but for six months of the year navigation is practically impossible.

In the volume of water there is all the irregularity of a mountain torrent; at the Bec d'Allier, for instance,—the meeting point of the two head streams,—while the maximum current is 353,200 cubic feet per second, the minimum is 10,600 cubic feet, and above Orleans the range lies between 31,800 and 850. During the drought of summer thin and feeble streams thread their way between the sandbanks of the channel; while at other times a stupendous flood pours down and submerges wide reaches of land. In the middle part of its course the Loire traverses the western portion of the undulating Paris basin, with its Tertiary marls, sands, and clays, and the alluvium carried off from these renders its lower channel inconstant; the rest of the drainage area is occupied by crystalline rocks, over the hard surface of which the water, undiminished by absorption, flows rapidly into the streams. A fall of from 3 to 4 inches over the whole river basin is sufficient to pour 35,320,000,000 cubic feet of water into the channels. When the rain is general over the whole area, the floods on the different tributaries reach the main river at different times; but when, through any cause, two or more of them arrive at the same time, inundations of the most serious character result. Attempts to control the river must have begun at a very early date, and by the close of the Middle Ages the bed between Orleans and Angers was enclosed by dykes 10 to 13 feet high. In 1783 a double line of dykes or *turcies* 23 feet high was completed from Bec d'Allier downwards. This great work had, however, the serious defect that the channel was so much narrowed that the embankments are almost certain to give way as soon as the water rises 16 feet (the average rise is about 14, and in 1846 it was more than 22). In more modern times the importance of the water-way from the sea to Nantes led to the embanking of the lower part of the course; but instead of a depth of 16 feet being secured, as the engineers anticipated, there is no more at full tide than 13 feet. One of the practical results of this state of matters has been the commercial development of Saint Nazaire and Paimbœuf, and the comparative decline of Nantes as a great shipping port. Besides the general embankments of the river, several of the towns along the Loire have constructed special works to defend themselves against the floods; Tours, the most exposed of all, is surrounded by a circular dyke. Various schemes for the systematic regulation of the Loire have been discussed. It has been proposed to construct in the upper valleys of the several affluents a number of gigantic dams or reservoirs from which the water, stored during flood, could be let off into the river as required. A reservoir of this kind, formed by the engineer Mathieu at the village of Pinay, about 18 miles above Roanne, and capable of retaining from 3500 to 4500 million cubic feet of water, has greatly diminished the force of the floods at Roanne, and maintained the comparative equilibrium of the current during the dry season. There is a canal (157 miles) along the left bank of the Loire between Roanne and Briare; and the Canal du Berri connects this with the navigable part of the Cher. The Canal du Centre extends from Digoin on the Loire to Châlon on the Saône; the Canal du Nivernais and the canals starting from Orleans and Briare communicate with the Seine; and the Nantes canal opens up the way to Lorient, Brest, and Dinan. The canals of the Sauldre and the Dive (20 and 26 miles respectively) are mainly for irrigation purposes.

See H. Blerzy, *Torrents, fleuves, et canaux de la France* (Paris, 1878), and his papers in *Rev. des Deux Mondes*, February and March, 1875.

LOIRE, a department of central France, made up of the old district of Forez and portions of Beaujolais and Lyonnais, all formerly included in the province of Lyonnais, lies between 45° 15′ and 46° 15′ N. lat. and between 3° 40′ and 4° 45′ E. long., and is bounded on the N. by the department of Saône-et-Loire, on the E. by those of Rhône and Isère, on the S. by Ardèche and Haute-Loire, and on the W. by Puy de Dôme and Allier. Its extreme length is 78 miles from north-west to south-east, and its extreme breadth from east to west is about 43 miles, the area being 1838 square miles. Until 1790 it constituted a single department along with that of Rhône. About an eighth part of the whole area belongs to the basin of the Rhone. The Loire, which has a fall within the department from 1365 feet to 886 feet, traverses alternately a series of narrow gorges and of broad plains, the beds of ancient lakes, including that of Forez between St. Rambert and Feurs, and, lower down, that of Roanne. Of its affluents the most important are the Lignon du Nord, the beautiful valley of which has been called "La Suisse Forezienne," and the Aix on the left, and on the right the Ondaine (on which stand the industrial towns of Chambon-Feugerolles and Firminy), the Furens, and the Rhin. To the Rhone the department contributes the Gier, upon which are situated the industrial towns of St. Chamond and Rive de Gier, and which forms a navigable channel to the Rhone at Givors. From Mont Pilat descends the Deôme, in the valley of which the workshops of Annonay begin. In the west are the Forez mountains, which separate the Loire basin from that of the Allier; their highest point (Pierre sur Haute, 5381 feet) is 12 miles west from Montbrison. They sink gradually towards the north, and are successively called Bois Noirs (4239 feet), from their woods, and Monts de la Madeleine (3600 to 1640 feet). In the east the Rhone and Loire basins are separated by Mont Pilat (4705 feet) at the north extremity of the Cevennes, and by the hills of Lyonnais, Tarare, Beaujolais, and Charolais, none of which rise higher than 2950 or 3280 feet. The climate of the department varies according to the elevation: on the heights it is cold and healthy, unwholesome in the marshy plain of Forez, mild in the valley of the Rhone. The annual rainfall is 39·37 inches on the Forez mountains, but only 24·79 at Roanne. More than half of the area consists of arable lands; one-seventh is occupied by forests, and one-seventh by meadows.

The plains of Forez and Roanne are the two most important agricultural districts, but the total production of grain within the department is insufficient for the requirements of the population. The pasture lands of Forez support a large number of horned cattle, sheep, goats, and pigs. Fairly good red wine is also grown within the department; potatoes, leguminous plants, beetroot, hemp, and colza are also cultivated. Poultry is reared, and bee-keeping is a considerable industry. Among the hills replantation has been set on foot. The Bois Noir forests yield good-sized pines and large quantities of wood for mining purposes. The so-called Lyons chestnuts are to a large extent obtained from Forez; the woods and pasture lands of Pilat yield medicinal plants, such as mint. The chief wealth of the department, however, lies in the coal deposits in the St. Étienne basin, the second in importance in France. The basin, which stretches from south-west to north-east between Firminy and Rive de Gier, is about 20 miles in length and 5 in breadth. In 1881 the output amounted to 3,454,612 tons of coal and anthracite, giving employment to 12,000 workmen below and 5000 above. The presence of coal has naturally encouraged various forms of the metal-working industries. At St. Étienne there is a national factory of arms, in which as many as 6000 have been employed; apart from other factories of the same kind carried on by private individuals, the production of hardware occupies 7000 persons; locks, common cutlery, chain cables for the mines, files, and nails are also made. Cast steel is largely manufactured, the aggregate production of all sorts of steel amounting in 1880 to 114,629 tons; the Loire workshops supply the heaviest constructions required in naval architecture. The glass industry has its centre at Rive de Gier. St. Étienne employs more than 60,000 persons in the fabrication of silk ribbons, to an annual value of £4,000,000; over and above this must be reckoned the manufacture of elastic ribbons and laces, and the dressing of raw silks. The arrondissement of Roanne manufactures cotton stuffs upon 11,000 looms, each employing three persons. That of Montbrison produces table linen. In the mountains between Haute-Loire and Puy de Dôme the women make black laces and embroidery. The department has numerous flour-mills, paper works, tan-yards, boat-building yards, silk-spinning works, and velvet, plush, and hat factories. There are three arrondissements —St. Étienne, Montbrison, and Roanne. The capital is St. Étienne. The population, 290,903 in 1801, was 590,613 in 1876.

LOIRE, HAUTE-, a department of central France, made up of Velay and portions of Vivarais and Gévaudan, three districts formerly belonging to the old province of Languedoc, of a portion of Forez formerly belonging to Lyonnais, and of a portion of lower Auvergne, is bounded on the N. by Puy de Dôme and Loire, on the E. by Loire and Ardèche, on the S. by Ardèche and Lozère, and on the W. by Lozère and Cantal, and lies between 44° 40′ and 45° 25′ N. lat.

and between 3° 5′ and 4° 30′ E. long., having an extreme length of 68 miles, a maximum breadth of 54 miles, and an area of 1916 miles. It belongs almost wholly to the Loire basin, but a few square kilometres to the north of Mont Mézenc are drained by the Erieux, a tributary of the Rhone. The highest point, Mont Mézenc, on the borders of Ardèche, is 5745 feet; it belongs to the Cévennes system, which sends ramifications throughout the entire department, giving it a mean altitude of 2950 feet. Reckoning from east to west are the Boutières, the Mégal or Meygal, the Velay hills, those of La Margeride, and finally the Luguet. The first mentioned ridge separates Haute-Loire from Ardèche, and ranges from 3280 to 4590 feet; it has a crust of lava thrown out from Mont Mézenc; efforts towards replantation are being made. Meygal presents a series of jagged peaks, recalling the Pyrenees on a small scale. It also has been covered by an immense flow of lava some 37 miles long and 490 feet thick, through which the Loire has forced a passage by means of gorges more than 1600 feet in depth. The highest point of the Meygal properly so called is upwards of 4590 feet. The Velay hills, which separate the Loire from the Allier (mean height about 3300 feet), consist of granitic rocks overlaid with the eruptions of more than one hundred and fifty craters, one of which is now occupied by the singular lake of Bouchet. Westward from the Allier are the forest-clad granitic hills of La Margeride, which rise to a height of nearly 5000 feet. The Luguet massif (3300 feet) rises in the north-west of the department on the left bank of the Alagnon, a tributary of the Allier. The river Loire, to which the department owes its name, enters at a point 16 miles distant from its source, and 2923 feet above the level of the sea. Within the 63 miles of its course through the eastern portion of the department, first in a northerly and afterwards in a north-easterly direction, it falls 1565 feet. The Allier, which joins the Loire at Nevers, traverses the western portion of Haute-Loire in a northerly direction, entering at a point 25 miles distant from its source, and 2369 feet above the sea; it traverses a narrow and deep valley overhung by lofty hills, and falls 1090 feet. The chief affluents of the Loire within the limits of the department are the Borne on the left, joining it near Puy, and the Lignon, which descends from the Mézenc, between the Boutières and Meygal ranges, on the right. The climate, owing to the altitude, the northward direction of the valleys, and the winds from the Cévennes, is cold, the winters being long and rigorous. Storms and violent rains are frequent on the higher grounds, and would give rise to serious inundations were not the rivers for the most part confined within deep rocky channels. Two-fifths of the area is occupied by arable lands, one-fifth by natural meadow and by orchards, and a somewhat smaller proportion by wood. The rest consists of pasture lands, vineyards, and uncultivated lands.

Numerous cattle of the celebrated Mézenc breed are reared, and also sheep and mules. The crops raised are wheat, meslin, rye, barley, oats, maize, potatoes (in large quantity), hemp, colza, and second-class wine. The woods yield pine, fir, oak, and beech. Large quantities of aromatic and pharmaceutical plants are found in the Mézenc massif. The department has two coal basins,—those of Brassac and Langeac, both on the Allier; in 1880 their total output was 225,153 tons. Copper, iron, zinc, argentiferous lead, arsenic, antimony, barytes, and fluor spar are also obtained, and there are good quarries of trachyte and limestone, as well as numerous unutilized mineral springs. Lace-making in various materials is the most extensive industry, occupying from 100,000 to 130,000 persons, and producing goods to the annual value of about £1,000,000. Ribbons and cloth are manufactured to some extent, and silk-dressing, wool-spinning, caoutchouc-making, various kinds of smith work, paper-making, glass-blowing, brewing, wood-sawing, and flour-milling are also carried on. There are three arrondissements—Puy, Brioude, and Yssingeaux; the capital is Puy. The population in 1876 was 313,721.

LOIRE-INFÉRIEURE, a maritime department of western France, is made up of a portion of Brittany on the right and of the district of Retz on the left of the Loire, and lies between 46° 45′ and 47° 40′ N. lat. and between 55′ and 2° 32′ W. long., being bounded on the W. by the ocean, on the N. by Morbihan and Ille-et-Vilaine, on the E. by Maine-et-Loire, and on the S. by Vendée. Its greatest length from east to west is 76 miles, its greatest breadth 65 miles, and its area 2654 square miles. The surface is very flat, and the highest point, in the north on the borders of Ille-et-Vilaine, is only 377 feet. The line of hillocks skirting the right bank of the Loire, and known as the "sillon de Bretagne," nowhere attains a height of 265 feet; below Savenay they recede from the river, and the meadows give place to peat bogs. North of St. Nazaire the Grande Brière, measuring 9 miles by 6, and rising scarcely 10 feet above the sea-level, still supplies old trees which can be used for joiner work; a few scattered villages occur on the more elevated spots, but communication is effected chiefly by means of the canals which intersect it. The district on the south of the Loire lies equally low; its most salient feature is the lake of Grandlieu, covering an area of 27 square miles, and surrounded by low and marshy ground, but so shallow (6·5 feet at most) that drainage would be comparatively easy. The Loire has a course of 68 miles within the department; its width above Nantes varies from 1300 to 3280 feet, and its volume at Nantes, where the tide begins to be felt, is never under 700 cubic metres per second. It has numerous islands. At Paimbœuf it is nearly 2 miles broad, but narrows again opposite St. Nazaire before finally entering the ocean. The bed is not sufficiently regular to allow easily the passage of vessels drawing more than 10 feet of water. On the left bank a canal of 9 miles is about to be opened between Pellerin, where the dikes which protect the Loire valley from inundation terminate, and Paimbœuf. The principal towns on the river within the department are Ancenis, Nantes, and St. Nazaire (one of the most important commercial ports of France) on the right, and Paimbœuf on the left. The chief affluents are on the right the Erdre and on the left the Sèvre, both debouching at Nantes. The Erdre has a succession of broad lakes which give it the appearance of a first class river; it forms part of the canal from Nantes to Brest. The Sèvre, on the other hand, is hemmed in by picturesque hills; at the point where it enters the department it flows past the famous castle of Clisson. Apart from the Loire itself, the only navigable channel of importance within the department is the Nantes and Brest canal already referred to, fed by the Isac, a tributary of the Vilaine, which separates Loire-Inférieure from Ille-et-Vilaine and Morbihan. The climate partakes of the general Armorican character in respect of humidity, but is Girondine in its mildness. At Nantes the mean annual temperature is 54°·7 Fahr., and there are one hundred and twenty-two rainy days, the annual rainfall being 25·6 inches. Of the entire area nearly two-thirds is arable; one-seventh is occupied by meadows; and vineyards, woods, heath, lakes, pools, and marshes occupy the remainder.

The quantity of live stock is considerable:—320,000 horned cattle, 180,000 sheep, 80,000 pigs, 38,000 horses, asses, and mules. Poultry also is reared, and there is a good deal of bee-keeping. Wheat, rye, buckwheat, oats, and potatoes are produced in great abundance; leguminous plants are also largely cultivated, especially near Nantes. Beetroot, hemp, and chestnuts represent, along with wine and cider, the chief remaining agricultural products. The woods are of oak in the interior and pine on the coast. The department has deposits of tin, lead, and iron, which are hardly wrought, if at all. North-west from Ancenis a little anthracite is obtained from a coal-bed which is a prolongation of that of Anjou. The salt marshes, about 6000 acres in all, occur for the most part between the mouth of the Vilaine and the Loire, and on the Bay of Bourgneuf. The salt manufacture, which as late as 1874 produced 43,475 tons, is now decaying. There are slate quarries in the north-east of the department, and the granite of the sea-coast and of the Loire up to Nantes is quarried for large blocks, while the limestone about Châteaubriant occupies numerous kilns. The industries of the department are well developed: steam-engines are built for Government at Indret, a few miles below Nantes; the forges of Basse-Indre are in good repute for the quality of their iron; and the production of the lead-smelting works at Couëron amounts to several millions of francs annually. There are also considerable foundries at Nantes, Chantenay, and St. Nazaire, and shipbuilding yards at Nantes, St. Nazaire, Paimbœuf, and Croisic. Among other industries may be mentioned the preparation of pickles and preserved meats at Nantes, the curing of sardines at Croisic and in the neighboring communes, salt-refining, the great sugar refinery at Nantes, and the tobacco manufacture also there. Fishing is prosecuted along the entire coast. Nantes, formerly one of the most important of French ports, has now given way before St. Nazaire, the trade of which in 1878 exceeded 1,500,000 tons. The principal imports are coal, colonial wares, wood, metals, manure; the exports are wine, salt, preserved meats and pickles, flour, refined sugar, and butter. The department is divided into five arrondissements—Nantes, Ancenis, Châteaubriant, Paimbœuf, and St. Nazaire; Nantes is the capital. The population in 1876 was 612,972, an increase of 243,667 since 1801.

LOIRET, a department of central France, made up of three districts of the ancient province of Orléanais,—Orléanais proper, Gâtinais, and Dunois,—together with portions of the Isle of France and Berri, lies between 47° 30′ and 48° 20′ N. lat. and between 1° 30′ and 3° 8′ E. long., and is bounded on the N. by Seine-et-Oise, on the N. E. by Seine-et-Marne, on the E. by Yonne, on the S. by Nièvre and Cher, on the S. W. by Loir-et-Cher, and on the N. W. by Eure-et-Loir; its greatest length, from north-west to south-east, is 75 miles, its greatest breadth, from north to south along the meridian of Paris, 50 miles, and its area 2614 square miles. The name is derived from the Loiret, a stream which issues from the ground some miles to the south of Orleans, and after a course of about 7 miles falls into the Loire; its large volume gives rise to the belief that it is a subterranean branch of that river. The Loire traverses the department by a broad valley which, though frequently devastated by disastrous floods, is famed for its rich tilled lands, its castles, its towns, and its vine-clad slopes. To the right of the Loire are Gâtinais (capital Montargis) and Beauce; the former district is so named from its *gâtines* or wildernesses, of which saffron is, along with honey, the most noteworthy product; Beauce, on the other hand, a monotonous tract of corn-fields without either tree or river, has been called the granary of France. Between Beauce and the Loire is the extensive forest of Orleans, which is slowly disappearing before the advances of agriculture. South of the Loire is Sologne, long barren and unhealthy from the impermeability of its subsoil, but undergoing gradual improvement in both respects by means of pine plantation and draining and manuring operations. The surface of the department presents little variation of level; the highest point (on the borders of Cher), is 900 feet above the level of the sea, and the lowest (on the borders of Seine-et-Marne) is 220 feet. The watershed on the plateau of Orleans between the basins of the Seine and Loire, which divide Loiret almost equally between them, is almost imperceptible. The lateral canal of the Loire from Roanne stops at Briare; from the latter town a canal connects with the Seine by the Loing valley, which is joined by the Orleans canal at Montargis. The only important tributary of the Loire within the department is the Loiret; the Loing, a tributary of the Seine, has a course of 40 miles from south to north, and is accompanied throughout first by the Briare canal and afterwards by that of Loing. The Essonne, another important affluent of the Seine, entering Loiret at Malesherbes, takes its rise on the plateau of Orleans, as also does its tributary the Juine. The department has the climate of the Sequanian region, the mean temperature being almost the same as that of Paris; the number of rainy days is one hundred and twenty, and the rainfall varies from 18·5 to 27·5 inches according to the district, that of the exposed Beauce being smaller than that of the woody Sologne. Two-thirds of the entire area is cultivable; between one-sixth and one-seventh is under wood; vineyards occupy one-twentieth; and the remainder is taken up by meadows, heath, and marsh.

A large number of sheep, cattle, horses, asses, pigs, and goats are reared; poultry, especially geese, and bees are plentiful. The yield of wheat and oats is much in excess of the consumption; the crops of rye, barley, meslin, potatoes, beetroot, colza, and hemp are also very important. Wine is abundant, but of inferior quality. Buckwheat supports bees by its flowers, and poultry by its seeds. Saffron is another source of wealth. The woods consist of oak, elm, birch, and pine; fruit trees thrive in the department, and Orleans is a great centre of nursery gardens. The industries are brick and tile making, and the manufacture of faience, for which Gien is one of the most important centres in France. The Briare manufacture of porcelain buttons and pearls employs 1500 workmen. Flour-mills are very numerous. There are iron and brass foundries, which, along with agricultural implement making, bell-founding, and the manufacture of pins, nails, and files, represent the chief metal-working industries. The production of hosiery, wool-spinning, and various forms of wool manufacture are also engaged in. A large quantity of the wine grown is made into vinegar (vinaigre d'Orléans). The tanneries produce excellent leather; and paper-making, sugar-refining, wax-bleaching, and the manufacturing of caoutchouc (in one factory) complete the list of industries. The exports are principally corn, flour, wine, vinegar, live-stock, and wood. The four arrondissements are those of Orleans, Gien, Montargis, and Pithiviers. The capital is Orleans. The population in 1876 was 360,903, an increase of 70,764 since 1801.

LOIR-ET-CHER, a department of central France, consists of a small portion of Touraine, but chiefly of portions of Orléanais proper, Blésois, and Dunois, districts which themselves formerly belonged to Orléanais. It lies between 47° 11′ and 48° 8′ N. lat. and between 0° 35′ and 2° 15′ E. long., and is bounded on the N. by Eure-et-Loir, on the N. E. by Loiret, on the S. E. by Cher, on the S. by Indre, on the S. W. by Indre-et-Loire, and on the N. W. by Sarthe, the greatest length (north-west to south-east) being 78 miles, maximum breadth 31 miles, and the area 2452 miles. Its name is derived from the Loir and the Cher, by which it is traversed in the north and in the south respectively. The Loire divides it into two nearly equal portions, the district on the right of the Loire being known as Beauce, while that on the right of the Loir again is called Perche; on the left of the Loire is Sologne. The surface of Perche is varied, and reaches a maximum height of 840 feet; its woods alternate with hedged fields and orchards, and rapid rivulets water the green valleys. Beauce is a rich agricultural country, where the monotony of the endless fields of corn is broken only by the houses grouped together in villages, or by the stacks which surround them. Sologne was formerly a region of forests, of which that of Chambord is one of the last remains. Its soil, formerly barren and unhealthy, has been considerably improved within recent years. The Cher and Loir traverse pleasant valleys, occasionally bounded by walls of tufa, in which numerous dwellings have been excavated; the stone extracted, after hardening by exposure to the air, has been used for building purposes in the nearer towns. Within the department the Loir has a course of 56 miles, the Cher of 50, and the Loire of 37. With the help of the Berri canal the last-mentioned is navigable throughout. The chief remaining rivers of the department are the Beuvron, which flows into the Loire on the left, and the Sauldre on the right of the Cher. All these named have a south-westerly course, following the slope of the department. The climate is temperate and mild, and healthy if Sologne be left out of account. The mean temperature ranges between 52° and 53° Fahr., and the rainfall is 25·4 inches. Of the total area more than a half is arable; one-sixth is under wood, and one-sixth is waste; vineyards, meadows, and pasture lands occupy the remainder.

Sheep are extensively reared, and the Perche breed of horses is much sought after for its combination of lightness with strength. There are more than twenty thousand beehives within the department. Beauce is the most productive district; in 1878 it yielded 342,000 quarters of wheat, 556,000 of oats, and 1,500,000 bushels of potatoes, besides meslin, rye, barley, buckwheat, beetroot, maize, colza, and hemp. In the same year the production of wine amounted to 27,000,000 gallons, the most valuable being that of Côte du Cher. The forests are an important source of wealth. Sologne supplies pine and birchwood for furnace fuel, and in the neighborhood of Blois there are oak, elm, and chestnut plantations. In the river valleys fruit trees and nursery gardens are numerous. Formerly the specialty of Loir-et-Cher was to supply Europe with gun flints. Building stones, and also clay for bricks and pottery, are also abundant. The chief industries are the manufacture of cloth at Romorantin (where spinning, ribbon-making, and tanning are also carried on), of white leather and gloves at Vendôme, distilling, glass-making, paper-making, pottery-making, and the like. The exports are wine, brandy, vinegar, wood, cloth, wool, leather, grain, legumes, wax, and leeches. Of the castles which adorn the department the finest and most famous is that of Chambord, near the left bank of the Loire, opposite Blois (the capital). The three arrondissements are those of Blois, Romorantin, and Vendôme. In 1876 the population was 272,634, an increase of 55,721 since 1801.

LOJA, or **Loxa**, a town of Spain in the province of Granada, lies in a beautiful valley through which flows the Genil, here crossed by a Moorish bridge, about 33 miles by rail west from Granada. The situation is very steep, and the streets in consequence are extremely crooked and irregular. The castle stands on a rock in the centre of the town, which, from being the key to Granada, was once a place of great military importance. The manufactures of Loja consist chiefly of coarse woollens, silk, paper, and leather. Salt is obtained in the neighborhood. The population in 1877 was 18,249.

Loja, which has sometimes been identified with the ancient *Ilipula*, or with the *Lacibi* (*Lacibis*) of Pliny and Ptolemy, first clearly emerges in the Arab chronicles of the year 890. It was taken by Ferdinand III. in 1226, but was soon afterwards abandoned, and did not finally fall under the arms of Castile until May 28, 1486, when it surrendered to Ferdinand and Isabella after a siege.

LOKEREN, a town of Belgium, in the province of East Flanders and district of Termonde, on the Durme (a small but navigable stream by which it communicates with the Scheldt), and 11 miles from Ghent on the railway to Antwerp, which is there joined by the lines to Termonde and Alost, and to Selzaete. It is a busy manufacturing place, with cotton factories, ropewalks, and bleach-works, etc. The church of St. Lawrence (17th century) has a fine pulpit, representing Jesus in the midst of the doctors. The population of the commune has increased from 11,960 in 1808 to 17,400 in 1876.

LOḲMÁN, a name famous in Arabian tradition. The Arabs distinguish two persons of this name. The older Loḳmán was an 'Ádite, and is said to have built the famous dyke of Ma'rib. He not only escaped the destruction sent on his nation for their refusal to hear the prophet Húd, but received the gift of a life as long as that of seven vultures, each of which is said to have lived eighty years.[1] The other Loḳmán, called "Loḳmán the Sage," is mentioned in the Koran (xxxi. 11). He is said to have been a Nubian slave, son of 'Anḳá, and to have lived in the time of David in the region of Elah and Midian (Maṣúdy, i. 110), but the commentators on the Koran (Abu Sá'úd, ii. 336) make him son of Bá'úrá, the son of Job's sister or daughter. This form of the legend, and many of the stories told of him (D'Herbelot, *s. v.*, but not those given by Nawawy, p. 526), show Jewish influence on the legend, and Darenbourg (*Fables de Loqmân le sage*, 1850) has pointed out that Bá'úrá seems to be identical with Beor, and that Loḳmán corresponds to Balaam, the roots of both names meaning "to swallow," so that the one may be viewed as a translation of the other. In favor of this identification Derenbourg advances several important and probably conclusive arguments from Jewish tradition; but in view of the divergent accounts given of Loḳmán it may be questioned whether Jewish influence created or only modified the Arabic tradition. The grave of Loḳmán was shown on the east coast of the Lake of Tiberias, but also in Yemen and elsewhere (Yáḳút, iii. 512; D'Herbelot, *s. v.*).

The name of Loḳmán is associated with numerous old verses, proverbs, and anecdotes of which Freytag, *Arabum Proverbia*, gives many examples. The fables which pass under his name, and were first printed by Erpenius (Leyden, 1615), are not mentioned by any Arabic writer. They appear to be of Christian origin, and are mainly derived, though not closely copied, from those of Syntipas and Æsop. They existed in the 13th century (Derenbourg, *ut supra*). The editions are numerous, the book having been much used as an elementary Arabic reading-book. Those of Rödiger (2d ed. 1839, with glossary) and Derenbourg (1850) claim special mention.

LOLLARDS, The, were the English followers of John Wickliffe, and were the adherents of a religious movement which was widespread in the end of the 14th and beginning of the 15th centuries, and which to some extent maintained itself on to the Reformation. The name is of uncertain origin: it has been traced to a certain Walter Lollard, but he was probably a mythical personage; some derive it from *lolium*, tares, quoting Chaucer (*C. T.*, Shipman's Prologue)—

> "This Lollere here wol prechen us somwhat . . .
> He wolde sowen some difficulte
> Or sprengen cokkle in oure clene corn;"

but the most generally received explanation derives the words from *lollen* or *lullen*, to sing softly. The word is much older than its English use; there were Lollards in the Netherlands as early as the beginning of the 14th century, who were akin to the Fratricelli, Beghards, and other sectaries of the recusant Franciscan type. The earliest official use of the name in England occurs in 1387 in a mandate of the bishop of Worcester against five "poor preachers," *nomine seu ritu Lollardorum confoederatos*. It is probable that the name was given to the followers of Wickliffe because they resembled those offshoots from the great Franciscan movement which had disowned the pope's authority and separated themselves from the mediæval church. The 14th century, so full of varied religious life, made it manifest that the two different ideas of a life of separation from the world which in earlier times had lived on side by side within the mediæval church were irreconcilable. The church chose to abide by the idea of Hildebrand and to reject that of Francis of Assisi; and the revolt of Ockham and the Franciscans, of the Beghards and other spiritual fraternities, of Wickliffe and the Lollards, were all protests against that decision. Hildebrand's object was to make church government or polity in all respects distinct from civil government—no civil ruler to touch churchman or church possession for trial or punishment, taxation or confiscation; and, in the hands of his successors, who followed out his principles, the church became transformed into an empire in rivalry with the kingdoms, and of somewhat the same kind, only that its territories were scattered over the face of Europe in diocesan domains, convent lands, or priests' glebes, its taxes were the tithes, its nobles the prelates. Francis of Assisi had another ideal. Christians, he thought, could separate themselves from the world, in imitation of Christ, by giving up property, and home, and country, and going about doing good and living on the alms of the people. For a time these two ways of separation from the world lived on side by side in the church, but they were really irreconcilable; Hildebrand's church required power to enforce her claims, and money, land, position were all sources of power. Church rulers favored the friars when they found means of evading their vows of absolute poverty, and gradually there came to be facing each other in the 14th century a great political Christendom, whose rulers were statesmen, with aims and policy of a worldly ambitious type, and a religious Christendom, full of the ideas of separation from the world by self-sacrifice and of participation in the benefits of Christ's work by an ascetic imitation, which separated itself from political Christianity and called it anti-Christ. Wickliffe's whole life was spent in the struggle, and he bequeathed his work to his followers the Lollards. The main practical thought with Wickliffe was that the church, if true to her divine mission, must aid men to live that life of evangelical poverty by which they could be separate from the world and imitate Christ, and if the church ceased to be true to her mission she ceased to be a church. Wickliffe was a metaphysician and a theologian, and had to invent a metaphysical theory—the theory of *Dominium*—to enable him to transfer, in a way satisfactory to himself, the powers and privileges of the church to his company of poor Christians; but his followers who were not troubled with need of theories, were content to allege that a church which held large landed possessions, collected tithes greedily, and took money from starving peasants for baptizing, burying, and praying, could not be the church of Christ and his apostles, who in poverty went about doing good.

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[1] Ṭabary, i. 240; Abulf., *H. A.*, 20; Damiry, ii. 384. The tradition has various forms. Maṣúdy, iii. 366, 375, gives Lokmán only the age of one vulture. Further details are given by Caussin de Perceval, *Essai*. The vultures of Lokmán, especially the seventh, whose name was Lobad, are often referred to in Arabic poetry and proverbs.

Lollardy was most flourishing and most dangerous to the ecclesiastical organization of England during the ten years after Wickliffe's death. It had spread so rapidly and grown so popular that a hostile chronicler could say that almost every second man was a Lollard. Wickliffe left three intimate disciples:—Nicolas Hereford, a doctor of theology of Oxford, who had helped his master to translate the Bible into English; John Ashton, also a fellow of an Oxford college; and John Purvey, Wickliffe's colleague at Lutterworth, and a co-translator of the Bible. With these were associated more or less intimately, in the first age of Lollardy, John Parker, the strange ascetic William Smith, the restless fanatic Swynderly, Richard Waytstract, and Crompe; and there must have been a large number of preachers who itinerated through England preaching the doctrines of their master. Wickliffe had organized in Lutterworth an association for sending the gospel through all England, a company of poor preachers somewhat after the Wesleyan method of modern times. "To be poor without mendicancy, to unite the flexible unity, the swift obedience of an order, with free and constant mingling among the poor, such was the ideal of Wickliffe's 'poor priests'" (*cf.* Shirley, *Fasc. Ziz.*, p. xl.), and, although proscribed, these "poor preachers," with portions of their master's translation of the Bible in their hand to guide them, preached all over England wherever they could be heard without detection. The Oxford university and many nobles supported them. Lord Montacute, Lord Salisbury, Sir Thomas Latimer of Braybrooke, and several others had chaplains who were Lollardist preachers; whilst many merchants and burgesses assisted the work with money. The organization must have been strong in numbers, but only the names of those have come down to us who were seized for heresy, and it is only from the indictments of their accusers that their opinions can be gathered. The preachers were picturesque figures in long russet dress down to the heels, who, staff in hand, preached in the mother tongue to the people in churches and graveyards, in squares, streets, and houses, in gardens and pleasure grounds, and then talked privately with those who had been impressed. The Lollard literature was very widely circulated,—books by Wickliffe and Hereford and tracts and broadsides,—in spite of many edicts proscribing it. In 1395 the Lollards grew so strong that they petitioned parliament through Sir Thomas Latimer and Sir R. Stury to reform the church on Lollardist methods. It is said that the Lollard Conclusions printed by Canon Shirley (p. 360) contain the substance of this petition If so, parliament was told that temporal possessions ruin the church and drive out the Christian graces of faith, hope, and charity; that the priesthood of the church in communion with Rome was not the priesthood Christ gave to his apostles; that the monk's vow of celibacy had for its consequence unnatural lust, and should not be imposed; that transubstantiation was a feigned miracle, and led people to idolatry; that prayers made over wine, bread, water, oil, salt, wax, incense, altars of stone, church walls, vestments, mitres, crosses, staves, were magical and should not be allowed; that kings should possess the *jus episcopale*, and bring good government into the church; that no special prayers should be made for the dead; that auricular confession made to the clergy, and declared to be necessary for salvation, was the root of clerical arrogance and the cause of indulgences and other abuses in pardoning sin; that all wars were against the principles of the New Testament, and were but murdering and plundering the poor to win glory for kings; that the vows of chastity laid upon nuns led to child murder; that many of the trades practised in the commonwealth, such as those of goldsmiths and armorers, were unnecessary and led to luxury and waste. These Conclusions really contain the sum of Wickliffite teaching; and, if we add that the principal duty of priests is to preach, and that the worship of images and going on pilgrimages are sinful, they include almost all the heresies charged in the indictments against individual Lollards down to the middle of the 15th century. The king, who had hitherto seemed anxious to repress the action of the clergy against the Lollards, spoke strongly against the petition and its promoters, and Lollardy never again had the power in England which it wielded up to this year.

If the formal statements of Lollard creed are to be got from these Conclusions, the popular view of their controversy with the church may be gathered from the ballads preserved in the collection of *Political Poems and Songs relating to English History*, published in 1859 by Mr. Thomas Wright for the Master of the Rolls series, and in the Piers Ploughman poems. *Piers Ploughman's Creed* (see LANGLAND) was probably written about 1394, when Lollardy was at its greatest strength; the ploughman of the *Creed* is a man gifted with sense enough to see through the tricks of the friars, and with such religious knowledge as can be got from the creed, and from Wickliffe's version of the Gospels. The poet gives us a "portrait of the fat friar with his double chin shaking about as big as a goose's egg, and the ploughman with his hood full of holes, his mittens made of patches, and his poor wife going barefoot on the ice so that her blood followed" (*Early English Text Society*, vol. xxx., pref., p. 16); and one can easily see why farmers and peasants turned from the friars to the poor preachers. The *Ploughman's Complaint* tells the same tale. It paints popes, cardinals, prelates, rectors, monks, and friars, who call themselves followers of Peter and keepers of the gates of heaven and hell, and pale poverty-stricken people, cotless and landless, who have to pay the fat clergy for spiritual assistance, and asks if these are Peter's priests after all. "I trowe Peter took no money, for no sinners that he sold. . . . Peter was never so great a fole, to leave his key with such a losell."

In 1399 the Lancastrian Henry IV. overthrew the Plantagenet Richard II., and one of the most active partisans of the new monarch was Arundel, archbishop of Canterbury and the most determined opponent of Lollardy. It has been alleged that Henry won his help by promising to do his utmost to suppress the followers of Wyclif, and this much is certain, that when the house of Lancaster was firmly established upon the throne the infamous Act *De Comburendo hereticos* was passed in 1400, and church and state combined to crush the Lollards. John Purvey was seized; William Sautrey (Chartris) was tried, condemned, and burned. The Lollards, far from daunted, abated no effort to make good their ground, and united a struggle for social and political liberty to the hatred felt by the peasants towards the Romish clergy. Jack Upland (John Countryman) took the place of Piers Ploughman, and upbraided the clergy, and especially the friars, for their wealth and luxury. Wickliffe had published the rule of St. Francis, and had pointed out in a commentary upon the rule how far friars had departed from the maxims of their founder, and had persecuted the *Spirituales* (the Fratricelli, Beghards, Lollards of the Netherlands) for keeping them to the letter (*cf.* Matthews, *English Works of Wyclif hitherto unprinted*, Early Eng. Text Soc., vol. lxxiv., 1880). Jack Upland put all this into rude nervous English verse:—

> "Freer, what charitie is this
> To fain that whoso liveth after your order
> Liveth most perfectlie,
> And next followeth the state of the Apostles
> In povertie and pennance:
> And yet the wisest and greatest clerkes of you
> Wend or send or procure to the court of Rome,
> . . . and to be assoiled of the vow of povertie."

The archbishop, having the power of the state behind him, attacked that stronghold of Lollardy the university of Oxford. In 1406 a document appeared bearing to be the testimony of the university in favor of Wickliffe; its genuineness was disputed at the time, and when quoted by Huss at the council of Constance it was repudiated by the English delegates. The archbishop treated Oxford as if it had issued the document, and procured the issue of severe regulations in order to purge the university of heresy. In 1408 Arundel in convocation proposed and carried the famous *Constitutiones Thomæ Arundel* intended to put down Wickliffite preachers and teaching. They provided amongst other things that no one was to be allowed to preach without a bishop's license, that preachers preaching to the laity were not to rebuke the sins of the clergy, and that Lollard books and the translation of the Bible were to be searched for and destroyed. He next attempted to purge the nobility of Lollardy. The earlier leaders had died, but there was still one distinguished Lollard, Sir John Oldcastle, in right of his wife Lord Cobham, "the good Lord Cobham" of the common people, who had been won to pious living by the poor preachers, and who openly professed the common Lollard doctrines. His chaplain, one of the itinerating preachers, was seized, then his books and papers were taken and burnt in the king's presence, and later he was indicted for heresy. It is said that at first he recanted, but the abjuration, said to be his, may not be authentic. In the end he was burnt for an obstinate heretic. These persecutions were not greatly protested against; the wars of Henry V. with France had awakened the martial spirit of the nation, and little sympathy was felt for men who had declared that all war was but the murder and plundering of poor people for the sake of kings. Mocking ballads were composed upon the martyr Oldcastle, and this dislike to warfare was one of the chief accusations made against him (comp. Wright's *Political Poems*, vol. ii. p. 244). But Arundel could not prevent the writing and distribution of Lollard books and pamphlets. Two appeared just about the time of the martyrdom of Oldcastle—The *Ploughman's Prayer* and the *Lanthorne of Light*. The *Ploughman's Prayer* declared that true worship consists in three things—in loving God, and dreading God, and trusting in God above all other things; and it showed how Lollards, pressed by persecution, became further separated from the religious life of the church. "Men maketh now great stonen houses full of glassen windows, and clepeth thilke thine houses and churches. And they setten in these houses mawmets of stocks and stones, to fore them they knelen privilich and apert, and maken their prayers, and all this they say is thy worship. . . . For Lorde our belief is that thine house is man's soul."

The council of Constance (1414–1418) put an end to the papal schism, and also showed its determination to put down heresy by burning John Huss. When news of this reached England the clergy were incited to still more vigorous proceedings against Lollard preachers and books. From this time Lollardy appears banished from the fields and streets, and takes refuge in houses and places of concealment. There was no more wayside preaching, but instead there were *conventicula occulta* in houses, in peasants' huts, in sawpits, and in field ditches, where the Bible was read and exhortations were given, and so Lollardy continued. In 1428 Archbishop Chichele confessed that the Lollards seemed as numerous as ever, and that their literary and preaching work went on as vigorously as before. It was found out also that many of the poorer rectors and parish priests, and a great many chaplains and curates, were in secret association with the Lollards, so much so that in many places processions were never made and worship on saints' days was abandoned. For the Lollards if not stamped out were hardened by persecution, and became fanatical in the statement of their doctrines. Thomas Bagley was accused of declaring that if in the sacrament a priest made bread into God, he made a God that can be eaten by rats and mice; that the pharisees of the day, the monks, and the nuns, and the friars, and all other privileged persons recognized by the church, were limbs of Satan; and that auricular confession to the priest was the will not of God but of the devil. And others held that any priest who took salary was excommunicate; and that boys could bless the bread as well as priests.

From England Lollardy passed into Scotland. Oxford infected St. Andrews, and we find traces of more than one vigorous search made for Lollards among the teaching staff of the Scottish university, while the Lollards of Kyle in Ayrshire were claimed by Knox as the forerunners of the Scotch Reformation.

The opinions of the later Lollards can best be gathered from the learned and unfortunate Pecock, who wrote his elaborate *Repressor* against the "Bible-men," as he calls them. He summed up their doctrines under eleven heads: they condemn the having and using images in the churches, the going on pilgrimages to the memorial or "mynde places" of the saints, the holding of landed possessions by the clergy, the various ranks of the hierarchy, the framing of ecclesiastical laws and ordinances by papal and episcopal authority, the institution of religious orders, the costliness of ecclesiastical decorations, the ceremonies of the mass and the sacraments, the taking of oaths, and the maintaining that war and capital punishment are lawful. When these points are compared with the Lollard Conclusions of 1395, it is plain that Lollardy had not greatly altered its opinions after fifty-five years of persecution. All the articles of Pecock's list, save that on capital punishment, are to be found in the Conclusions; and, although many writers have held that Wickliffe's own views differed greatly from what have been called the "exaggerations of the later and more violent Lollards," all these views may be traced back to Wickliffe himself. Pecock's idea was that all the statements which he was prepared to impugn came from three false opinions or "trowings," viz, that no governance or ordinance is to be esteemed a law of God which is not founded on Scripture, that every humble-minded Christian man or woman is able without "fail and defaut" to find out the true sense of Scripture, and that having done so he ought to listen to no arguments to the contrary; he elsewhere adds a fourth (vol. i. p. 102), that if a man be not only meek but also keep God's law he shall have a true understanding of Scripture, even though "no man ellis teche him saue God." These statements, especially the last, show us the connection between the Lollards and those mystics of the 14th century, such as Tauler and Ruysbroeck, who accepted the teachings of Nicholas of Basel, and formed themselves into the association of the Friends of God.

The question remains—What was the connection between the Lollard movement and the Reformation in England? Many writers make Lollardy the forerunner of Reformation teaching; others, like Mr. Gairdner, relying on the facts that the persecution of the Lollards did not rouse the English nation in the way that the martyrdom of Huss excited the Bohemians, and that Lollardy had almost faded out of sight in the beginning of the 16th century, admit only a casual connection between the two awakenings.

The problem is scarcely one which can be settled by counting the numbers of Lollards convicted at different periods from the beginning to the end of the 15th century, or by pointing to the enthusiasm or indifference of the mass of the English nation to Lollard doctrines. The English Reformation down to the middle of Elizabeth's reign was much more a political than a religious movement with the great proportion of English people. Lollardy in its most essential and invariable characteristics had much more in common with mediæval religious revivals than with Reformation piety, and Lollard preaching must have had much more resemblance to that of Ockham and his recusant Franciscans than that of Luther, Calvin, or Peter Martyr. But Lollardy did one thing for England which other mediæval revivals did not do for the lands in which they arose; it made the Bible familiar to the people in their mother tongue, and this must have been a positive preparation for the English Reformation of no ordinary power. May not the great peculiarity of the English Reformation on its religious side, the repeated attempts to give a good version of the Bible from the original tongues into English, by Tyndale, Coverdale, Taverner, Cranmer, the Genevan refugees, and Parker, with the revisions and combinations of these various translations, on to our present authorized version, have come from the fact that Lollard Biblemen, as Pecock calls them, had made a good English Bible a necessity for an English reformation of religion?

Literature.—Lechler, *Johann von Wiclif*, 2d vol. 1878; Shirley, *Fasciculus Zizaniorum*, Master of the Rolls Series, 1858; Babington's edition of Pecock's *Repressor of over much blaming of the Clergy*, 2 vols., Master of the Rolls Series, 1860; Matthew, *The English Works of John Wyclif*, Early English Text Society, 1880; Wright, *Political Poems and Songs*, Master of the Rolls Series, 2 vols., 1859; J. Gairdner and J. Spedding, *Studies in English History*, 1881; Foxe's *Book of Martyrs*; Höfler's *Anna von Luxemburg*, 1871. (T. M. L.)

LOMBARD, PETER (*c.* 1100–1160), bishop of Paris, better known as *Magister Sententiarum*, the son of obscure parents, was born about the beginning of the 12th century, at Novara (then reckoned as belonging to Lombardy). After receiving his education in jurisprudence and the liberal arts at Bologna, he removed to France, bearing a recommendation to Bernard of Clairvaux, who first placed him under Lotolf at Rheims, and afterwards sent him to Paris with letters to Gilduin, the abbot of St. Victor. His diligence and talents soon brought him into notice, and ultimately obtained for him a theological chair, which he held for a number of years; during this period he is said to have been the first to introduce theological degrees. On June 29, 1159, he succeeded his former pupil, Philip, brother of Louis VII., in the bishopric of Paris, but did not long survive the promotion; according to the most trustworthy of the meagre accounts we have of his life, he died on July 20 of the following year.

His famous theological handbook, *Sententiarum Libri Quatuor*, is, as the title implies, primarily a collection of "sententiæ patrum." These are arranged (professedly on the basis of the aphorism of Augustine, Lombard's favorite authority, that "omnis doctrina vel rerum est vel signorum") into four books, of which the first treats of God, the second of the creature, the third of the incarnation, the work of redemption, and the virtues, and the fourth of the seven sacraments and eschatology. It soon attained immense popularity, ultimately becoming the text-book in almost every theological school, and giving rise to endless commentaries. A charge of heresy ("nihilianism") was indeed raised against Lombard for a particular view which he seemed not remotely to have indicated regarding Christ's human nature, but neither at the synod of Tours, where the question was first broached in 1163, nor at the subsequent Lateran synod in 1179, does a condemnation seem to have been obtained. In 1300 the theological professors of Paris agreed in the rejection of sixteen propositions taken from Lombard, but their decision was far from obtaining universal currency.

Besides the *Sententiæ*, Lombard wrote numerous commentaries (*e. g.*, on the Psalms, Canticles, Job, the Gospel Harmony, and the Pauline Epistles), sermons and letters, which still exist in MS. The *Glossæ seu Commentarius in Psalmos Davidis*, first published at Paris in 1533, and the *Collectanea in omnes D. Pauli Epistolas* (Paris, 1535) have been reprinted by Migne.

LOMBARDS. The history of the Lombards falls into three divisions:—(1) The period before the invasion in 568 A. D.; (2) the Lombard kingdom in Italy between 568 and 774; (3) the period of their incorporation with the Italian population, and the history of Lombardy and its cities as one of the great provinces of Italy—(*a*) from the restoration of the empire under Charles the Great (800) to the peace of Constance with Frederick Barbarossa (1183), and (*b*) from the declaration of independence to the time of the tyrannies and, afterwards, of the French, Spanish, and Austrian rule.

1. The name *Lombard* is the Italianized form of the national name of a Teutonic tribe, *Longobardi*, itself an Italian arrangement, based on a supposed etymology of the Teutonic *Langbard*, *Langobardi*, the form used when they are first named by Roman writers—Velleius and Tacitus. The etymology which made the name mean *Longbeard* is too obvious not to have suggested itself to Italians, and perhaps to themselves (see Zeuss, 95, 109;) it is accepted by their first native chronicler, Paul the Deacon, who wrote in the time of Charles the Great. But the name has also been derived from the region where they are first heard of. On the left bank of the Elbe, "where Börde or Bord still signifies a fertile plain by the side of a river," a district near Magdeburg is still called the *Lange Börde;* and lower down the Elbe, on the same side, about Lüneburg, the *Bardengau*, with its *Bardewik*, is still found; it is here that Velleius, who accompanied Tiberius in his campaign in this part of Germany, and who first mentions the name, places them. As late as the age of their Italian settlement, the Lombards are called *Bardi* in poetical epitaphs, though this may be for the convenience of metre.

Their own legends bring the tribe as worshippers of Odin from Scandinavia to the German shore of the Baltic, under the name of *Winili*, a name which was given to them in a loose way as late as the 12th century (*e. g.*, by Ordericus Vitalis; *cf.* Zeuss, 57). By the Roman and Greek writers of the first two centuries of our era they are spoken of as occupying, with more or less extension at different times, the region which is now Hanover and the Altmark of Prussia. To the Romans they appeared a remarkable tribe:—"gens etiam Germana feritate ferocior," says Velleius, who had fought against them under Tiberius; and Tacitus describes them as a race which, though few in numbers, more than held their own among numerous powerful neighbors by their daring and love of war. In the quarrels of the tribes they appear to have extended their borders; in Ptolemy's account of Germany, in the 2d century, they fill a large space among the races of the north-west and north. But from the 2d century the name disappears,[1] till it is found again at the end of the 5th century as that of a half Christian tribe on the northern banks of the Danube. How they got there, and what relation these Langobards bore to those who lived in the 1st and 2d centuries on the west bank of the Elbe, we learn little from the vague stories preserved by their traditions; but they are described (*B. G.*, ii. 14, 15) by Procopius, a contemporary, as subject to one of the most ferocious of the tribes on the Danube, the Heruli, also a Teutonic tribe, by whose oppression they were driven in despair to a resistance, which ended in the utter defeat and overthrow of their tyrants. We know nothing of the way in which Christianity was introduced among them, probably only among some of their noble families; but they were Arians like their neighbors and predecessors in Italy, the Goths, and like them they brought with them into Italy a hierarchy of bishops, priests, and deacons; but, while the Gothic Bible of Ulfilas is partially preserved, whatever religious literature the Langobards had in the shape of versions of the Scriptures or liturgical forms has utterly perished. They were among the Teutonic tribes which were generally on good terms with the empire, and were encouraged by it in their wars with their more barbarous neighbors. After defeating the Heruli and destroying their tribal organization, the Langobards attacked the Gepidæ with equal success, scattering the tribe or incorporating its survivors in their own host. They thus became the most formidable of the Teutonic tribes of the Danube. They had alliances with the distant Saxons, probably a kindred stock, and with the Hunnish Avars of the Danube. Their kings belonged to a royal line, and made marriages with the kings of the Franks and the other German nations. Their wars led them westwards, and for forty years they are said to have occupied Pannonia, the region between the Danube and the valleys of the Drave and Save. Thus following the line of movement of the Goths, they resolved at last to strike for the great prize which the Goths had won and lost. Through the eastern passes, and the border land of Friuli, they invaded Italy. It is said that they were invited by Narses, the conqueror of the Goths, in revenge for his ill treatment by the masters whom he had served.

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[1] Except in the Anglo-Saxon *Traveller's Song*, of probably between 375–485; see Guest's *English Rhythms*, 2, 77, 83, 87.

2. In 568 Alboin, king of the Langobards, with the women and children of the tribe and all their possessions, with Saxon allies, with the subject tribe of the Gepidæ, and a mixed host of other barbarians, descended into Italy by the great plain at the head of the Adriatic. There was little resistance to them. The war which had ended in the downfall of the Goths had exhausted Italy; it was followed by famine and pestilence; and the Government at Constantinople, away in the East, made but faint efforts to retain the province which Belisarius and Narses had recovered for it. Except in a few fortified places, such as Ticinum or Pavia, the Italians did not venture to encounter the new invaders; and, though Alboin was not without generosity, the Lombards, wherever resisted, justified the opinion of their ferocity by the savage cruelty of the invasion. In 572, according to the tragic tale of the Lombard chronicler, a tale which recalls the story of Candaules in Herodotus, Alboin, the fierce conqueror, fell a victim to the revenge of his wife Rosamond, the daughter of the king of the Gepidæ, whose skull Alboin had turned into a drinking cup, out of which he forced Rosamond to drink; but the Langobards had already shown themselves in ravaging bands all over Italy, and in the north had begun to take possession. Military chiefs, whom, after the Latin writers, we call "dukes," corresponding to the German "Herzog," were placed, or placed themselves, first in the border cities, like Friuli and Trent, which commanded the north-eastern passes, and then in other principal places in Italy; and this arrangement became characteristic of the Lombard settlement. The principal seat of the settlement was the rich plain watered by the Po and its affluents, which was in future to receive its name from them; but their power extended across the Apennines into Liguria and Tuscany, and then southwards to the outlying dukedoms of Spoleto and Benevento. The invaders failed to secure any maritime ports such as Genoa, Pisa, Naples, Salerno, Ravenna, or any territory that was conveniently commanded from the sea. Pavia, or, as it was called, Ticinum, the one place which had obstinately resisted Alboin, became the seat of their kings, as it had been one of the seats of the Gothic kingdom.

After the short and cruel reign of Cleph, the successor of Alboin, the Lombards (as we may begin for convenience sake to call them) tried for ten years the experiment of a national confederacy of their dukes, without any king at their head. It was the rule of some thirty-five or thirty-six petty tyrants, under whose oppression and private wars even the invaders suffered, while the Italians were remorselessly trodden under foot. With anarchy among themselves and so precarious a hold on the country, hated by the Italian population and by their natural leaders the Catholic clergy, threatened also by an alliance of the Greek empire with their natural and persistent rivals the Franks beyond the Alps, they resolved to sacrifice their turbulent independence to the usual necessities of the Teutonic invaders which led to the election of a king. In 584 they chose Authari, the grandson of Alboin, and endowed the royal domain with a half of their possessions. From this time till the fall of the Lombard power before the arms of their rivals the Franks under Charles the Great, the kingly rule continued. Authari, "the Long-haired," with his Roman title of Flavius, marks the change from the war-king of an invading host to the permanent representative of the unity and law of the nation, and the increased power of the crown, by the possession of a great domain, to enforce its will. The independence of the dukes was surrendered to the king. The dukedoms in the neighborhood of the seat of power were gradually absorbed, and their holders transformed into royal officers. Those of the northern marches, Trent and Friuli, with the important dukedom of Turin, retained longer the kind of independence which marchlands usually give where invasion is to be feared. The great dukedom of Benevento in the south, with its neighbor Spoleto, threatened at one time to be a separate principality, and even to the last resisted, with varying success, according to the personal characters of its dukes, the full claims of the royal authority at Pavia.

The kingdom of the Lombards lasted more than two hundred years, from Alboin (568) to the fall of Desiderius (774),—much longer than the preceding Teutonic kingdom of Theodoric and the Goths. But it differed from the other Teutonic conquests in Gaul, in Britain, in Spain. It was never complete in point of territory: there were always two, and almost to the last three, capitals—the Lombard one, Pavia, the Latin one, Rome, the Greek one, Ravenna; and the Lombards never could get access to the sea. And it never was complete over the subject race: it profoundly affected the Italians of the north; in its turn it was entirely transformed by contact with them; but the Lombards never overcame the natural repulsion of the two races, and never amalgamated with the Italians till their power as a ruling race was crushed by the victory given to the Roman element by the restored empire of the Franks. The Langobards, German in their faults and in their strength, but coarser, at least at first, than the Germans whom the Italians had known, the Goths of Theodoric and Totila, found themselves continually in the presence of a subject population very different from anything which the other Teutonic conquerors met with among the provincials,—like them, exhausted, dispirited, unwarlike, but with the remains and memory of a great civilization round them, intelligent, subtle, sensitive, feeling themselves infinitely superior in experience and knowledge to the rough barbarians whom they could not fight, and capable of hatred such as only cultivated races can nourish. The Lombards who came into Italy with the most cruel incidents of conquest, and who, when they had occupied the lands and cities of Upper Italy, still went on sending forth furious bands to plunder and destroy where they did not care to stay, never were able to overcome the mingled fear and scorn and loathing of the Italians. They adapted themselves very quickly indeed to many Italian fashions. Within thirty years of the invasion, Authari took the fancy of decking himself with the imperial title of Flavius, even while his bands were leading Italian captives in leash like dogs under the walls of Rome, and under the eyes of Pope Gregory; and it was retained by his successor. They soon became Catholics; and then in all the usages of religion, in church building, in founding monasteries, in their veneration for relics, they vied with Italians. Authari's queen, Theodelinda, solemnly placed the Lombard nation under the patronage of St. John the Baptist, and at Monza she built in his honor the first Lombard church, and the royal palace near it. King Liutprand (712–744) bought the relics of St. Augustine for a large sum to be placed in his church at Pavia. Their Teutonic speech disappeared; except in names and a few technical words all traces of it are lost. But to the last they had the unpardonable crime of being a ruling barbarian race or caste in Italy. To the end they are "nefandissimi," execrable, loathsome, filthy. So wrote Gregory the Great when they first appeared. So wrote Pope Stephen IV., at the end of their rule, when stirring up the kings of the Franks to destroy them. Authari's short reign (584–591) was one of renewed effort for conquest. It brought the Langobards face to face, not merely with the emperors at Constantinople, but with the first of the great statesmen popes, Gregory the Great (590–604). But Lombard conquest was bungling and wasteful. It was ever ready to lapse into mere plunder and warfare; and when they had spoiled a city they proceeded to tear down its walls and raze it to the ground. But Authari's chief connection with the fortunes of his people was an important though an accidental one. The Lombard chronicler tells us a romantic tale of the way in which Authari sought his bride from Garibald, duke of the Bavarians, how he went incognito in the embassy to judge of her attractions, and how she recognized her disguised suitor. The bride was the Christian Theodelinda, and she became to the Langobards what Bertha was to the Anglo-Saxons, and Clotilda to the Franks. She became the mediator between the Lombards and the Catholic Church. Authari, who had brought her to Italy, died shortly after his marriage. But Theodelinda had so won on the Lombard chiefs that they bid her as queen choose the one among them whom she would have for her husband and for king. She chose Agilulf, duke of Turin (592–615). He was not a true Langobard, but a Thuringian. It was the beginning of peace between the Lombards and the Catholic clergy. Agilulf could not abandon his traditional Arianism, and he was a very uneasy neighbor, not only to the Greek exarch, but to Rome itself. But he was favorably disposed both to peace and to the Catholic Church. Gregory interfered to prevent a national conspiracy against the Langobards, like that of St. Brice's day in England against the Danes, or that later uprising against the French, the Sicilian Vespers. He was right both in point of humanity and of policy. The Arian and Catholic bishops went on for a time side by side; but the Lombard kings and clergy rapidly yielded to the religious influences around them, even while the national antipathies continued unabated and vehement. Gregory, who despaired of any serious effort on the part of the Greek emperors to expel the Lombards, endeavored to promote peace between the Italians and Agilulf; and, in spite of the feeble hostility of the exarchs of Ravenna, the pope and the king of the Lombards became the two real powers in the north and centre of Italy. Agilulf was followed, after two unimportant reigns, by his son-in-law, the husband of Theodelinda's daughter, King Rothari (636–652), the Lombard legislator, still an Arian though he favored the Catholics. He was the first of their kings who did for the Lombards what was done by all the Teutonic conquerors as soon as they felt themselves a nation on Roman soil; he collected their customs under the name of laws,—and he did this, not in their own Teutonic dialect, but in Latin. The use of Latin implies the use of Latin scribes or notaries, and implies that the laws were a notice to the Italians of the usages and rules of their conquerors, which, so far as they applied, were to be not merely the personal law of the Lombards, but the law of the land, and binding on Lombards and Romans alike. But such rude legislation could not provide for all questions arising even in the shattered and decayed state of Roman civilization. It is probable that among themselves the Italians kept to their old usages and legal precedents where they were not overridden by the conquerors' law, and by degrees a good many of the Roman civil arrangements made their way into the Lombard code, while all ecclesiastical ones, and they were a large class, were untouched by it.

The precise nature of the relations, legal and political, of the Lombards, as a conquering race, or a military caste, to the Italians is still a subject of controversy, owing to the prevailing mixture of clearness and obscurity in the documents of the time. There must have been, of course, much change of property; but appearances are conflicting as to the terms on which land generally was held by the old possessors or the new comers, and as to the relative legal position of the two. Savigny held that, making allowance for the anomalies and usurpation of conquest, the Roman population held the bulk of the land as they had held it before, and were governed by an uninterrupted and acknowledged exercise of Roman law in their old municipal organization. Later inquirers, Leo, Troya, and more recently Hegel, have found that the supposition does not tally with a whole series of facts, which point to a Lombard territorial law ignoring completely any parallel Roman and personal law, to a great restriction of full civil rights among the Romans, analogous to the condition of the rayah under the Turks, and to a reduction of the Roman occupiers to a class of half-free "aldii," holding immovable tenancies under lords of superior race and privilege, and subject to the sacrifice either of the third part of their holdings or the third part of the produce. Probably something like this, with exceptions and anomalies, represents the state of things, at least at first; but it must be remembered that regular and consistent arrangements were very unlikely to have been thought of early in such a conquest as that of the Lombards, that the Romans suffered probably rather from the insolence of barbarians than from the rules of a constitutional settlement, and that a conquered race always and naturally exaggerates its own humiliations and grievances, and in this case has the chief telling of the story. It might also be expected that the tribal customs of Teutonic conquerors would be more modified in Italy than elsewhere, by the deeply-rooted traditions and customs of the old Roman rule. The Lombards were rough and harsh, and the Italians never ceased to hate them; but we know by experience how two portions of a population possessed of equal civil rights can hate one another, where they differ in blood and history. The Roman losses, both of property and rights, were likely to be great at first; how far they continued permanent during the two centuries of the Lombard kingdom, or how far the legal distinctions between Rome and Lombard gradually passed into desuetude, is a further question. The legislation of the Lombard kings, in form a territorial and not a personal law, shows no signs of a disposition either to depress or to favor the Romans, but only the purpose to maintain, in a rough fashion, strict order and discipline impartially among all their subjects.

From Rothari (*ob.* 652) to Liutprand (712–744) the Lombard kings, succeeding one another in the irregular fashion of the time, sometimes by descent, sometimes by election, sometimes by conspiracy and violence, strove fitfully to enlarge their boundaries, and contended with the aristocracy of dukes inherent in the original organization of the nation, an element which, though much weakened, always embarrassed the power of the crown, and checked the unity of the nation. Their old enemies the Franks on the west, and the Slavs or Huns, ever ready to break in on the north-east, and sometimes called in by mutinous and traitorous dukes of Friuli and Trent, were constant and serious dangers. By the popes, who represented Italian interests, they were always looked upon with dislike and jealousy, even when they had become zealous Catholics, the founders of churches and monasteries; with the Greek empire there was chronic war. From time to time they made raids into the unsubdued parts of Italy, and added a city or two to their dominions. But there was no sustained effort for the complete subjugation of Italy till Liutprand, the most powerful of the line. He tried it, and failed. He broke up the independence of the great southern duchies, Benevento and Spoleto. For a time, in the heat of the dispute about images, he won the pope to his side against the Greeks. For a time, but only for a time, he deprived the Greeks of Ravenna. Aistulf, his successor, carried on the same policy. He even threatened Rome itself, and claimed a capitation tax. But the popes, thoroughly irritated and alarmed, and hopeless of aid from the east, turned to the family which was rising into power among the Franks of the West, the mayors of the palace of Austrasia. Pope Gregory III. applied in vain to Charles Martel. But with his successors Pippin and Charles the popes were more successful. In return for the transfer by the pope of the Frank crown from the decayed line of Clovis to his own, Pippin crossed the Alps, defeated Aistulf, and gave to the pope the lands which Aistulf had torn from the empire, Ravenna and the Pentapolis (754–756). But the angry quarrels still went on between the popes and the Lombards. The Lombards were still to the Italians a "foul and horrid" race. At length, invited by Pope Adrian I., Pippin's son Charles once more descended into Italy. As the Lombard kingdom began, so it ended, with a siege of Pavia. Desiderius, the last king, became Charles's prisoner (774), and the Lombard power perished. Charles, with the title of king of the Franks and Lombards, became master of Italy, and in 800 the pope, who had crowned Pippin king of the Franks, claimed to bestow the Roman empire, and crowned his greater son emperor of the Romans (800).

3. To Italy the overthrow of the Lombard kings was the loss of its last chance of independence and unity. To the Lombards the conquest was the destruction of their legal and social supremacy. Henceforth they were equally with the Italians the subjects of the French king. Charles, the Carolingian king, expressly recognized the Roman law, and allowed all who would be counted Romans to "profess" it. Latin influences were not strong enough to extinguish the Lombard name and destroy altogether the recollections and habits of the Lombard rule; Lombard law was still recognized, and survived in the schools of Pavia. Lombardy remained the name of the finest province of Italy, and indeed for a time was the name for Italy itself. But what was specially Lombard could not stand in the long run against the Italian atmosphere which surrounded it, with its countless and subtle forces, social, political, and religious. Generation after generation passed more and more into real Italians. Antipathies, indeed, survived, and men even in the 10th century called each other Roman or Langobard as terms of reproach. But the altered name of Lombard also denoted henceforth some of the proudest of Italians; and, though the Lombard speech had utterly perished, their most common names still kept up the remembrance that their fathers had come from beyond the Alps.

But the establishment of the Frank kingdom, and still more the re-establishment of the Christian empire as the source of law and jurisdiction in Christendom, had momentous influence on the history of the Italianized Lombards. The empire was the counterweight to the local tyrannies into which the local authorities established by the empire itself, the feudal powers, judicial and military, necessary for the purposes of government, invariably tended to degenerate. When they became intolerable, from the empire were sought the exemptions, privileges, immunities from that local authority, which, anomalous and anarchical as they were in theory, yet in fact were the foundations of all the liberties of the Middle Ages in the Swiss cantons, in the free towns of Germany and the Low Countries, in the Lombard cities of Italy. Italy was and ever has been a land of cities; and, ever since the downfall of Rome and the decay of the municipal system, the bishops of the cities had really been at the head of the peaceful and industrial part of their population, and were a natural refuge for the oppressed, and sometimes for the mutinous and the evil doers, from the military and civil power of the duke or count or judge, too often a rule of cruelty or fraud. Under the Carolingian empire, a vast system grew up in the North Italian cities of episcopal "immunities," by which a city with its surrounding district was removed, more or less completely, from the jurisdiction of the ordinary authority, military or civil, and placed under that of the bishop. These "immunities" led to the temporary sovereignty of the bishops; under it the spirit of liberty grew more readily than under the military chief. Municipal organization, never quite forgotten, naturally revived under new forms, and with its "consuls" at the head of the citizens, with its "arts" and "crafts" and "guilds," grew up secure under the shadow of the church. In due time the city populations, free from the feudal yoke, and safe within the walls which in many instances the bishops had built for them, became impatient also of the bishop's government. The cities which the bishops had made thus independent of the dukes and counts next sought to be free from the bishops; in due time they too gained their charters of privilege and liberty. Left to take care of themselves, islands in a sea of turbulence, they grew in the sense of self-reliance and independence; they grew also to be aggressive, quarrelsome, and ambitious. Thus, by the 11th century, the Lombard cities had become "communes," commonalties, republics, managing their own affairs, and ready for attack or defence. Milan had recovered its greatness, ecclesiastically as well as politically; it scarcely bowed to Rome, and it aspired to the position of a sovereign city, mistress over its neighbors. At length, in the 12th century, the inevitable conflict came between the republicanism of the Lombard cities and the German feudalism which still claimed their allegiance in the name of the empire. Leagues and counter-leagues were formed; and a confederacy of cities, with Milan at its head, challenged the strength of Germany under one of its sternest emperors, Frederick Barbarossa. The struggle was terrible. At first Frederick was victorious; Milan, except its churches, was utterly destroyed; everything that marked municipal independence was abolished in the "rebel" cities; and they had to receive an imperial magistrate instead of their own (1158–62). But the Lombard league was again formed. Milan was rebuilt, with the help even of its jealous rivals, and at Legnano (1176) Frederick was utterly defeated. The Lombard cities had regained their independence; and at the peace of Constance (1183) Frederick found himself compelled to confirm it.

From the peace of Constance the history of the Lombards is merely part of the history of Italy. Their cities went through the ordinary fortunes of most Italian cities. They quarrelled and fought with one another. They took opposite sides in the great strife of the time between pope and emperor, and were Guelf and Ghibelline by old tradition, or as one or other faction prevailed in them. They swayed backwards and forwards between the power of the people and the power of the few; but democracy and oligarchy passed sooner or later into the hands of a master who veiled his lordship under various titles, and generally at last into the hands of a family. Then, in the larger political struggles and changes of Europe, they were incorporated into a kingdom, or principality, or duchy, carved out to suit the interest of a foreigner, or to make a heritage for the nephew of a pope. But in two ways especially the energetic race which grew out of the fusion of Langobards and Italians between the 9th and the 12th centuries has left the memory of itself. In England, at least, the enterprising traders and bankers who found their way to the West, from the 13th to the 16th centuries, though they certainly did not all come from Lombardy, bore the name of Lombards. In the next place, the Lombards, or the Italian builders whom they employed or followed, the "masters of Como," of whom so much is said in the early Lombard laws, introduced a manner of building, stately, solemn, and elastic, to which their name has been attached, and which gives a character of its own to some of the most interesting churches in Italy. (R. W. C.)

LOMBOK (called Tanah Sasak by the natives, and Saliparan or Selaparang by the Balinese, Lombok being properly the name only of a village on the north-east side), an island of the East Indian Archipelago, belonging to the lesser Sunda group, and separated from Bali by the Strait of Lombok, from Sumbawa by the Strait of Alas. It stretches from about 115° 44′ to 116° 40′ E. long. and from 8° 12′ to 9° 1′ S. lat., and its area is estimated at 2080 square miles. Rising out of the sea with bold and often precipitous coasts, Lombok is mountainous towards the south, and in the north-east contains one of the principal volcanic summits of the whole archipelago—Rindjani or peak of Lombok, 8688 feet according to Horsburgh's measurement, 12,379 according to Melvill de Carnbée, and 11,834 according to Smits. There is no active crater in the island, but in 1815 it suffered severely from the eruption of Tombora on the neighboring island of Sumbawa. Of the numerous streams by which it is watered none are navigable except by small boats; among the mountain lakes Segara Anak, lying some 9000 feet above the sea, is noteworthy in point of size. The best harbor is Ampanan (8° 34′ 15″ S. lat., 116° 3′ 40″ E. long.) on the west coast, often visited by European and American vessels; that of Labuhan Tring farther south is also good, but less frequented. Forest-clad mountains and stretches of thorny jungle alternating with rich alluvial plains, cultivated like gardens under an ancient and elaborate system of irrigation, make the scenery of Lombok exceedingly attractive; and to the naturalist it is of particular interest as the frontier island of the Australian region, with its cockatoos and megapods or mound builders, its peculiar bee-eaters and ground thrushes. Rice is the principal export; ponies, skins, ducks' eggs and other eggs, and edible nests, are also sent from the island. The rajah of Lombok (who has his capital at Mataram, a large village on the west coast, and his country seat at Gunong Sari) is tributary to the susuhunan of Bali and Lombok; he has possession of the whole island, which was formerly divided into the four states of Karang-Asam Lombok on the west side, Mataram in the north-west, Pagarawan in the south-west, and Pagutan in the east. Balinese supremacy dates from the conquest by Agong Dahuran in the beginning of the present century; the union under a single rajah dates from 1839. The population is variously estimated. The *Woordenboek van Ned. Ind.* (1869) gives about 405,000 souls; Behm and Wagner conjecture 100,000 in 1880. The greater portion are Sassaks, as the Mohammedanized native stock are called; but the dominant Balinese, who still retain their Buddhist creed, may amount to about a twentieth of the whole.

See Zollinger, in *Tijdschrift voor Ned. Ind.*, Jaarg. ii.; J. P. Freyss, in the *Tijdschr. v. Ind. taal- land- en volkenkunde*, ix. (3d series); Melvill de Carnbée, in *Moniteur des Indes*, 1847; W. R. van Hoevell, *Reis over Java*, etc.; Wallace, *Malay Archipelago*.

LOMONÓSOFF, **Mikhail Vasilievich** (1711-1765), was born in the year 1711, in the village of Denisovka (which in later times has had its name changed in honor of the poet), situated on an island not far from Kholmogorī, in the government of Archangel. His father, a fisherman, took the boy as soon as he was ten years of age to assist him in the labors of his calling; but his eagerness for knowledge was unbounded. The few books accessible to him he almost learned by heart; and, seeing that there was no chance of his stock of knowledge being enlarged under the arctic skies of his native place, he resolved to betake himself to Moscow in the best way he could. An opportunity occurred when he was seventeen years of age, and by the intervention of friends he obtained admission into the Zaikonospasski school. There his progress was very rapid, especially in Latin, and in 1734 he was sent from Moscow together with other promising students to St. Petersburg. There again his proficiency, especially in physical science, was remarked by all, and he was one of the young Russians chosen to complete their education in foreign countries. He accordingly commenced the study of metallurgy at Marburg; but, not content with his work under the professors, he now began to write poetry, imitating German authors, among whom he has said to have especially admired Günther. His *Ode on the Taking of Khotin from the Turks* was composed in 1739, and attracted a great deal of attention at St. Petersburg. During his residence in Germany Lomonósoff married a native of the country, and found it difficult to maintain his increasing family on the scanty allowance granted to him by the St. Petersburg Academy, which, moreover, was irregularly sent. His circumstances became embarrassed, and he resolved to leave the country secretly, and to return home. On his arrival in Russia, after an adventure with a Prussian recruiting officer which at one time threatened serious consequences, he rapidly rose to distinction, and was made professor of chemistry in the university of St. Petersburg; he ultimately became rector, and in 1764 secretary of state. He died in 1765.

The most valuable of the works of Lomonósoff are those relating to physical science, and he wrote upon many branches of it. He everywhere shows himself a man of the most varied learning. He compiled a Russian grammar, which long enjoyed popularity, and did much to improve the rhythm of Russian verse. Many of his poems are good, but they do not constitute his chief claim to be remembered. The school upon which he formed himself as a poet was a bad one. We must remember that these were the days of falsely-conceived classicism, and the French taste upon which all the literature of Europe was moulded. His great merit is that he belongs to the glorious band of patriots, which includes such men among Slavs as Dositei Obravodich, Raich, and Primus Truber,—men whose object was to elevate and give dignity to their country,—earnest toilers in the field of national education.

LOMZA, or **Lomzha**, a government of Russian Poland, is bounded on the N. by Prussia and the Polish government of Suwalki, on the E. by the Russian government of Grodno, on the S. by the Polish governments of Siedlce and Warsaw, and on the W. by that of Plock. It covers an area of 4670 square miles, or 9½ per cent. of all Poland. It is mostly flat or undulating, with a few tracts in the north and south-west, where the deeply-cut valleys give a hilly aspect to the country. Extensive marshes overspread it, especially on the banks of the Nareff, and in the east there are also good forests. Lomza is traversed by the Nareff, which flows from east to south-west, joining the Bóg in the south-western corner of the government. The Bóg flows along the southern border, joining the Vistula 20 miles below its junction with the Nareff. The inhabitants numbered 501,385 in 1872, the Poles constituting 76 per cent. of the population (or 83 per cent. when the Poles who are mixed with Lithuanians are included), the Jews 14½ per cent., and the Germans 2 per cent. Of this population 402,146 belonged in 1870 to the Catholic Church, 10,354 to the Protestant, and 1817 to the Greek and United Churches. In 1878 394.570 were peasants, while only 76,950 belonged to the citizen class, and 11,470 to the nobility (*szlachta*). In 1877 45 per cent. of the total area, or 1,366,000 acres, were under crops. Stock raising is carried on to some extent (197,900 cattle, 263,700 sheep, and 68,705 horses). The wood trade is an important branch of industry, but manufactures are very imperfectly developed, the total production in 1873 having been only some £110,000, or 1·3 per cent. of the total for Poland. Lomza produces some wooden wares, spirits, tobacco, and sugar. There is only one railway (between Grodno and Warsaw); the Bóg is navigable, but only wood is floated down the Nareff. The province is divided into eight districts, of which the chief towns are Lomza (13,860), Pultusk (7950), and Ostrolenka (6900) on the Nareff; Mazowiec (2750), Ostrów (6300), Maków (6600), Kolno (4800), and Szczuczyn (4750). Tykocin (5400) and Nasielsk (6250), although not district towns, have lately acquired some importance.

Lomza, capital of the above province, on the Nareff, 80 miles north-east from Warsaw, and 30 miles north from the Chizheff station of the railway between Warsaw and Grodno, had a population in 1872 of 13,860.

Lomza is an old town, one of its churches having been erected before the year 1000. In the 16th century it carried on a brisk trade with Lithuania and Prussia. It was well fortified and had two citadels, but nevertheless had often to suffer from the invasions of Germans and Tartars, and in the 17th century it was twice plundered by the Cossacks of the Ukraine. In 1795 it fell under the dominion of Prussia, and after the peace of Tilsit it came under Russian rule.

LONDON.

Plates IX., X.

LONDON, the metropolis of England, and the chief town of the British empire, is situated on both banks of the river Thames, about 50 miles from its mouth, St. Paul's Cathedral being in 51° 30′ 48″ N. lat. and 0° 5′ 48″ W. long. The old City of London is wholly included in the county of Middlesex, but the town beyond the City limits extends into portions of three other counties,—namely, Surrey and Kent on the south, and Essex on the east. The area and population of the various governmental divisions of London are given below (pp. 830, 831).

Geology.

SITE.—A great part of London is built on sands and gravels belonging to the Drift period, marking the ancient bed of a much larger river than the present Thames. This formation, resting immediately on the London Clay, extends along both banks of the present river, with an average breadth of about 2 miles; but in some parts there is immediately adjoining the banks a considerable breadth of alluvial deposits, or occasionally of artificially constructed embankments. On the north bank the alluvial soil comprehends the greater part of Westminster; on the south bank it stretches east from Lambeth Bridge, gradually widening to a breadth of about half a mile, and from Southwark to Deptford occupying a still wider area. The sands and gravels again occur at Greenwich Hospital, but are succeeded by the Greenwich and Woolwich marshes. The Isle of Dogs opposite Greenwich is constructed wholly of artificial embankments, and at one time the area it now occupies formed part of the mouth of the Lea, along whose banks the alluvial formation runs northwards between Bow and Stratford to Stoke Newington, widening to a considerable area at the marshes of West Ham and Plaistow. At Fareham, Battersea Park, Cheapside, Victoria Park, and to the south of Stoke Newington, there are considerable areas occupied by brick earth. The London Clay crops to the surface throughout the whole of north-west London, with the exception of a small portion to the south of Regent's Park, which is encroached upon by the sands and gravels, and the summits of Hampstead and Highgate, which are occupied by the silicious sands of the Bagshot series. In west London the Clay extends south to Kensington Gardens, and in north London it occupies part of Islington and the district north of Highbury and Stoke Newington. South of the Thames it encroaches irregularly on Wandsworth, Clapham, Camberwell, and Deptford, and comprehends nearly all the district round Sydenham. The Lower Tertiaries are represented by the Thanet sands at Greenwich and in the neighborhood of Deptford, by the Woolwich and Reading beds, which occur at Camberwell, Dulwich, and Lewisham, and by the Blackheath beds, which are best seen at Blackheath. Chalk, the basement rock of the London basin, and the source of the water supply for the deep wells, only crops to the surface in the neighborhood of Greenwich.

Surface.

The original surface of the soil of London has been much altered in the course of generations, the depth of made earth being often very great. At one period the Thames flowed straight from Lambeth to Limehouse, and the greater part of the district now stretching south and east of the river to the range of heights in the neighborhood of Sydenham and Greenwich was occupied by marshes or shallow lagoons. North of the Thames the greater part of London is built on several ranges of small eminences lying between the river and the northern heights of Hampstead (430 feet), Highgate, and Hornsey. The original city clustered round the eminence now crowned by St. Paul's, and formerly intersected by the ravine of the Walbrook. To the north and east it was bounded by an extensive fen, from which Finsbury takes its name. To the west was the Fleet river, which flowed from Hampstead in a south-easterly direction to King's Cross, and then more southerly to Clerkenwell, where on account of the steepness of its banks it received the name of Holebourne or Hollowburn. It was navigable to King's Cross, and for a long period formed a convenient and well-protected harbor for the city. A more extended elevation, included in the district now occupied by the Inns of Court, Bloomsbury, and Soho, was bounded on the west by the Tyburn, which rose near the Swiss Cottage, and, after an easterly course till reaching the present Regent's Park, flowed southwards nearly in the line of Marylebone Lane and Bond Street. Tyburn Hill was bounded on the west by the Westbourne; and to the south and west an extensive range of low ground, now included in Westminster, Pimlico, Chelsea, and Kensington, was in early times for the most part covered by water. Westwards the low ground is bounded by Notting Hill, whence an elevated region lying between the smaller eminences and the "northern heights," and including Primrose Hill, runs in a north-westerly direction to Camden Town, Islington, and Highbury. The hilly regions in the neighborhood of Kensington and Notting Hill formed part of an extensive forest, and St. John's Wood was originally a dense thicket.

Administrative history.

GOVERNMENT AND ADMINISTRATION.—At first the municipal constitution of London was loose and disjointed in its form, resembling that of the shire rather than the town, but even from the time of Henry I. the independence of its jurisdiction was complete, and the citizens, besides the right of inheritance and tenure not then possessed by the rest of England, enjoyed exemption from the Danegeld and from similar obligations. By the 13th century the later form of the municipality was already shaped in its main features, although at this stage residence in the borough and not membership in a trade guild was the basis of citizenship. This in some respects premature development of municipal functions has always given to London a peculiar and unique position in respect of municipal government. Its charters, which in early times served as the model for charters to new incorporations, have defied the attacks of reform. The system of government was more heterogeneous and complicated than that of other English towns. London is practically a borough by prescription, and its special rights and privileges have made those who possess them distrustful of change. The mere extent of the new city surrounding the old, and the rapidity of its growth, have also tended to postpone the attempt to grapple with the problem of its government. Until 1855, when the Metropolitan Board of Works was formed, the whole administration of the metropolis was of a mediæval character. The City was governed by old charters, confirmed but not interpreted by a special Act of William and Mary, and the various parishes of the rest of the metropolis had each its own peculiar system of administration, regulated by local Acts which differed widely in different localities. No direct change of vital importance was made in the constitution and functions of the City corporation by the Metropolis Local Management Act of 1855, but the very existence of the Metropolitan Board implied a certain limitation of its authority, and the additional functions conferred by successive Acts on the Metropolitan Board have in some degree circumscribed its influence. As modified by the Act of 1855,[1] the government of London within what is known as the metropolitan area consists of the City Corporation, the Metropolitan Board of Works, and thirty-eight vestries and district boards; while various authorities, to be afterwards mentioned, exercise jurisdiction in special matters over the whole area of the metropolis or in separate localities.

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[1] [By Act of 1888, about 118 square miles were erected into the county of London, containing fifty-seven districts, each of which elects two councillors, the City adding four. The County Council superseded the Metropolitan Board of Works, and it elects nineteen alderman associates for six years each; councillor's term is three years.—AM. ED.]

Government of the City.

The City of London, which is a county in itself, and with which the borough of Southwark is assimilated, is governed by a lord mayor, twenty-six aldermen, and two hundred and six common councilmen, forming a Court of Common Council. This court has a certain independent power to enact regulations for the government of the City, is entrusted with the management of the finances and the estates of the corporation, elects most of the officials, and controls the police. The City elects a sheriff of Middlesex as well as a sheriff of London; and the lord mayor is elected by the trade guilds in common hall from among the aldermen who have served as sheriffs. He is lord lieutenant within the City, the dispenser of its hospitality, the chairman of the courts of the corporation, and holds certain other offices, the dignity of which is now almost entirely nominal. The aldermen, who hold office for life, are chosen by the several wards, each ward electing one. Since 1867 the power of election has been enjoyed by all possessing the household and lodger franchise. The Court of Aldermen has the power of appointment to certain offices, exercises judicial functions in regard to licensing and in disputes connected with the ward elections, has some power of disposal over the City cash, and possesses magisterial control over the City, each alderman being a judge and magistrate for the whole City, and by virtue of his office exercising the functions of a justice of the peace. The common councillors were chosen originally in the reign of Edward I. as assistants to the aldermen, and in 1384 were constituted a standing committee to regulate the affairs of the City, each ward choosing four, six, or eight, according to its size. A gradual increase in their number took place until 1840, when it was fixed at two hundred and six. From the time of Richard II. the election was vested in freemen householders, but it is now regulated by the Act of 1867. The Court of Common Hall, formerly the popular assembly or ancient *folkmote*, is now composed of the lord mayor, four aldermen, and the liverymen of the city guilds, and nominates yearly two aldermen, who must previously have been sheriffs, for the Court of Aldermen to select one for the office of lord mayor. The sheriffs are themselves chosen by the Court of Common Hall, which also appoints the chamberlain, the bridge masters, and the city auditors.

City guilds.

The fragmentary and indirect participation in the government of London at present exercised by the livery companies represents the remnants of an influence which was paramount from the time of Edward III., when enactments were passed which made admission to the freedom of the city dependent on membership in a trade or mystery. Originally established to afford mutual aid to members of their "craft," the guilds of London gradually assumed a certain control over their trade or manufacture, and by the payment of large sums of money obtained various monopolies, with the power to make by-laws for the regulation of their craft. From gifts for charitable purposes, and from entrance money and fines, many of the guilds, on account of the rise in the value of property, have amassed enormous wealth. Within the limits of the City alone the gross annual rental of the land possessed by them is over £500,000, and it is believed that the land they possess outside its limits is of equal value. At one time their number was over one hundred, but they now number seventy-six, and some represent trades which are extinct. Twelve so-called "great companies" claim precedence over the others, but of these some are not so wealthy as a few of the less highly privileged. The "livery" or dress of the companies, first formally adopted in the reign of Edward III., was ultimately worn only by a higher grade of the members called liverymen. The extension of London beyond the City limits and changes in trade maxims and in social life have now left them little more than the shadow of their former authority over trade and manufacture, but a few, such as the fishmongers, the stationers, the goldsmiths, and the apothecaries, still discharge certain functions in the regulation of their several crafts. Besides administering their charities, many of the companies contribute largely to benevolent objects of pressing need, and some take an interest in promoting technical instruction, and in various matters relating to their special trade or manufacture; but the business of most of them is now chiefly of a ceremonial kind. The halls of the companies number thirty-five, and many of them are of interest either from their architectural merits, their antiquarian associations, or the portraits or other objects they contain. Their annual assessed value is over £60,000. The hereditary connection of the companies with the corporation, their large ownership of property in the City, and their control over so many charities still enable them to exercise a very great influence in municipal affairs.

The following list (Table I.) gives details regarding the twelve great companies, and six other companies which may be ranked next to them in importance:—

Name.	Date.	Situation of Hall.	Purchase of Freedom.	Livery Admission.
Great Companies.			£ s. d.	£ s. d.
Mercers	1393	Cheapside	...	...
Grocers	1345	Poultry	4 11 0	23 10 0
Drapers	1364	Throgmorton Street	108 0 0	26 5 0
Fishmongers	1363	Upper Thames Street	113 10 6	31 15 0
Goldsmiths	1327	Foster Lane	1 19 0	63 7 0
Skinners	1327	Dowgate Hill	...	...
Merchant Taylors	1466	Threadneedle Street	84 0 0	80 8 0
Haberdashers	1448	Gresham Street	84 0 0	...
Salters	1530	St. Swithin's Lane	...	20 0 0
Ironmongers	1464	Fenchurch Street	110 1 6	45 5 0
Vintners	1363	Upper Thames Street	126 0 0	...
Clothworkers	1480	Mincing Lane	110 11 6	108 17 0
Other Companies.				
Apothecaries	1615	Water Lane	105 0 0	22 0 0
Armorers	1452	Coleman Street	113 18 0	33 2 6
Barbers	1462	Monkwell Street	...	40 2 6
Cordwainers	1410	Cannon Street	60 0 0	40 0 0
Saddlers	1364	Cheapside	63 0 0	20 5 0
Stationers	1556	Ludgate Hill	33 0 0	70 0 0

Special prerogatives of the City corporation.

The corporation of the City of London still retains certain exceptional prerogatives. The lord mayor's court still exercises civil jurisdiction, the two courts of the sheriffs' compter survive in the City of London court, and the lord mayor exercises the functions of judge in the central criminal court, which superseded the court of oyer and terminer in 1834, and extends beyond the radius of the Metropolitan area. The corporation possesses the sole right to establish markets within 7 miles of the City; it enjoys a metage of grain, partially commuted in 1872 to a fixed duty chargeable by weight, and applied to the preservation of Epping Forest and other open spaces; and it levies coal and wine duties, continued by various Acts, for defrayment of the cost of public improvements. Most of the work of the corporation is performed by committees; and "commissioners of sewers," under act of Parliament, have charge of the cleaning, lighting, and paving of the streets.

City accounts.

A large portion of the City income is derived from rents, which have increased from £3488 in 1692 to £19,199 in 1785, £45,269 in 1825, and £117,781 in 1881. In 1692 the City markets were farmed for £3100, the profit being about £2500; in 1785 their revenue was £15,631, and the profit £2621; in 1825 these were respectively £58,958 and £52,271; and in 1881 they were £152,816 and £20,911. The total revenue of the City in 1692 was £11,658, in 1785 £59,356, and in 1881 £896,688, not including the public and trust accounts, which are regulated by various Acts of Parliament. They include the Bridge-House estate account, the sewers rate, the Metropolitan Board of Works sewers rate, the police rate, the ward rate, and the duties on coal, wine, and grain. The total charge of the government establishment in 1692 was £3947, and in 1881 it was £51,855, not including £7866 spent in pensions of officials. In 1692 the lord mayor received an annual sum of £100 for his care of the market, and an ancient fee of £80 out of the chamber. He has now an annual salary of £10,000, and in addition to this his personal expenses in 1881 amounted to £4433. The salaries of the recorder, the chamberlain, the common sergeant, the town-clerk, and some other officers have risen in a somewhat similar proportion. The City in 1692 spent nothing on special acts of hospitality or on the promotion of literature, science, or art, while its contribution to the poor rates was only £66. It now spends several thousands annually on the reception of eminent persons, while to the London almshouses it in 1881 contributed £1884, to general charitable purposes £5179, for education £5394, for technical instruction £2000, for the Guildhall library and museum £5398, and for music £3027. The debt of the corporation, which is solely connected with the construction of improvements and public markets, was on December 31, 1881, £5,496,150, the money spent for these purposes since 1759 being nearly £10,000,000. The ratable value of the City and liberties has since 1801 increased sevenfold, having risen from £507,372 to £3,535,494.

Corporation buildings.

The Guildhall, rebuilt by Dance in 1789, contains the greater part of the walls of the old building of 1411, which was damaged by the fire of 1666, and also the crypt divided into three aisles by clustered columns of marble supporting a groined roof richly adorned with carvings. The principal front was restored in 1867 in the Gothic style. In addition to the great hall used for state banquets and receptions, the building contains the common council chamber, the aldermen's room, and several courts of justice. Adjoining the Guildhall is the free library of the corporation, and a museum of antiquities relating to the City. The Mansion House at the east end of the Poultry, erected in 1740 from the designs of Dance, is the official residence of the lord mayor. In addition to the justice room and various reception rooms, it contains the Egyptian hall, in which certain special banquets of the lord mayor are held.

Metropolitan Board.

By the Metropolis Local Management Act of 1855, the metropolis was divided into thirty-nine vestries or district boards,[1] which elect the forty-five members who form the Metropolitan Board of Works, the city of London electing three members, each of the six great parishes of Islington, Marylebone, St. Pancras, Lambeth, St. George's (Hanover Square), and Shoreditch two members, and the other districts one each or one in combination. The board was originally established for the formation and maintenance of main sewers, but later Acts have made it the administrative authority of the metropolis in a great variety of other matters, including the construction of main thoroughfares, the carrying out of great metropolitan improvements, the formation of new streets, the construction and maintenance of parks, the preservation of commons and open spaces, the maintenance of the fire brigade, and the administration of certain enactments specially applicable to the metropolitan area. The total sum raised by the board for application to its various purposes since 1856 to 31st December, 1881, was £28,689,749, and its net liability on the 31st December, 1881, was £13,437,940. The capital required for the execution of great works is raised by the issue of stock bearing interest at the rate of 3½ and 3 per cent., which has the same facilities of transfer as the Government stocks, and is redeemable in sixty years from creation. The rate per pound levied by the board has varied very greatly, being 2·09d. in 1856, and as high as 6·99d. in 1867, while for 1883 it is estimated at 6·2d. The total net charge in 1880 was £652,213, and for 1882 it is estimated at £715,822. The ratable annual value of property in the metropolis has risen from £11,283,663 in 1856 to £27,386,086 in 1882.

Vestries.

The vestries and district boards are entrusted with the management of local sewers, the lighting, paving, and cleaning of their own thoroughfares, and the removal of nuisances. For paving, except in the old main thoroughfares, they have power to charge adjoining properties, and in several districts a small income is obtained from realized property. The total amount of money advanced to them on loan by the Board of Works up to 31st November, 1881, was £3,631,769, of which £3,297,430 was redeemable by 1929 and £334,338 by 1941.

Other administrative authorities.

The School Board of London has in regard to education a rating and legislative authority over a district corresponding with that of the Metropolitan Board of Works. The metropolitan police force outside the City limits and within a radius of 12 miles of Charing Cross is under the control of the Home Secretary. The Tower of London is governed by the constable of the Tower, assisted by fifty magistrates, and the borough of Westminster is still under the nominal care of the dean and burgesses. The Metropolitan Asylums Board, the Burial Board, the Thames Conservancy Board, and the Lea Conservancy Board constitute the principal other direct governing authorities having relation to London, but the water and gas companies enjoy monopolies which imply a certain degree of irresponsible authority, and a right of taxation not sufficiently defined and limited. Within an area less than the district of the Board of Works there are ten parliamentary boroughs, which return in all twenty-two members, the City returning four members, and Southwark (from 1295), Westminster (1547), Marylebone (1832), Finsbury (1832), Tower Hamlets (1832), Greenwich (1832, extended in 1868), Lambeth (1832), Hackney (1868), and Chelsea (1868), two each. London University (1868) returns one member.

Growth.

GROWTH AND POPULATION.—For some centuries after the Conquest there are almost no data for an estimate of the extent and population of London, but a great impulse was given to its increase by the settlement of Normans and the opening up of intercourse with the Continent. The statement of Fitzstephen that it furnished, in the reign of Stephen, 60,000 men-at-arms and 20,000 knights, cannot be accepted as applying only to the City. Peter of Blois, under Henry II., only estimated its numbers at 40,000, although he may possibly have referred only to adults (*Opera*, ed. Giles, vol. ii. p. 85). In any case, previous to the great plague of 1349 it must have numbered at least 90,000, for in that year, according to Stow, as many as 50,000 persons were buried in the cemetery of Spitalcroft, specially consecrated for the purpose. There were severe ravages from the same cause in 1361 and 1369; and the calculation of Chalmers (*Comparative Estimate of Great Britain*, 1802), founded on the Subsidy Rolls of 1377, shows a population of only 34,971; but the emperor Manuel II., who visited it in 1400, states that it was to be preferred to every city of the West for population, opulence, and luxury (Macpherson, *Annals of Commerce*, vol. i. p. 611). Notwithstanding the regulations of Elizabeth for checking its growth, London had by the end of the century advanced considerably beyond its old boundaries. Giovanni Botero, writing about 1590, classes it with Naples, Lisbon, Prague, and Ghent, as possessing about 160,000 inhabitants more or less, while Paris was said to possess over 400,000 inhabitants. The "Bills of Mortality," which were begun in 1592, were in 1604 extended to St. Bartholomew the Great, Bridewell Precinct, and Trinity in the Minories, which were partly within the City liberties, and to St. Clements Danes, St. Giles-in-the-Fields, St. James (Clerkenwell), St. Catherine (Tower), St. Leonard (Shoreditch), St. Mary in Whitechapel, St. Martin-in-the-Fields, and St. Mary Magdalen (Bermondsey). St. Mary at the Savoy was added in 1606, and Westminster in 1626. The parishes of Hackney, Islington, Lambeth, Newington, Rotherhithe, and Stepney, which were included in 1636, were, according to Graunt (*Observations on the Bills of Mortality*, 1676), still country villages in 1672, and indeed occupied an isolated position up to the middle of the 18th century. The result of the census of the city taken in 1631 is given by Graunt as 130,178, but the sum of his details is 130,268. By 1661 he reckoned it to have increased to 179,000. He also concluded that the population within the limits of the "Bills of Mortality[1] was 460,000, and that from the beginning of the century it had increased from 2 to 5. The population of London and its suburbs, excluding Westminster and the distant parishes, he placed at 384,000, or about a fourth less than Paris. Notwithstanding the plague of 1665 and the fire of 1666, London towards the close of the 17th century increased with great rapidity. Evelyn, writing in 1684, states that it had nearly doubled within his own recollection. Sir William Petty, in his *Essay on Political Arithmetic*, estimated the population in 1683, including that of Westminster and Southwark, at 696,000, but Gregory King, in his *Observations on the State of England*, first published by Chalmers, allowing 5½ persons to every house, makes it in 1694, within the limits of the "Bills of Mortality," only 530,000. From about this period London superseded Paris as the largest city in Europe. During the first half of the 18th century its progress was fluctuating, but on the peace of 1763 a great impulse was given to its prosperity, and after 1780 a rapid rate of progress commenced, which still shows no signs of diminution. Until 1756 there was sufficient space for the Mayfair east of Hyde Park, but by the end of the century the aristocracy had nearly all migrated west from Covent Garden and Soho. Islington was still almost disjoined from the metropolis, but the great eastern suburbs had become so consolidated as almost to absorb even Hoxton, Bethnal Green, and Stepney. The first census of 1801 included St. Pancras, Marylebone, Paddington, Kensington, and Chelsea, but Chelsea was still a solitary suburban retreat, Kensington was little more than "the old court suburb," Paddington and Westbourne were rural hamlets, and Marylebone and St. Pancras had less than one-fourth of their present population. The populous city surrounding Regent's Park had scarcely any existence before 1820, but by 1830 it as well as Somers Town had become absorbed in the metropolis, especially by additions in the neighborhood of St. Pancras church and London university. Eastwards the most rapid extension had been in the direction of Greenwich, which was now united with Lambeth by a continuous line of houses. Belgravia in the south-west, and Tyburnia to the north of Hyde Park are chiefly the product of the next twenty years. Since that period the suburban districts have in all directions become almost consolidated, and beyond the present limits of the registrar-general fringes of houses, extending in some instances outside even the 12 miles circuit from Charing Cross, connect the metropolis with populous towns which a few years ago were solitary hamlets. Within the last twenty years the rate of increase of the outer ring of this greater London has been 126·8 per cent., while that of London proper has been only 36·0, its outer ring showing an increase of 63·8 per cent., but its central area a decrease of 13·2,—the decrease in the City being 54·8, in the Strand 30·5, St Giles 16·3, Holborn 9·5, Westminster 11·9, St. George's (Hanover Square) and Marylebone 4·1, and in the eastern central districts of Whitechapel, St. George-in-the-East, and Shoreditch 9·6, 3·8, and 2·2 respectively. In these latter districts the decrease has been occasioned chiefly by improvements, but in the central business districts it is almost entirely the result of the substitution of business premises for dwelling-houses. The day census of the City taken in 1866 shows that the number of persons employed daily within its limits was 170,133, and that of 1881 gives a day population of 261,061, while the night population in 1871 was 74,897 and in 1881 only 50,526. The rapidity of the growth of London is largely due to the peculiar development of its trade and commerce, and is also closely connected with the interest excited by politics and the meetings of parliament. The bonds of connection between London and England thus pulsate daily with a manifold vitality. London is the emporium of England, the centre of its great monetary transactions, the home of its science, literature, and art, and the yearly resort of its aristocratic and landed proprietor classes. Since the beginning of the century its rate of increase has exceeded that of England generally.

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[1] [By Act of 1885 there were fifty-seven districts formed, but the functions of the Metropolitan Board have been given to the new County Council.—AM. ED.]

Nationalities.

The proportion of inhabitants born outside its limits amounts to one-third of its entire population. The number of the natives of European states is in excess of those born in Scotland, and that of the natives of Ireland is about double, while the natives of the counties of England and Wales amount to more than a million. Irishmen by descent may be estimated at about 250,000 persons, Scots 120,000, foreigners 200,000, viz., Asiatics, Africans, and Americans together 45,000, Europeans 155,000 (Germans 60,000, French 30,000, Dutch 15,000, Poles 12,000, Italians 7500, Swiss 5000). The number of Jews is about 40,000. The special foreign district of London is that of Soho; another foreign district lies in the neighborhood of Ratcliff Highway, now St. George Street. The lower-class Jews inhabit the neighborhood of Houndsditch and Aldgate. The Italian street musicians and vendors of ices form a small colony near Hatton Garden.

Tables of population.

Table II. shows the percentage of the population of London to the rest of England, the numbers before 1801 being only approximate; Table III. the areas, houses, and population of London in various governmental divisions; and Table IV. the population of the several registration districts at different periods from 1801.

TABLE II.

	1550.	1600.	1650.	1700.	1750.	1801.	1821.	1841.	1851.	1861.	1871.	1881.
Population	90,000	180,000	350,000	550,000	600,000	864,035	1,227,590	1,872,365	2,362,236	2,803,989	3,254,260	3,814,571
Percentage to England	3·60	3·27	6·26	9·16	9·16	9·72	10·23	11·78	13·18	13·97	14·33	14·69

TABLE III.

	Area[1] in Acres.	1861. In-habited Houses.	1861. Population.	1861. Persons to an Acre.	1871. In-habited Houses.	1871. Population.	1871. Males.	1871. Females.	1881. In-habited Houses.	1881. Population.	1881. Persons to an Acre.
London Police District, "Greater London"	441,587	434,580	3,222,720	7	528,794	3,885,641	1,819,896	2,065,745	645,818	4,764,312	11
Registration London	75,362	350,421	2,803,989	37	417,767	3,254,260	1,523,151	1,731,109	486,286	3,814,571	51
London under the Board of Works and School Board	75,490	360,065	2,818,862	37	419,642	3,266,987	1,528,318	1,738,669	488,995	3,832,441	51
Parliamentary Boroughs District—											
City of London	668	13,298	112,063	168	9,805	74,897	36,459	38,438	6,493	50,526	76
Borough of Chelsea	7,028	...	...	...	35,020	258,050	112,526	145,524	47,954	366,516	52
" Finsbury	5,147	44,363	386,844	75	51,818	452,484	213,259	239,225	59,952	524,480	102
" Greenwich	8,561	...	...	...	26,078	169,361	83,680	85,681	30,842	206,651	24
" Hackney	4,700	...	...	...	49,259	362,378	171,742	190,636	55,865	417,191	89
" Lambeth	5,655	45,252	298,082	53	54,981	379,048	177,189	201,859	69,222	498,967	88
" Marylebone	5,429	48,000	436,296	80	52,290	477,532	211,710	265,822	58,863	498,311	92
" Southwark	1,990	25,683	193,443	97	26,965	208,725	104,620	104,105	27,526	221,866	111
" Tower Hamlets	4,097	...	...	...	51,310	391,790	193,549	198,241	55,965	438,910	107
" Westminster	2,546	26,480	253,965	99	25,484	246,606	115,539	131,067	25,312	228,932	89
Total of Parliamentary Boroughs District	45,841	334,318	2,640,253	58	331,955	3,020,871	1,420,273	1,600,598	482,984	3,452,350	75

[1] Exclusive of area under Thames.

Streets.

STREETS, BRIDGES, etc.—By the non-adoption of Wren's plans the opportunity afforded through the great fire was forever lost of constructing a model capital, and within the City limits the streets are still in many cases confused and intricate. The total absence of plan in the construction of the nucleus of London has doubtless tended to aggravate the confusion outside the old boundaries. The growth of the immense new outer city was, moreover, for centuries totally unregulated by the control of any central authority. The principal lines of streets formed along the old public highways are insufficient as main lines of communication for the increased population, and the absence of direct connection between important points causes traffic to be enormously impeded. The longest line of street communication in London is that which is formed by the junction of the lines of the Edgeware and Uxbridge Roads at the Marble Arch, whence it extends eastward by Oxford Street, Holborn, Newgate Street, Cheapside and other important City streets, Whitechapel Road, and Mile End Road to Bow. At Cheapside a branch from it runs westward by Fleet Street, the Strand, Haymarket, Piccadilly, and Knightsbridge to Kensington. Much of the effect of the fine architecture of the City streets is totally lost from promiscuous crowding, and the main connecting streets between the City and the West End display, at certain parts, much meanness and incongruity. Regent Street, the most fashionable thoroughfare of London, possesses ample width, and the splendor of its shops to some extent atones for the plain monotony of its regular architecture. In Oxford Street, which ranks next to it in importance, many buildings of a more ornamental character have lately been erected. Piccadilly, the eastern half of which is occupied chiefly by shops, and the western by dwelling houses and clubs, is a medley of every species of architecture, but is to some extent effective from the variety of its contrasts, and its outlook to the Green Park. Trafalgar Square, with its fountains, its Nelson column, its statues, and its wide expanse, has an airy and pleasant effect, but the huge erections which surround it are a very miscellaneous group, and few of them are worthy of the site. The clubs and hotels in Pall Mall and its neighborhood represent every variety of Grecian and Italian architecture. The private houses in the more fashionable regions are not remarkable for external beauty, but in summer time flowers and foliage give the West End squares and terraces a bright and pleasant aspect. A special characteristic of London is the enormous space covered by the suburban cottages and villas of the middle classes. Close to the most fashionable regions there are many mean back streets tenanted by workmen, but the principal territories of the working classes are comprehended in the dense and dreary districts east and south-east of the City. The improvements lately carried out in the City and other central districts, and the substitution of business premises for dwelling houses, have compelled large numbers of these classes to live at a long distance from their work, and also caused undue crowding in the less remote regions. The running of workmen's trains from the suburbs and the efforts of various private building associations and of the Metropolitan Board, guided by the Artisan and Laborers' Dwellings Improvement Act, have only partially mitigated these evils.

Street improvements.

Since 1785 the greater part of London within the city limits has been rebuilt, and its streets have been much altered, the principal improvements being the reconstruction of the lines from London Bridge to Finsbury Pavement, and from Blackfriars Bridge to Farringdon Road, both intersecting the City from north to south; the rebuilding of Bartholomew Lane, Lothbury, Threadneedle Street, and Cannon Street from King William Street to St. Paul's; and the construction, in conjunction with the Metropolitan Board, of the Holborn Viaduct and of Queen Victoria Street from Blackfriars Bridge to the Mansion House. The Metropolitan Board now exercises a certain control over the formation of new streets, but its powers are hampered by previous circumstances and by various restrictions. The principal new thoroughfares opened up by the board, besides Queen Victoria Street and the Holborn Viaduct, are Garrick Street,

TABLE IV.

	Area in Acres.	1801.		1841.		1861.	1871.	1881.	
		Population.	Persons to an Acre.	Population.	Persons to an Acre.	Population.	Population.	Population.	Persons to an Acre.
City of London within the walls	380	63,832	168	54,626	144	44,400	28,098	...	...
City of London within and without the walls	668	128,269	192	123,563	185	112,063	74,897	50,526	76
London City and Westminster	3,207	281,541	88	345,805	108	362,804	318,097	279,458	87
London City, Westminster, and Southwark	3,818	348,179	91	445,261	117	478,540	419,297	501,824	131
London within the old "Bills"	21,587	746,233	35	1,358,345	62	1,797,488	1,947,509	2,096,461	97
St. Luke's, Chelsea	796	11,604	15	40,179	50	63,439	71,089	88,101	111
Kensington	2,190	8,556	4	26,834	12	70,108	120,299	162,924	74
St. Marylebone	1,506	63,982	42	138,164	91	161,680	159,254	155,004	103
Paddington	1,251	1,881	1	25,173	20	75,784	96,813	107,098	86
St. Pancras	2,672	31,779	12	129,763	48	198,788	221,465	236,209	89
Limits of Rickman, 1801	30,002	864,035	29	1,718,458	57	2,367,282	2,616,429	2,847,797	95
Hammersmith	2,287	5,600	2	13,453	6	24,519	42,691	71,916	31
Fulham	1,716	4,428	3	9,319	5	15,539	23,350	42,895	25
St. Mary, Stoke-Newington	638	1,462	2	4,490	7	6,608	9,841	22,780	36
St. Mary, Stratford-le-Bow	563	2,101	4	4,626	8	11,590	26,055	37,060	66
Bromley	608	1,684	3	6,154	10	24,077	41,710	64,845	106
Camberwell	4,450	7,059	2	39,868	9	71,488	111,306	186,555	42
Greenwich District: St. Paul's, Deptford	1,574	11,849	7	18,664	12	37,834	53,714	76,740	48
" " St. Nicholas, Deptford	111	6,988	62	6,958	63	8,189	6,474	7,901	71
" " Greenwich	1,741	14,339	8	29,595	17	40,002	40,412	46,628	27
" " Woolwich	1,126	9,826	9	25,785	23	41,695	35,557	36,600	32
Limits of Registrar-General, 1838–43	44,816	923,816	21	1,872,365	42	2,648,728	3,007,539	3,441,212	77
Clapham	1,137	3,864	3	12,106	11	20,894	27,347	36,378	32
Battersea	2,208	3,365	1	6,617	3	19,600	54,016	107,248	49
Wandsworth	2,433	4,445	2	7,614	3	13,346	19,783	28,005	11
Putney	2,235	2,428	1	4,684	2	6,481	9,439	18,221	8
Tooting	566	1,189	2	2,840	5	2,055	2,827	25,545	7
Streatham	2,914	2,857	1	5,994	2	8,027	12,148		
Limits of Registrar-General, 1844–46	56,804	946,464	17	1,912,220	34	2,719,128	3,182,599	3,651,609	65
Hampstead	2,248	4,343	2	10,093	4	19,106	32,281	45,436	20
Charlton-upon-Woolwich	1,236	747	·6	2,655	2	8,472	7,699	10,980	9
Plumstead	3,388	1,166	·3	2,816	·8	24,502	28,259	33,252	10
Lewisham: Eltham, Lee, Lewisham village, Sydenham	12,186	6,148	·5	17,543	1	32,783	58,422	78,344	6
Police on duty, 1841	...	...	...	3,090	...	...	...	...	...
London within Tables of Mortality, 1851	75,362	958,863	13	1,948,417	26	2,803,989	3,254,260	3,814,571	51

Covent Garden (1861), Southwark Street (1864), Northumberland Avenue (1876), and Theobald's Road and Clerkenwell Road, begun in 1873 to connect Oxford Street and Old Street. They have also effected extensive improvements in the neighborhood of Whitechapel, Shoreditch, Park Lane, and Kensington. The more important schemes in contemplation are a new street from Tottenham Court Road to Charing Cross, another from Oxford Street to Piccadilly Circus, the widening of Coventry Street, of Gray's Inn Road, and of Tooley Street, and alterations of a less extensive character at Kentish Town, Hackney, and Camberwell. A scheme has been put forth by Government to relieve the pressure at Hyde Park Corner. Altogether up to 31st December, 1881, the board have expended in street improvements £6,531,856, of which probably one-third will be defrayed by sales of property. In addition to this over £4,000,000 have been spent on the Thames Embankment and Queen Victoria Street, and the board have contributed about £626,077 to defray local improvements by district boards and vestries, as well as £1,360,500 for artisans' dwellings.

Thames Embankment. The Thames Embankment, with its marine wall of large granite blocks facing the river, supports on the north side a spacious thoroughfare which forms one of the finest promenades in London. The total cost of the various portions of the embankment was over £3,000,000, the greater part of which is being defrayed by the coal and wine duties levied by the City corporation. By the construction (1864–70) of that portion known as the Victoria Embankment, stretching from Blackfriars Bridge to Westminster, about 37 acres of land have been reclaimed, of which 19 are occupied by carriage and footways, 7½ have been conveyed to adjoining proprietors, and about 8 have been formed into ornamental grounds. The Albert Embankment (1865–68), stretching on the south side of the river from Westminster Bridge to Vauxhall Bridge, includes about 9 acres, which are now chiefly occupied by St. Thomas's Hospital. The Chelsea Embankment (1871–74), which is the extension of one previously constructed between Vauxhall Bridge and Chelsea Hospital, involved the reclamation of about 9½ acres of ground, now occupied partly by a roadway 70 feet wide, and partly by a flower garden.

Bridges. There are twelve bridges, other than railway bridges, over the Thames within the metropolitan area, the most easterly being London Bridge and the most westerly Hammersmith Bridge. Three of these, London Bridge, Southwark Bridge, and Blackfriars Bridge, are within the City area. New London Bridge, a noble structure by Rennie, was opened in 1831, having cost £1,458,311. As populous and busy commercial districts extend for several miles to the east of it on both sides of the Thames, it is not only totally inadequate for the requirements of traffic, but is also removed beyond many convenient lines of communication. On this latter account the proposal to widen it—in itself a very unsatisfactory plan—has met with almost no support; but a bill promoted by the Metropolitan Board for erecting a high level bridge at the Tower failed also to commend itself to a committee of the House of Commons. Until 1769, when the Blackfriars Bridge was erected, London Bridge stood alone. Old Blackfriars Bridge was replaced in 1869 by the present one of five iron arches resting on granite, erected from the designs of Page at a cost of £320,000. Southwark Bridge, designed by Rennie, 1815–19, consists of three iron arches of great elegance resting on stone piers, and cost £800,000. Partly from the unsuitability of its approaches, it has not proved of very much service.

The number of passengers and vehicles passing over the London and Blackfriars Bridges in a single day of 1823 is given in the July number of the *Monthly Review* for that year, and in 1881 similar information was obtained, in regard to the three bridges, for the traffic in the direction of the City. Multiplying these figures by two, we find that the foot passengers crossing London Bridge in 1823 numbered 89,640, while in 1881 they were 157,886, and that the number of vehicles had increased from 6182 to 21,466; that over Blackfriars Bridge the passengers had increased from 61,069 to 87,134, and the vehicles from 4047 to 14,584, while 30,090 passengers and 3560 vehicles passed over Southwark Bridge, the increase in the number of passengers over the three bridges being thus 124,401, and of vehicles 28,381. At the earlier date Southwark Bridge was practically unused, but in 1865 the toll was abolished, and the bridge purchased by the corporation for £218,868. The Metropolitan Toll Bridges Act of 1877 required the Metropolitan Board to extinguish the tolls on all the Thames bridges and the bridge over Deptford Creek, and thereafter to repair and maintain them, the county authorities of Middlesex and Surrey paying each £1200 a year towards their maintenance. The bridges freed by the Act were the Charing Cross foot-bridge, for which £98,540 was paid to the South-Eastern Railway; Waterloo Bridge (1811–17), designed by Rennie in a style similar to London Bridge, constructed at a cost of £1,000,000, and purchased for £475,000; Lambeth Bridge (1862), built of iron at a cost of £40,000, and purchased for £36,049; Vauxhall Bridge (1811–16), similar in form to Southwark Bridge, erected for over £300,000, and purchased for £225,230; Chelsea Suspension Bridge (1858), designed by Page, erected by the Government for £88,000, purchased for £75,000; the Albert Suspension Bridge (1873) and Battersea Bridge, an old wooden structure, both purchased for £300,000; Wandsworth Bridge for £52,761; Putney Bridge (1729), a picturesque old timber structure, for £58,000; and Hammersmith Bridge for £112,500. Battersea and Putney bridges are about to be re-erected, and Deptford Creek Bridge is to be widened and improved at a cost of £109,091. The total amount of money spent by the board in connection with bridges up to 18th December, 1881, was £1,479,697. The amount to be paid by the board for their maintenance in 1882 is estimated at £90,502. The river is crossed by many railway bridges, and the Thames tunnel, begun in 1825 and completed in 1843, at a cost of £468,000, for the purposes of traffic, was purchased in 1865 by the Great Eastern Company, and is now used as a railway tunnel. A subway under the Thames from Tower Hill to Tooley Street was constructed in 1869 at a cost of £16,000. The communication in the neighborhood of the river is greatly facilitated by the frequent passenger steamers.

Maintenance of streets. The cleaning, watering, and paving of the streets are more satisfactory than might be expected from the fact that each district depends solely on its own local authority. Several Acts for paving the Strand were passed in the 14th century, and in the 16th century for the streets outside the City. In 1614 the citizens began to pave the margins of the streets before their doors, but the middle of the streets were laid with large pebbles very unevenly. In 1661 the money obtained from hackney coach licenses, £5 for each annually, was applied to keeping them in repair. The use of squared granite blocks, with raised footways, was introduced by Acts of Parliament for Westminster in 1761, and for London generally in 1766. Within the last twenty years asphalt and wooden pavement have been largely substituted for granite in the principal thoroughfares.

Conveyances. Hackney coaches are first mentioned in 1625, when they were kept at inns, and numbered altogether only 20. In 1652 their number was limited to 200, in 1662 to 400, in 1694 to 700, in 1715 to 800, in 1771 to 1000, and in 1799 to 1200. In 1832 the restriction of their number was abolished. The number of cab drivers in 1871 was 10,043, and of cabs 7818, of which 3295 were hansoms and 4523 four-wheelers; in 1881 the number of drivers was 12,630, and of cabs 9652, of which 5805 were hansoms and only 3847 four-wheelers. Omnibuses were first introduced in 1829. Many of the principal streets are too crowded for tramways, but in South London tramcars are more used than omnibuses, and there are also several routes in the northern and eastern districts. The Metropolitan and Metropolitan District Railway lines, which run partly underground, and form almost a complete belt round the "inner circle" of London, with several branches intersecting it, and others communicating with various suburban lines, have proved invaluable in relieving the throng of vehicles on the streets, and in affording rapid communication between important points; but the railway system in and around London has suffered greatly in directness from the absence of a complete plan embracing proper connecting links between the lines of the several companies. The annual number of passengers on the Metropolitan Railway is now about 60 millions. The Regent, Grand Junction, and several other canals, besides connecting London with the

internal navigation of England, supply a means of transport for heavy goods between various districts of the metropolis.

Postal districts.

London is divided into eight postal districts, viz., Eastern Central (E.C.), Western Central (W.C.), Northern (N.), North-Western (N.W.), Western (W.), South-Western (S.W.), South-Eastern (S.E.), and Eastern (E.). In the E.C. district there are twelve deliveries of letters daily, in the town portions of the other districts, which extend to about 3 miles from the General Post-Office, eleven deliveries, and in the suburban portions six deliveries.

Royal parks.

OPEN SPACES.—London owes the possession of its finest parks rather to accident than to intention. Eastwards and northwards no effort was made to preserve any part of the "delightful plain of meadow land interspersed with flowing streams," mentioned by Fitzstephen, or of the "immense forest of densely wooded thickets," or of the "common fields" in the great fen, notwithstanding the riot of the citizens in the reign of Henry VIII. against the invasion of their rights by enclosure. Westward, however, the inroads of the builder were interrupted by the royal parks, which, lying adjacent to each other, cover an area of about 900 acres. St. James's Park, 80 acres, transformed from a swamp into a deer park, bowling green, and tennis court by Henry VIII., extended and laid out as a pleasure ground by Charles II., and rearranged by Nash (1827–29), possesses beautiful combinations of water and foliage. Green Park, 70 acres, lying between St. James's Park and Piccadilly, is unadorned except by rows of trees and by parterres of flowers bordering Piccadilly. Hyde Park, 390 acres, stretches westward from the district of Mayfair to Kensington Gardens. Originally forming part of the manor of Hyde, which was attached to Westminster Abbey, Hyde Park at the dissolution of the monasteries was taken possession of by Henry VIII. In 1652 the park, which then included a large portion of the ground now joined to Kensington Gardens and extended to 621 acres, was sold for £17,068, 6s. 8d., but in 1660 it was rebought by the Crown, having some time before this become the great "rendezvous of fashion and beauty." It possesses nine principal gateways, of which that at Hyde Park Corner on the south-east and the Marble Arch on the north-east present the most striking features. The former, designed by Decimus Burton and erected in 1828 at a cost of £17,000, consists of three imposing arches adorned with rilievos copied from the Elgin marbles. The Marble Arch, originally intended as a monument to Nelson, was first erected at a cost of £80,000 in front of Buckingham Palace, and was placed in its present position in 1851. With its fine expanse of grass, its bright flower beds and clumps of shrubbery, its noble old trees, its beautiful ornamental lake the Serpentine, its broad avenues crowded with equipages, its Rotten Row alive with equestrians, its walks lined with thousands of loungers of very various nationalities, professions, and grades of social position, Hyde Park in the height of the season presents a scene which in the brilliancy of its *tout ensemble* and its peculiarly mingled contrasts can probably be paralleled nowhere else. In the 17th and 18th centuries Hyde Park was a favorite meeting place for duellists, and in the present century has been frequently the scene of great political gatherings. To the west are Kensington Gardens, 360 acres, originally attached to Kensington Palace, and enlarged in the reign of George II. by the addition of nearly 300 acres taken from Hyde Park. They are more thickly planted than the "Park," and also contain an avenue of rare plants and shrubs, and several walks lined with flowering trees. Regent's Park in the north-west, 470 acres, occupying the site of Marylebone Park, which in the time of Elizabeth was used as a hunting ground, owes its preservation to the intention of George III. to erect within it a royal palace. It contains the gardens of the Zoological Society and of the Royal Botanic Society, as well as the grounds of a few private villas. The northern half of the park is in summer devoted to cricket; in the south-east corner there is a flower garden of rather antique design; and in the south-west a portion bounded on the north by an artificial lake is let to private householders. To the north of Regent's Park there are about 12 acres of open ground surrounding Primrose Hill, 220 feet, commanding an extensive view of London. Battersea Park, 180 acres, formed (1852–58) at a cost of £312,890, on the south side of the Thames, besides a fine promenade along the banks of the river, several walks and carriage drives bordered with parterres, and a wide expanse for cricket and other amusements, contains a subtropical garden, which during August and September possesses much of the witchery of an ideal fairy-land. East London, after the enclosure of Finsbury Fields, had no special recreation ground until the opening of Victoria Park, which was sanctioned by an Act of Parliament in 1842, and was in 1872 increased to about 300 acres. Finsbury Park, 115 acres, formed by the Metropolitan Board of Works from the grounds of Hornsey Wood House at a cost of £112,000; Southwark Park, Rotherhithe, 63 acres, formed at a cost of £111,000; West Ham Park in the extreme east, partly purchased by the City corporation; Greenwich Park (see GREENWICH); and the gardens on the Thames Embankment, with various squares and semi-private gardens, sum up the other ornamental open spaces of London.

Other parks.

Public commons.

The Metropolitan Board, under various Acts of Parliament, have secured the exclusive right of the public in several commons and open spaces, which with the parks under their care comprise together an area of 1698 acres, giving with the royal parks and Battersea Park, Victoria Park, and West Ham Park a total of over 3000 acres, or about a twenty-fifth part of the whole metropolitan area. The principal public commons are Hampstead Heath, a wild hilly region now encroached on by buildings on all sides except the north and north-west, commanding fine views both of London and the country, and, with its clear bracing air and its unkempt and rugged beauty, breaking on the visitor with all the effect of a sudden surprise; Blackheath Common, 267 acres, a bare sandy expanse to the south of Greenwich Park, containing a good golfing course; Clapham Common, 220 acres; Wormwood Scrubs, 194 acres; the Tooting Commons, 207 acres; and Plumstead Common, 110 acres. The total sum expended by the Board of Works in the purchase, preservation, and adornment of parks and open spaces up to 31st December, 1881, was £436,760. All the parks and open spaces already mentioned are included in the Metropolitan Board district, but outside this area there is in the neighborhood of London a large number of uncultivated spaces to which the public have various rights, some of them of an obscure and undefined character. A return made to the House of Commons in 1865 gives the area of public commons within radii of 25 miles and of 15 miles of the metropolis, the area of those within the smaller circuit being 13,301 acres. Of Epping Forest 5600 acres have been secured to the public by the corporation of the City, and in 1871 an Act was passed for the preservation of Putney Heath and Wimbledon Common, but Hounslow Heath, of old the favorite resort of highwaymen, and at one time over 4000 acres in extent, is now nearly all under cultivation. Richmond Park, the grounds of Hampton Court Palace, the gardens at Kew, the fine surroundings of the Crystal and Alexandra Palace, the cricket grounds at the Oval and Lord's, may practically be also reckoned among the public parks of London. In addition to this the river Thames itself supplies facilities for recreation which are safe from the inroads of the builder; and all round the metropolis there are numerous footpaths through the open fields.

Water supply.

WATER SUPPLY.—For two centuries after the Conquest, London obtained a sufficient supply of pure water partly from the rivers or streams which passed through it and partly from wells sunk into the sands above the chalk. Holywell, Clerk's Well (Clerkenwell), and St. Clement's Well (near St. Clement's Inn) are mentioned by Fitzstephen as those "of most note." In 1236 the magistrates purchased from Gilbert Sanford the liberty to convey the waters of the Tyburn from Paddington in leaden pipes to the city, and a great conduit of lead castellated with stone was begun in West Cheap in 1285. Various other conduits were built in the 14th and 15th centuries, some for the water of the Thames, from which also the inhabitants were supplied by the city company of water-bearers, who brought it in leathern panniers slung on horses. In 1582 a great step in advance was taken by Peter Moris, a Dutchman, the real originator of the Thames water companies, who erected a "forcier" on an arch of London Bridge to convey tho Thames water into the houses in the east end of the city as far as Gracechurch Street; in 1594 another was erected near Broken Wharf for West Cheap, Fleet Street, and the district round St. Paul's, and in 1610 a third at Aldersgate without the gate. Moris, who obtained the lease of one arch of London Bridge for five hundred years at a rental of 10s. per annum, and two years later the use of another arch, erected for his purpose very ingenious machinery; and the works continued until 1701 in the possession of the family, who after amassing large wealth sold the lease to a company for £30,000. They ultimately occupied four arches, and continued till 1822, when the supply was purchased by the Southwark Company for £10,000. In 1605 an Act was passed for supplying the northern districts from springs near Ware in Herts. This enterprise was in 1609 undertaken by Hugh Myddleton, who, when his funds became exhausted in 1612, received the necessary money from James I. on condition of his sharing in the profits. With this assistance the reservoirs at Clerkenwell supplied by the New River were opened in 1613. In 1630 a scheme to bring water to London and Westminster from Hoddesden in Herts was promoted by aid of a lottery licensed by Charles I. on condition that the promoters should pay £4000 per annum into the king's treasury. Strype, writing in 1720, mentions that "there is not a street in London but water runs through it in pipes conveyed underground, and from those pipes there is scarce a house whose rent is £15 or £20 per annum but hath the convenience of water brought into it," while "for the smaller tenements there is generally a cock or pump convenient to the inhabitants."

The water companies. In 1721 the Chelsea Water Company began to supply water from the Thames to Westminster and the parts adjacent, and in 1783 the supply of south London was supplemented by the erection of the Lambeth waterworks opposite Charing Cross. The Vauxhall Company was established at Vauxhall Bridge in 1805, the West Middlesex near Hammersmith in 1806, the East London on the River Lea at Bow in the same year, the Kent on the Ravensbourne at Deptford in 1810, the Grand Junction at the Grand Junction Canal in 1811, and the Southwark at London Bridge in 1822. For several years before the interference of parliament the companies had agreed to restrict themselves to separate localities. The Acts of 1847 required the companies to provide pure and wholesome water for the use of the inhabitants in the districts supplied by them, and also to provide water for general use. An Act passed in 1852 compelled the removal of the companies beyond the tidal limits of the Thames, contained regulations as to rates, enforced thorough filtration, and endeavored to make provision for a constant supply. The rates, which differ in the various companies, were in some respects amended by the Act of 1871; but, as it fails to guard against claims for back dividends, no sufficient guarantee is provided against the raising of the rates. These are charged chiefly on the value of the houses, but the Acts do not distinguish with sufficient clearness between the gross annual value and the rental. A proposal in 1880 to purchase the rights of the companies, whose capital was then a little over £12,000,000, for £34,160,000, failed to commend itself to a committee of the House of Commons.

Their accounts being made up at different periods, it is impossible to give comparative returns for the companies; the following are the figures (Table V.), as best they can be stated, for two years:—

	Ordinary Capital.	Preference and Loan Capital.	Total Capital.	Total Expenditure.	Income.	Working Expenses.	Dividends.
1871–2	£7,561,526	£2,520,340	£10,081,866	£10,137,710	£992,610	£389,258	£608,352
1880–1	9,087,917	3,448,981	12,536,898	12,612,589	1,532,784	610,899	921,885
Increase	1,526,391	928,641	2,455,032	2,474,879	540,174	221,641	313,533

Within ten years the increase of capital has thus been about 24 per cent., or 2⅜ per cent. per annum, the increase of the income 54 per cent., or 5⅜ per cent. per annum, and of the expenses 57 per cent., or 5$\frac{7}{10}$ per annum. Thus, while in 1871 there was a capital of 10 millions, gaining 6 per cent. profits, in 1881 there was a capital of 12½ millions producing 7⅜ per cent. Within the last two years the value of the property has been increasing at a more rapid ratio, and probably at the rate of £1,250,000 per annum; but, as on account of the proposals to buy up the rights of the companies they have at present special reasons for curtailing expenses and delaying the carrying out of all but essential improvements, it is impossible to know how much of the increase is temporary and artificial.

The problem of future supply. According to Dr. Frankland the water of the Thames and the Lea, notwithstanding the most efficient possible filtration, are, on account of sewage pollution, becoming less and less fit for domestic use, about one-half of the water at present supplied being already grossly polluted, and a very large proportion of the remainder occasionally polluted. He therefore recommends that the supply of water for domestic use should be taken from the springs of the basin before they reach the river. At the present rate of the increase of London the supply required will, however, within forty years exceed that which may be obtainable in the whole Thames basin in times of summer drought, such as may occur in any year, and thus in a future not far distant a means of storage must be provided, or a new source of supply discovered, involving an outlay which would at least double the rates on the present rental. The Kent Company, which obtains its supply from the chalk wells, is the only one possessing wholly unpolluted sources, but the New River Company also obtains about one-tenth of its supply from springs, the remainder being obtained from the Lea. The East London Company obtains its supplies from the Lea and Thames, and the other companies from the Thames alone. The following table (VI.) gives certain particulars:—

Authorized Daily Supply from Thames.	Other Sources.	Average Supply from Thames.	Other Sources.	No. of Supplies to Houses.	Houses on Constant Supply.	Estimated Population Supplied.	Subsidiary Storage.		Filtered Storage.		Miles of Mains in the Metropolis.	Miles of Mains Constantly Charged.
							Area.	Capacity.	Area.	Capacity.		
110,000,000	Not Restricted.	68,000,000	72,000,000	622,000	186,000	4,600,000	Acres. 457¾	Gals. 1,264,850,000	Acres. 46	Gals. 150,067,000	2,707	759

Old methods of lighting.

LIGHTING.—From 1416 the citizens of London were under an obligation to hang out candles between certain hours on dark nights for the illumination of the streets; and in 1661 a special Act of Parliament was passed to enforce the custom. The corporation in 1684 granted a license to Edward Heming, the inventor of oil lamps, for the sole supply of the public lights for twenty-one years, but the duty was then once more assigned to the individual citizens. A second agreement with contractors not proving satisfactory, the corporation in 1736 obtained from parliament permission to erect lights where they thought proper, and to levy a rate, which in that year yielded £15,000. Gas-lighting was in 1807 introduced in Pall Mall by the erection of a small apparatus to supply the lamps on the one side of the street, the other being still lighted with oil. In 1810 the Gas Light and Coke Company received a charter permitting it to supply gas to any persons within "the cities of London and Westminster, and the borough of Southwark," and as the result of their enterprise Westminster Bridge in 1813 was lighted with gas, and in 1814 the whole of the streets of St. Margaret's parish. The City of London Gas Company was formed in 1817, and soon afterwards other seven companies. After several years' wasteful competition the companies came to an agreement in 1857 to restrict themselves to separate localities. This led to the Metropolitan Gas Act of 1860, the only effectual provisions of which were those in reference to the quality of the gas. The City of London Gas Act of 1868, limiting the price of gas within the City to 3s. 9d. per 1000 feet, except in certain cases, was the only other measure of a restrictive character passed before 1876, and previous to this the companies, by amalgamation, and through the favorable terms on which they were allowed to increase their capital and to raise new shares, had enormously increased the value of their dividends. The Act of 1876, from the provisions of which the London Gas Company is exempt, adopted a sliding scale of dividends, one-half of the profits, after a 10 per cent. dividend had been paid, going to the shareholders, the other being applied to reduction in the price of the gas, it being also provided that the price should not be more than 3s. 9d., and that when additions were made to the capital the shares should be put up to auction. The experimental introduction of the electric light by the commissioners of sewers of the City, and by the Metropolitan Board (for the Thames Embankment and some of the bridges), has led the gas companies to provide better lights in some of the more important streets.

The gas companies.

The following table (VII.) will show that the prosperity of the companies[1] has not been affected by the legislation of 1876, and as yet has not materially suffered from the threatened competition of electric lighting:—

	Total Gas Companies Year ending December 30, 1880.	Totals, Year ending December, 1874.	Increase + or Decrease — from 1874 to 1880.
	£	£	£
Amount of capital authorised	12,050,719	10,482,900	+1,567,819
Paid up capital	10,784,961	8,887,286	+1,897,675
Capital remaining to be paid up	1,265,757	1,595,614	— 329,857
Loan capital authorised	3,363,167	2,058,667	+1,304,500
Loan capital remaining to be borrowed	1,803,805	829,455	+974,350
Amount of capital on which 10 per cent. is paid	8,032,720	7,246,800	+785,920
Total income	3,993,543	3,708,198	+285,345
Total expenditure	2,794,858	2,767,266	+27,592
Total gas sales	3,015,444	2,914,800	+100,644
Contract for public lighting	221,271	268,297	— 47,026
Coal carbonised ... Tons	1,998,254	1,444,996	+553,258
Gas sold for private lights ... Ft.	17,012,025	11,648,859	+5,363,166
Gas sold for public lamps ... "	1,124,438	1,074,595	+49,843
Public lamps ... No.	60,346	54,119	+6,227

Protection from fire.

FIRE EXTINCTION.—Until 1866 the duty of extinguishing fires was in the hands of the fire insurance companies, which in 1832 united in support of one brigade for the whole of London, but only kept a comparatively small establishment, in the central districts of the metropolis. The other districts were protected by small hand-engines kept up by the parochial authorities according to the 14 Geo. III. c. 78. Since the staff of the fire insurance companies was placed under the care of the Metropolitan Board, the number of stations has been increased from 17 to 53, with 4 floating stations, while 11 movable stations have also been provided; the number of engines has been increased from 11 steam and 27 manual to 3 floating engines, 38 steam land engines, and 115 manual; and the number of men has been increased from 130 to 536, in addition to 68 coachmen and pilots. The board has also undertaken the duty of protecting life from fire, which previous to 1867 was discharged by a society supported by voluntary subscriptions, and they at present maintain 137 fire-escapes, which are stationed during the night in the most prominent parts of the metropolis. The total receipts of the brigade in 1880 was £91,545, and the expenses £88,980, of which £56,021 was defrayed by the board, £10,000 was paid by the treasury, and £21,464 was contributed by the insurance companies, at the rate of £35 for every £1,000,000 insured by them. In 1881, the expenses were over £100,000, of which over £60,000 was defrayed by rates. The number of persons endangered by fire during 1881 was 154, of whom 114 were saved and 40 lost their lives. The following table (VIII.) gives a classification of fires since 1874:—

	Number of Fires.			Percentage.	
	Serious.	Slight.	Total.	Serious.	Slight.
1874	154	1419	1573	10	90
1875	163	1366	1529	11	89
1876	166	1466	1632	11	89
1877	159	1374	1533	10	90
1878	170	1489	1659	10	90
1879	159	1559	1718	9	91
1880	162	1709	1871	9	91
1881	167	1824	1991	8	92

Early sanitary regulations.

SANITARY ARRANGEMENTS.—Until 1531 no provision was made for the construction of underground main sewers, notwithstanding that in 1290 the exhalations from the Fleet overcame the incense burnt at the altars in the neighboring churches, and that in 1307 the river, on account of the accumulation of filth, had become inaccessible for ships. The Act of Henry III. in 1531, which provided for the appointment of a commission of sewers, was renewed in 1548 by Edward VI., and extended in its application by James I. in 1607; and subsequently separate commissions were granted as the population extended to other districts. The most important work of the old commission of sewers was the bridging over of the Fleet in 1637. In 1841 this sewer, which drained an area of over 400 acres, was widened at a cost of about £47,000, and at its mouth an iron culvert was provided which carried its discharge into the middle of the Thames. Other main sewers were constructed, but the bridging of them over was carried out slowly and in a very imperfect manner. In early times the nuisances were carried away by the scavengers and the sewage received into wells, which when full were pumped into the kennels of the streets. Until 1848 the discharge of house sewage into the main drainage was forbidden, and the construction of cesspools enforced, the majority of which were unprovided with overflow drains, but after 1810 there was considerable improvement in connection with the introduction of better arrangements for a supply of water. Under the auspices of the Metropolitan Commission of Sewers, created by the Act of 1848, a more satisfactory system of local drainage was enforced; but its action in regard to the main sewage discharge was so dilatory that the pressure of public opinion led to the Metropolitan Local Management Act of 1855 providing for the creation of the Metropolitan Board of Works, in which was vested the care of the main sewers, and to which was entrusted the construction of works for their discharge at a distance from London re

Commission of sewers.

Metropolitan Board.

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[1] By amalgamation the companies have now been reduced to four:—Gas Light and Coke Company, paid up capital, £7,515,000; South Metropolitan Gas Company, £1,881,990; Commercial Gas Company, £675,845; London Gas Company, £762,126.

garded as sufficient to prevent the pollution of the river. Works were commenced in 1859, and completed in 1865 at a cost of £4,607,000, providing three lines of intercepting sewers on the north side of the river, which convey the discharge 11 miles below London Bridge, and two lines on the south side, which convey their discharge 4 miles farther down. These works comprise 80 miles of main intercepting sewers, in addition to four pumping stations to raise the sewage from the lower levels. The total length of the main street sewers entrusted to the board was about 165 miles, one-fifth of which consisted of offensive open sewers, while many of the others were of most defective design or out of repair. The total cost of repairing these sewers, and connecting them with the new main drainage system, was estimated at £800,000, and works to the value of £750,000 have been executed. The sum expended on main drainage and main sewers up to 31st December, 1881, was £5,684,470. The opinion seems to be increasing that the present method of getting rid of the sewage of London is radically wrong, and undoubtedly the sewage discharge may reach proportions which may absolutely demand a new supplemental scheme. For the four years ending 1878, the average daily sewage discharge was 122½ millions of gallons, in 1878 it was 157½ millions, and it is now estimated at 180 millions.

Thames conservancy.

The conservancy of the Thames was in 1857 transferred from the corporation to a body of twelve, nominated by various authorities, and presided over by the lord mayor; and in 1867 the conservancy of the upper reaches from Staines to Cricklade was vested in a board, of which the conservators of the lower reaches formed the majority. Under the auspices of these two boards not only has the navigation of the river been very much improved, but very stringent care has been exercised to prevent its unnecessary pollution. In 1868 the Lea was also placed under the control of a conservancy board. The expenses of the boards are defrayed by tonnage dues, tolls, pier dues, fines, and licenses, and contributions from the canal and water companies.

Street sanitation.

The sanitary condition of the streets and houses is under the care of vestries and district boards, but great variety exists in regard to the efficiency with which the work is performed.

Cemeteries.

An Act passed in 1845 provides for the prohibition of interment in any of the cemeteries within the metropolitan area by order in council, and forbids the construction of new burial grounds within 2 miles of the metropolis except on the approval of the secretary of state. The power of constructing cemeteries for their several districts is granted to the vestries, who may borrow money for this purpose from the Public Works Loan Commissioners, and are required to appoint a board for their management. The commissioners of sewers for the City of London are the burial board for the City parishes. The secretary of state has the power to issue regulations in regard to the construction of cemeteries and the arrangements connected with interment. Among the more important suburban cemeteries are Kensal Green (in which many eminent persons have been interred), Brompton, Hampstead, Highgate, Abney Park, Nunhead, and Norwood.

Climate.

HEALTH.—Apart from the deleterious influence of smoke and defective sanitary arrangements, London must be regarded as exceptionally healthy. Although subject occasionally to rapid alternations of temperature, the climate is generally mild and according to the seasons equable, with an early spring and a long autumn. The following table (IX.) gives a summary of Greenwich meteorology for thirty-two years, 1849–80:—

Weekly Movement of Air in Miles.	Yearly Fall of Rain in Inches.	Mean Dryness of Atmosphere.	Mean Temperature for the Year.	Mean Temperatures for Quarters ending in			
				March.	June.	Sept.	Dec.
1811	24·8	5·9	49·3	39·9	52·7	60·4	44·1

Smoke and fogs.

In 1306, when the population did not exceed 50,000, the citizens of London petitioned Edward I. to prohibit the use of sea coal, and he passed a law making the burning of it a capital offence. John Evelyn, in *Fumifugium*, written in 1661, complains that on account of the increase of coal smoke the gardens no longer bear fruit, and instances various cases in which the smoke had been prejudicial to health, but the influence of smoke in increasing fogs and intensifying their evils seems not to have been appreciable. The smoke-producing area has since then increased from about 3 square miles to over 100 square miles, and the average daily consumption of coals in domestic fireplaces has mounted to about 27,000 tons, or in winter probably to 40,000 tons, which in certain states of the atmosphere produces a cloud of smoke resting for days over the central districts of the town, and shutting out the sun, even when it does not descend in foggy weather as a thick, impenetrable, and partly poisonous mass of darkness. During the fogs of 1879–80 asthma increased 220 per cent. and bronchitis 331 per cent., and in the week ending February 13, 1882, the death-rate, owing to the dense fogs, rose from 27·1 in the previous week to 35·3, diseases of the respiratory organs rising to 994, the corrected weekly average of this class of diseases being 430. The evil is mainly due to the smoke of domestic fireplaces.

Death-rate and birth-rate.

The death-rate of London has steadily declined since the beginning of the century, when it was first exceeded by the birth-rate. A record of the births and deaths of London entitled "Bills of Mortality" was made by the parish clerks in the plague year of 1593, and from 1603 was continued even after the returns had begun to be published by the registrar-general. Though they only included the births of persons baptized according to the forms of the Church of England, and the deaths of persons buried in consecrated ground within the parishes included in the "Bills," and were in many cases very carelessly compiled, they place it beyond doubt that even in years when London was exempt from the plague the rate of mortality required a large immigration from the country to take the place of those who died in London. Previous to 1593 the great plague years were 1349, 1361, and 1369.

The following table (X.) shows the number of births and deaths in the great plague years of the seventeenth century, and the average annual number for every decade in the 18th century:—

Years.	Total Deaths.	Deaths from Plague.	Births.	Excess of Deaths.	Average 10 Years ending	Deaths.	Births.	Excess of Deaths.	Average 10 Years ending	Deaths.	Births.	Excess of Deaths.
1593	17,844	10,662	4,021	13,823	1710	21,461	15,623	5,838	1760	22,001	17,156	4,845
1603	42,042	36,269	4,789	37,253	1720	23,909	17,111	6,798	1770	24,943	19,784	5,159
1625	54,265	35,417	6,783	47,482	1730	27,492	18,203	9,289	1780	23,851	19,243	4,608
1636	23,359	10,400	9,522	13,837	1740	26,492	16,830	9,662	1790	23,080	21,477	1,603
1665	97,306	68,596	9,967	87,339	1750	25,352	14,457	10,895	1800	24,270	22,605	1,665

The average mortality of London in 1881 was 21·6 per 1000, or 1·1 less than that of the twenty other large towns of England, while the rate for England was only 20·5. It is to be remembered that London contains a comparatively small proportion of working class population. Its sanitary condition is still very far in advance of that of Paris, where at present the death-rate is about 130 for 100 in London. The registrar-general calculates that according to the density of London, its normal death-rate should be much lower than it is, but besides the fact that mortality is influenced by other causes than sanitary arrangements, the extended area augments the evil results of density and the lesser density in some districts cannot counterbalance the excessive crowding of others. Table XI. gives the annual rate of mortality per 1000 persons living for various periods, and Table XII. the number of births and of deaths from the principal zymotic diseases and from all causes:—

TABLE XI.—*Annual Rate of Mortality, 1851–81.*

Area in Square Miles.	Persons to a Square Mile, 1881.	Annual Rate of Mortality per 1000 Persons living.											
		Ten Years.			Year 1880.	1880—Quarters ending				1881—Quarters ending			
		1851–60.	1861–70.	1871–80.		March.	June.	Sept.	Dec.	March.	June.	Sept.	Dec.
118	82,827	28·6	24·3	22·4	21·5	26·5	18·8	20·4	20·1	22·7	20·2	20·5	21·7

TABLE XII.—*Deaths from Zymotic Diseases and from all Causes, 1841–81.*

	Total Births.	Total Deaths.	Deaths of Infants under one Year.	Deaths from Principal Zymotic Diseases.									Percentage of Deaths from Principal Zymotic Diseases.
				Total.	Small-pox.	Measles.	Scarlet Fever.	Diphtheria.	Hooping-Cough.	Fever.	Diarrhœa.	Cholera.	
1841–51	665,661	528,110	104,461	109,244	8,416	18,011	18,314		18,079	20,890	14,946	15,588	20·9
1851–60	864,563	610,478	183,775	129,913	7,150	18,766	26,317		22,497	22,597	24,700	12,886	21·3
1861–70	1,067,988	736,342	173,454	156,988	8,347	17,338	34,391	5,828	26,550	27,149	30,487	7,408	21·3
1871–79	1,114,685	710,869	175,662	120,908	15,076	16,439	18,192	3,792	25,278	12,111	28,824	1,196	17·0
1881	...	81,120	20,907	18,681	475	1,501	3,073	541	3,488	886	3,767	...	16·9

Marriage-rate. The mean marriage-rate for ten years 1870–79 was 19·2, and for 1880 it was 18·1. The percentage of children born out of wedlock in 1880 was 3·9, that for England being 4·8.

Provision markets. MARKETS AND FOOD SUPPLY.—A regulation passed in 1277 ordained that no market should be kept on London Bridge or elsewhere except in places specially appointed for the purpose, and that no person should buy wares in Southwark that were to be bought in the City. In 1322 a decree was issued by the mayor that none should sell fish or flesh "out of the markets appointed, to wit, Bridge Street, East Cheap, Old Fish Street, St. Nicholas shambles, and Stocks market;" and in 1328 a charter was granted to the corporation by Edward III., conveying to it the sole right to establish markets within 7 miles' circuit of the city. In 1345 a proclamation was passed that poultry instead of being sold in lanes or hostels should be brought to Leaden Hall, and in the same year it was decreed that butchers and fishmongers should sell in the enclosed place called the "Stokkes," and not in the king's highway. After Acts passed in 1351 and 1382 on behalf of aliens and foreigners, all regulations formerly made in reference to the sale of provisions in London were repealed, and the dealers placed under the control of the mayor and aldermen, thus confirming a system of public markets and bazaars even for the retail trade, which remained almost inviolate till the time of Edward VI., up to whose reign there was, according to Stow, scarcely such a thing as a shop between Westminster and St. Paul's. The system, though now broken up even in regard to provisions so far as the retail trade is concerned, remains intact in regard to the vending of certain provisions wholesale, and still exercises a considerable influence on general retail. The principal markets mentioned by Stow are Smithfield, Bartholomew Fair, Leaden Hall, Grass Church (Grace Church) market, chiefly for corn, meal, and cheese; East Cheap flesh market, the adjoining alley to which, Red Rose Lane, had by this time received the less idyllic title of Pudding Lane, on account of the butchers making use of it for the disposal of the offal before transferring it to their dung-boats on the Thames; Newgate market for corn, afterwards for meat; St. Nicholas shambles; Stocks market, established in 1282 on a place occupied by public stocks, and rebuilt in 1410, for flesh, fish, and poultry; and the fish market in Old Fish Street. He also states that in 1302 bread was sold in Bread Street in the open market. Before the great fire Stocks market was occupied by greengrocers, the important vegetable market at Honey Lane had also been established, and markets, chiefly for meat and fowls, were held at Holborn Bars and outside Temple Bars. The increase of the population led in 1657 to the establishment by Lord Clare of Clare market, which, though now frequented only by a very humble class of buyers, was declared a free market by a special Act of Cromwell's parliament, and was for a long time one of the principal markets for all kinds of provisions. Other markets subsequently established were those of St. James by the earl of St. Albans, Bloomsbury by the earl of Southampton, Brook market by Lord Brook, Hungerford market, Newport market, Haymarket, and Mayfair. Newport market for meat still exists, but the others have been gradually superseded. The principal markets now existing are Smithfield (central meat market and poultry market), Leadenhall (poultry and game), Billingsgate (fish), Covent Garden (fruit and vegetables), the cattle markets at Copenhagen Fields and Deptford, the Bermondsey leather market, and the Cumberland, Smithfield, and Whitechapel hay markets.

Old Smithfield market. A market for horses and cattle was held at Smithfield (*Smoothfield*) in the time of Fitz-stephen, and doubtless long anterior to this. The priory of St. Bartholomew in Smithfield obtained from Henry II. the privilege of a fair for drapers, which was kept three days yearly, originally in the church-yard at a considerable distance from the place occupied by the cattle market, and latterly became a scene of great riot, until it was abolished in 1853. A year later the cattle market was removed to Copenhagen Fields. There were 80 butchers in London and suburbs in 1533, each of whom killed 9 oxen weekly, which in forty-six weeks, none being killed in Lent, would amount to 33,120 yearly. In John Erswick's *Brief Note of the Benefit of Fish Days* (1593), it is estimated that 60 butchers, freemen of the city, killed each 5 oxen weekly, or altogether 300 per week, and that the foreigners or non-freemen killed four times as many, or 1200 weekly, the total number of cattle annually killed being thus 69,000. By Richard II. a law was passed enacting that no flesh should be killed in London but at Knightsbridge or such like distance from the city, but in the time of Stow the slaughter-houses of the freemen butchers were in Pentecost Lane adjoining St. Nicholas shambles and near the Butchers' Hall. Probably the arrangements in regard to slaughter-houses were then more advanced in London than they are now, for, although sufficient slaughter-houses to dispose of all the cattle sold at Copenhagen Fields have been erected adjoining the market, a very large number of cattle are still killed in underground cellars, which, notwithstanding the superintendence of the Board of Works under the Slaughter-Houses Act of 1874, are in the majority of cases totally unsuited for the purpose. The number of these slaughter-houses before the passing of the Act, when they were licensed by the justices, was 1429; but they have now been reduced to a little over 900. The following table (XIII.) gives the average yearly number of sheep and cattle sold at Smithfield at various periods from 1731 to 1854, when the market was removed:—

	Cattle.	Sheep.		Cattle.	Sheep.
1731-1740	95,601	583,713	1842-1846	185,529	1,523,850
1751-1760	86,271	648,684	1847-1851	226,856	1,480,614
1791-1800	124,695	757,672	1852-1854	266,279	1,521,923
1801-1810	131,318	951,940	1854	268,008	1,589,280

Copenhagen Fields and Deptford markets. The market at Copenhagen Fields, Holloway, covers upwards of 20 acres, and was erected at a cost of £441,000, with accommodation for 6616 bullocks, 34,980 sheep, 1425 calves, and 900 pigs. Deptford foreign market, which occupies the site of Deptford dockyard, and was bought for £100,000, has an area of 22 acres. The following table (XIV.) gives the number of cattle, sheep, and pigs sold at the metropolitan markets since 1870:—

	Cattle.					Sheep.					Pigs.				
	Home Supply.	Foreign Supply.				Home Supply.	Foreign Supply.				Home Supply.	Foreign Supply.			
	Metropolitan Cattle Market.	Metropolitan Cattle Market.	Foreign Cattle Market.	Total.	Total.	Metropolitan Cattle Market.	Metropolitan Cattle Market.	Foreign Cattle Market.	Total.	Total.	Metropolitan Cattle Market.	Metropolitan Cattle Market.	Foreign Cattle Market.	Total.	Total.
1870	162,831	109,447	...	109,447	272,278	1,152,193	484,555	...	484,555	1,636,748	5,950	5,300	...	5,300	11,250
1871	146,385	122,086	...	122,086	268,371	931,740	592,260	...	592,260	1,524,000	7,299	990	...	990	8,289
1872	178,969	70,559	38,426	108,985	287,954	800,100	568,265	122,601	690,866	1,490,966	8,379	40	178	218	8,597
1873	181,826	113,296	7,090	120,386	302,210	766,645	692,705	2,339	695,044	1,461,689	7,795	690	394	1,084	8,879
1874	186,992	119,080	7,175	126,255	313,247	999,185	650,350	114	650,464	1,649,649	5,878	82	16,955	17,037	22,915
1875	174,445	126,565	29,255	155,820	330,265	917,620	701,370	86,496	787,866	1,705,486	3,512	18	21,470	21,488	24,996
1876	189,500	138,075	21,860	159,935	349,435	852,680	767,930	38,714	806,644	1,659,324	1,821	...	12,573	12,573	14,394
1877	159,585	41,485	67,817	109,302	268,887	719,771	60,421	697,714	758,135	1,477,906	1,675	...	10,051	10,051	11,726
1878	173,680	66,170	60,675	126,845	300,525	776,780	59,070	699,911	758,981	1,535,761	2,370	710	25,575	26,285	28,655
1879	200,210	44,995	81,445	126,440	326,650	807,760	87,040	662,197	749,237	1,556,997	1,285	535	18,949	19,484	20,769
1880	178,290	50,170	120,196	170,366	348,656	789,010	77,860	658,899	736,759	1,525,769	940	30	23,864	23,894	24,834

Central meat market. The Central London meat market, opened in Smithfield in 1868 at a cost of about £250,000, to supersede Newgate market, is built in the Italian Renaissance style, with towers at the four corners, and occupies about 3 acres, its length being 625 feet and its breadth 240. Below the market area there is a railway terminus. To the west of the meat market another one-third its size was opened in 1875 for poultry and provisions. From 1869 to 1875 the toll received from the meat market increased from £14,220 to £18,272, or 28½ per cent., and with the addition of the poultry and provision market it had increased in 1880 to £24,310, or 71 per cent. The total amount of meat sold in the market in 1879 was 213,614 tons; in 1880 the total amount was 221,448 tons, of which 107,326 tons were country-killed, 80,905 town-killed, 7381 foreign, and 25,836 American, the amount of American meat in 1876 being only 5513 tons. A large quantity of meat is conveyed to the butchers direct without entering the market, and several butchers also buy their cattle and get them killed privately. As, moreover, the cattle markets and the meat market supply towns and villages beyond the metropolitan area, there is a double impossibility of forming from these sales an estimate of the actual amount of butcher's meat consumed in London.

Leadenhall market. Leadenhall, which according to Stow belonged in 1309 to Sir Hugh Neville, and had been used as a market before it came into the possession of the city in 1411, was enlarged in 1444 by an addition for a granary in connection with the corn market which had been removed to it from Cornhill, the clothes market also following before 1503; and before 1553 the foreign butchers who formerly stood in the High Street off Lime Street had been ordered to take stalls in it. A great part of it in the time of Stow was used as a wool market, but afterwards it became the principal provision market in the city; and, according to Pennant, the Spanish ambassador told Charles II. that he believed there was more meat sold in that market than in all the kingdom of Spain. The Leadenhall underwent improvements in 1713 and 1814; and in 1881 a new structure of elegant design, with an area of 26,900 square feet, and erected at a cost of £50,000, was opened as a market for fowls and game, the principal commodities sold at Leadenhall for many years.

Billingsgate. Billingsgate, the great fish market of the metropolis, was from an early period a harbor for small ships and boats, and in the time of Stow had almost superseded its great rival Queenhithe, which was in the possession of the Crown. As it grew in importance fish stalls were erected in its neighborhood, but the original market for fish was in Fish Street; and Friday Street, Cheapside, which received its name from being inhabited by fishmongers who served Friday's market, is mentioned as early as 1303. The Act of 1699, which made Billingsgate a "free market for fish," to some extent interfered with the ancient control of the fishmongers, although the custom of selling fish there had been introduced long previously. Until 1846 Billingsgate was a mere assemblage of wooden sheds. The building erected in that year was succeeded by another in 1877, with an area of 39,000 feet instead of 20,000; but, on account of the deficiency of its communications and its defective internal accommodation and arrangements, the market is totally inadequate. Among several abortive efforts to establish other markets for fish was Columbia market, which was completed in 1869 by the Baroness Burdett-Coutts for over £200,000, and presented as a fish market to the City, but failed to attract salesmen. The City authorities have the intention to utilize the vegetable market in course of erection at Smithfield as a fish market, and a scheme is also being promoted for a fish market in the parish of St. Paul, Shadwell. A fish and vegetable market has been established by the Great Eastern Railway Company at Canning Town. The quantity of fish brought to London by rail is not given by the markets committee prior to 1866, but in 1848 the quantity brought by water alone was 106,739 tons. In 1866 the total brought by water and rail was 132,004, in 1870 it was 117,193, in 1875 only 94,949, but since 1877, when the new market was opened, it has gradually increased from 107,168 to 130,629, or nearly 2000 tons less than in 1866, and scarcely 12,000 more than were brought in 1848 by water alone. There has of late years been a more rapid increase in the quantity of water-borne fish, but the amount brought by rail is at present about two-thirds of the whole. Thus, with a population which since 1851 has increased by two-fifths, the fish supply has practically remained stagnant, while, owing to delay in consequence of increased pressure of traffic, the fish often deteriorate so as to be unfit for human food.

Covent Garden. Covent Garden market, for vegetables, fruit, and flowers, which occupies the site of a convent garden belonging to Westminster Abbey, seems to have been used as a market very early in the 17th century, and it received a considerable impulse from the discontinuance of Stocks market on account of the building of the Mansion House and also of Honey Lane market, which in 1823 was superseded by the City of London school, while since the removal of Hungerford market to make way for Charing Cross station it has remained the only vegetable and flower market of importance in the metropolis, although vegetables of a cheap kind are sold at the Borough and Spitalfields markets, watercresses at Farringdon market, which superseded the Fleet vegetable market in 1824, and potatoes at the station of the Great Northern Railway. Until 1828 Covent Garden market consisted of an unsightly array of sheds. The present building, erected by the duke of Bedford, though lately much improved, is quite inadequate for its requirements, while the arrangements for the disposal of mud and refuse are very reprehensible.

Tattersall's. Tattersall's, Knightsbridge, established by Richard Tattersall in 1780, is one of the principal marts in England for riding and carriage horses, and may be regarded as the headquarters of the turf.

One of the principal difficulties connected with the establishment of new markets in London lies in the inconvenient railway arrangements, which render it impossible to obtain a site that shall have sufficient and direct communication with the several districts of England and with the Continent.

Costermongers. The poorer classes obtain a cheap supply of vegetables and other provisions from costermongers and itinerant vendors, who either occupy stands in special localities, especially in the East End, and in High Street (Islington), Hampstead Road, Edgeware Road, and York Road (Somers Town), or hawk them through the streets. The capital possessed in 1861 by these vendors, who then numbered 41,040, was estimated at £40,000, their gross amount of annual trade at £2,700,000, and their annual gains at £900,000. Since that period their numbers, capital, trade, and gains have probably increased at least one-third.

COMMERCE AND INDUSTRY.—London, which was a port of some consequence in the time of the Romans,

Growth of London commerce. is spoken of by Bede as the "mart of many nations resorting to it by sea and land." The Hanse merchants, protected by a clause of Magna Charta, began in the 13th century to frequent London in large numbers, and, after obtaining liberty in 1236 to land and store the wool imported by them, are supposed to have settled in the Steelyard about 1250, but as early as the 8th century they had begun to frequent Billingsgate, and in 978 King Ethelred had conferred certain privileges on them and on other traders. Probably by the time of Fitzstephen London had become the most renowned mart of the world, with the exception perhaps of Antwerp and Bruges. The foreign merchants received a special charter from Edward I. in 1303, and, notwithstanding occasional interference with their privileges, the Hanse traders, who had erected extensive factories and storehouses near their "Gildhall," gradually absorbed the greater portion of the foreign trade of London, until the incorporation of the Merchant Adventurers of England, in 1505, for trading in wool to the Netherlands. The trade with the Levant, which had become of some importance in the 15th century, soon largely extended, and commercial intercourse was also opened up with Barbary, Guinea, and Brazil. After the abolition of the special privileges of the Steelyard merchants, the trade in wool was transferred almost entirely to the Merchant Adventurers, the annual export of English wool and drapery to Antwerp and Bruges in 1566 being estimated at over £2,000,000. The close of the 16th century was marked by the rapid extension of maritime discovery, and the spirit of enterprise was stimulated by the grant of monopolies to those companies which should first open up communication with undiscovered countries. One of the earliest and most successful of the great maritime companies was the Russian, incorporated in 1553, which, besides establishing an extensive commerce with the ports of Russia, had an overland trade with Persia. The foundation of the Royal Exchange by Gresham in 1566 marked an era in the commercial history of London; and the destruction of Antwerp by the duke of Parma in 1585 left it without a rival as the emporium of Europe. The settlement of many of the Flanders merchants in England gave a great impetus to the manufacture of silks, damasks, and other fine cloths, but from the time of the expulsion of the Steelyard merchants by Elizabeth in 1597 the development of the maritime trade of London was solely in the hands of English companies. The incorporation of the Turkey Company in 1579, of the East India Company in 1600, of the Virginia Company in 1606, and of the Hudson's Bay Company in 1670 must be regarded, not only as the most important events connected with the growth of the port in the 17th and 18th centuries, but as of prime consequence in relation to the social and political history of England.

Present trade. In the trade of London there is a large excess of imports over exports, arising from the fact that it is specially a mart, and is removed from proximity to any large manufacturing district. The value in 1880 of the total trade of Liverpool, £191,489,838, was nearly equal to that of London, which was £194,043,836, but the value of the imports of London exceeded those of Liverpool by nearly £34,000,000, while the exports of Liverpool exceeded those of London by about £31,000,000. London has almost a monopoly of the trade with the East Indies and China, and has thus become the chief emporium for tea, coffee, sugar, spices, and indigo, and for silks and Eastern manufactures. A great part of the overland trade of London with India has till quite recently been carried on *via* Southampton, which, and also Folkestone, Newhaven, and Dover, may be regarded as virtually ports of London. The value of the imports of Folkestone, Newhaven, and Dover in 1880 amounted together to £24,485,034, and their exports to only £4,432,244; the imports of Southampton were valued at £9,205,183, and its exports at £9,306,326. In the Mediterranean and Levant trade London has now a powerful rival in Liverpool. From European and Asiatic Turkey London imports corn, dried fruits, madder, and various other special products; from Greece currants and olive oil; from Italy olive oil, wine, sumach, oranges, and lemons; from Spain wine and dried fruits; from Portugal and the Azores oranges and wine. Nearly the whole of the French trade with England is concentrated in London, the imports including all the special French manufactures, and large quantities of butter, eggs, vegetables, and corn. It is, however, largely carried on through the southern ports, the value of the imports of silk to Folkestone in 1880 being £3,614,014, and those of London only £260,646, while the imports of eggs at Newhaven greatly exceed those of London, as do also the imports of butter and eggs at Southampton. London absorbs the greater part of the Baltic imports to England, especially timber, corn, cattle, wool, and provisions, the tonnage of the shipping that entered from Germany in 1881 being 634,741, from Belgium 249,161, from Sweden 416,997, from Norway 201,056, from the northern ports of Russia 401,076, and from Denmark 135,634. The tonnage that entered from the southern ports of Russia only amounted to 50,883, but much of this trade is carried on *via* Southampton. The chief imports from Russia are corn, tallow, timber, hemp, linseed, and wool. The fact that the staple manufacture of Lancashire is cotton has enabled Liverpool to gain a superiority over London in the United States trade, with the exception of imports of tobacco from Virginia; but the shipping that entered London from the Atlantic ports of the United States in 1881 had a burden of 670,079 tons, and from the Pacific ports of 3248 tons. From Central America London obtains its chief supply of the finer woods, and also jalap, sarsaparilla, indigo, coffee, and Peruvian bark, and from South America sugar, hides, india-rubber, coffee, diamonds, and various drugs. From Canada the port receives timber, corn, cattle, and provisions, from the Australian islands wool, oil, gold, copper, tin, provisions, and cattle; and it possesses more than half the trade of England with the West Indies, the principal imports being sugar and molasses, fruit, rum, coffee, cocoa, fine woods, pimento, and ginger.

Foreign and colonial trade. On account of the burning of the records at the custom-house, and the absence of regular parliamentary returns, it is impossible to give a continuous summary of the progress of the shipping before 1816, but the following table (XV.) gives the returns of the shipping engaged in the foreign and colonial trade in various years from 1693 to that date, and the yearly average for subsequent periods.

	Entered Inwards.		Cleared.	
	Vessels.	Tonnage.	Vessels.	Tonnage.
1693	...	117,387	...	104,662
1694	...	185,972	...	81,148
1750	...	511,680	...	179,860
1790	...	681,095	...	848,098
1800	...	796,632	...	729,554
1816	3,119	629,050	3,077	618,828
1816-20	4,416	804,481	3,604	681,298
1821-30	4,840	888,481	3,628	726,954
1831-40	5,538	1,047,862	4,630	928,744
1841-50	8,018	1,596,458	5,706	1,124,798
1851-60	10,650	2,627,280	7,746	2,080,432
1861-70	11,249	3,988,069	7,909	2,641,745
1871-80	11,435	5,135,225	8,618	4,029,938
1881	10,765	5,810,043	8,061	4,478,960

TABLE XVI.

	Entered.		Cleared.	
	Vessels.	Tonnage.	Vessels.	Tonnage.
1855	19,040	2,852,228	8,488	878,182
1860	18,365	3,154,561	8,818	1,077,004
1865	14,928	3,065,880	8,035	1,121,864
1870	12,798	2,849,872	9,125	1,206,592
1874	30,828	3,505,449	9,882	1,247,548
1881	36,112	4,239,668	10,470	1,458,715

Coasting trade.

Since 1873 vessels with ashes and manure have been included in the coasting trade, and therefore the figures after that date show much greater progress than has actually taken place. In 1750 the number employed was 6396, and in 1795 it was 11,964 of 1,176,400 tons. Table XVI. gives details from 1855.

Registered shipping.

The following table (XVII.) gives the number of vessels registered in the port of London in various years from 1701:—

	Vessels.	Tonnage.	Men.		Sailing Vessels.		Steam Vessels.		Total.	
					Vessels.	Tonnage.	Vessels.	Tonnage.	Vessels.	Tonnage.
1701	560	84,882	10,165	1850	2,719	573,427	333	67,916	3,052	641,343
1791	1,842	378,516	30,860	1860	2,411	680,392	527	189,199	2,938	869,591
1800	2,666	568,262	41,402	1870	2,221	774,531	690	294,056	2,911	1,068,587
1819	4,760	894,627	56,948	1881	1,637	506,865	1,072	611,714	2,709	1,118,579

Values of exports and imports.

Declared values of the exports from London have been made at various periods, and are now made annually in the statement of the trade of the United Kingdom. Since 1840 the value has more than quadrupled, being in that year £11,586,037, from which it gradually rose almost without intermission till it was £60,232,118 in 1874, but from that year it declined till in 1879 it was £47,335,753. In 1880 it again rose to £52,600,929, considerably above the average of the four years 1876–79, which was £49,884,673, but as much below the average of 1872–75, which was £57,144,480. No return of the value of the imports is given before 1872, when they were £124,174,141. The value for 1880, £141,442,907, exceeds that of any previous year, the next being that for 1877, £140,332,773, while the average for 1876–79 was £129,449,956, and for 1872–75 £132,754,772. The following table (XVIII.) gives details of the principal imports for 1860 and 1880, and also a comparison with the United Kingdom in regard to the same articles:—

Principal Articles.	1860.			1880.		
	United Kingdom.		Port of London.	United Kingdom.		Port of London.
Animals, living: oxen, bulls, and cows	No.	77,010	54,079	No.	350,853	122,992
Sheep and lambs	"	320,219	287,203	"	941,121	679,522
Cocoa	lb.	9,009,860	6,672,631	lb.	23,511,101	20,750,014
Coffee	"	82,767,746	72,784,354	cwts.	1,546,451	1,357,397
Corn: wheat	qrs.	5,880,958	1,180,903	"	55,261,924	12,808,355
Barley	"	2,112,861	486,460	"	11,705,290	1,792,338
Oats	"	2,290,951	1,645,901	"	13,826,732	9,375,631
Pease	"	314,201	56,289	"	2,146,251	555,417
Beans	"	439,834	86,503	"	2,577,133	587,342
Indian corn	"	1,851,762	43,188	"	37,224,733	4,413,708
Wheat meal or flour	cwts.	5,086,220	1,079,394	"	10,558,812	2,040,124
Fruits: currants	"	755,415	474,949	"	820,146	482,132
Lemons and oranges	bushels	1,154,410	511,111	bushels	3,658,799	1,433,588
Raisins	cwts.	242,770	149.788	cwts.	395,290	255,613
Hides: untanned	"	848,328	408 981	lb.	1,241,788	752,045
Tanned	lb.	4,707,272	1,960,411	"	47,658,442	21,417,755
Mahogany	tons	44,710	22,590	tons	41,349	23,709
Metals: copper ore	"	97,317	5,802	"	145,475	2,983
Copper, part wrought and part unwrought	"	11,753	3,778	"	36,578	10,833
Tin, unwrought	cwts.	58,220	50,110	cwts.	389,967	381,757
Oil: train, blubber, and spermaceti oils	tuns	17,029	6,314	tuns	15,231	4,392
Palm oil	cwts.	804,326	153.094	cwts.	1,032,823	83,506
Olive oil	tuns	20,859	5,068	tuns	20,260	2,597
Seed oil	"	12,995	9,022	"	16,754	2,973
Provisions: bacon and hams	cwts.	326,106	149,236	cwts.	5,334,648	593,179
Beef, salted	"	261,259	113,790	"	1,017,956	126,130
Pork	"	178,009	128,045	"	409,267	120,014
Butter	"	840,112	427,942	"	2,326,305	319,352
Cheese	"	583,283	202,506	"	1,775,997	257,507
Eggs	cu. ft.	838,477	245,135	gt. hund.	6,228,405	909,406
Spirits: rum	galls.	7,319,678	5,171,824	galls.	6,107,661	3,878,736
Brandy	"	2,842,543	1,547,624	"	3,006,385	1,880,097
Geneva	"	635,410	206,160	"	254,503	67,913
Sugar: unrefined	cwts.	8,817,276	4,846,132	cwts.	17,001,618	6,509,553
Refined and crush sugar	"	345,010	98,281	"	3,036,074	1,396,905
Molasses	"	606,508	95,372	...		...
Tea	lb.	88,946,532	83,711,086	lb.	206,971,570	206,816,609
Tobacco	"	48,936,471	23,483,031	"	59,571,973	26,645,681
Cigars	"	2,727,255	1,469,224	"	3,502,928	2,044,738
Wine	galls.	12,475,001	9,178,729	galls.	17,385,496	10,682,179
Wood and timber: not sawn	loads	1,275,109	212,381	loads	2,130,541	222,388
Sawn or split	"	1,452,806	411,654	"	4,116,749	1,208,218
Staves	"	76,378	27,090	"	108,536	33,729
Wool: sheep and lambs	lb.	145,501,651	79,700,815	lb.	460,960,907	358,776,758
Alpaca and llama	"	2,894,926	31,662	"	2,548,656	...

Docks.

In the time of Stow, Billingsgate had begun to supersede Queenhithe as the principal landing place of the port of London; but he also gives a list of other "common watergates," and mentions that there were besides "divers private wharfs and keys all along from the east to the west end of the city, where merchants of all nations had landing places, warehouses, cellars, and stowage of their goods and merchandise." On account, however, of the attempts made to avoid the payment of customs by the use of private landing places, a royal proclamation of Elizabeth appointed certain quays to be used as general landing places and others for special purposes. After the great fire the limits of the port were declared to be the North Foreland and London Bridge; certain wharves named "legal quays" were appointed for the general trade, and others named sufferance wharves were permitted to be used under certain conditions with the special leave of the commissioners. The frontage of the legal quays in 1795 was only 1419 feet, and of the sufferance quays about 3500 feet, and so inadequate was the storage accommodation that it would not have sufficed even for the single article of sugar. After the proposal for the establishment of wet docks was made by the West India Company the system was very rapidly extended. The West India docks at the Isle of Dogs were opened in 1802, the London docks at Wapping in 1805, the East India docks at Blackwall in 1806, St. Katherine's docks to the east of the Tower in 1828, the Victoria docks in 1850, and the Millwall docks at the Isle of Dogs in 1868. The West India Company was granted for twenty years a monopoly of the West India trade, the London Dock Company of the trade in wine, brandy, tobacco, and rice, and the East India Company of the East India and China trade, but in no case were the privileges of the companies renewed. The various docks have at different times undergone improvement and extension to meet modern necessities, the latest addition being the Albert extension of the Victoria dock, opened in 1880, which affords an additional water space of 70 acres, and is unsurpassed in the completeness of its arrangements by any other dock in the world. The St. Katherine's, London, and Victoria and Albert docks are now held by one company, and the East and West India docks by another, who are adding to their accommodation by the construction of the Tilbury docks specially for ocean steamers. All the great merchandise docks are thus on the north side of the river—the Commercial docks,

which date from 1696, and were reconstructed in 1807, and the Surrey docks (1812), on the south side of the river, being used almost exclusively for timber and grain. The position of St. Katherine's docks renders it impossible to adapt them to modern requirements; and probably, on account of the increased use of large ocean steamers, all the older docks may soon be superseded as regards the bulk of the foreign trade. The water area of the docks on the north side of the river, which in 1861 was 272 acres, will soon be 465 acres. The Surrey and Commercial dock, which is very complicated in its construction, has a total area, including land and water, of 330 acres. The land and water area (in acres) of the several docks on the north side of the river at present completed or in process of construction is as follows (Table XIX.):—

Docks.	London.	St. Katherine's.	East and West India.	Victoria and Albert.	Millwall.	Tilbury.	Total.
Water......	40	10	136	173	36	70	465
Land......	59	13	210	460	200	530	1,472
Total......	99	23	346	633	236	600	1,937

Warehouses. The bonded warehouse system was sanctioned in the port of London in 1803, and the exclusive enjoyment for several years of this privilege gave it a great advantage over the other ports of the kingdom. The warehouses of the dock companies, each occupied with their special class of goods, embrace a large portion of the City area, but the rapidity with which goods now pass into consumption renders this kind of dock property at present very unprofitable, and it is probable that very soon many of the warehouses will be turned to other uses.

Custom-house. The Custom-House in Lower Thames Street was built by Laing, 1814–17, but on account of the subsidence of the central part the present Corinthian façade, 490 feet in length, designed by Smirke, was afterwards added. In the building there is a museum containing various old documents and specimens of articles seized by the custom-house authorities.

Trinity House. Trinity House, Tower Hill, a plain building with an ornamental façade, erected in 1793 from the designs of Wyatt, is the seat of an association of mariners which received a charter from Henry VIII. in 1514, and gradually acquired the management of lighthouses and buoys not only on the Thames but on the whole English coast, besides the superintendence of naval arsenals and dockyards. Along with the corporation of the City it had the conservancy of the Thames, until those authorities were superseded by the Thames Conservancy Board. Its general rights and privileges have also been much curtailed since 1853, when it was put under the partial control of the Board of Trade, but it has still the sole charge of the erection and maintenance of lighthouses and buoys, the examination of pilots and of navigating lieutenants; and two of its elder brethren act as nautical advisers in the High Court of Admiralty.

The City The prosperity of that portion of London known as the City is largely due to its proximity to the port, but the rapid development of the trade of the port is closely connected with the increase of London outside the City limits, which is of course dependent on a great variety of causes. The uninterrupted extension of the business and financial transactions of the City, and the connection of these with the rapid increase of the surrounding population, is sufficiently evidenced by the fact that the ratable annual value of the City has risen from about £760 an acre in 1801 to about £5300 an acre in 1881; that the net profits under the commercial and mercantile schedule D for the combined boroughs of the metropolis (1879–80) amounted to £81,088,368, of which the profits for the City alone amounted to £39,263,424, a larger sum than that of the whole seventeen next largest cities and towns of the United Kingdom; and that the number of persons entering the City daily during the sixteen hours of business has increased from 657,379 in 1866 to 739,640 in 1881.

Exchanges. The business centre of London is the Royal Exchange, which occupies a commanding position between Threadneedle Street and Cornhill, at the principal convergence of the City thoroughfares. The first building, erected 1565–70 by Sir Thomas Gresham and presented to the City, was destroyed by the great fire, and the second opened in 1669 was also burnt in 1838. The present exchange (1839–44), designed by Tite and erected at a cost of £180,000, is a quadrangular structure with an imposing Corinthian portico at its principal entrance, and encloses a court surrounded by an ambulatory. It is in the open central area that the commercial transactions take place—the ground floor being occupied by shops and offices, and the principal floor by insurance companies and "Lloyd's rooms." The principal exchanges for special articles are the corn exchange in Mark Lane, where the privilege of a fair was originally granted by Edward I.; the wool exchange in Coleman Street; the coal exchange adjoining the custom-house, erected in 1849 in the Italian style, and consisting of a rotunda surmounted by a dome; and the auction mart for landed property in Tokenhouse Yard. The metal market is a very important one; and there is also a very large consignment of precious metals and diamonds, the workers in which are chiefly concentrated in the neighborhood of Clerkenwell.

The Mint. The Royal Mint, Tower Hill, erected in 1805 on the site of the Cistercian abbey of St. Mary, is the only mint in England for the fabrication of gold and silver coins, but bronze coins are chiefly made at Birmingham, and gold coinage is now also manufactured at Sidney and Melbourne.

Banking. The unique commercial position of London, and its intercourse with every quarter of the globe, have assisted to make it financially in a more complete sense than it is commercially the metropolis of the world. The stock jobbers and brokers, who according to the City census of 1881 numbered 1682, and who have their offices chiefly in the courts and alleys adjoining the Bank of England and the Royal Exchange, are nearly all members of the stock exchange, for whom the present building in Capel Street was erected in 1801; but there is also an open stock exchange in Lothbury. The earliest approximation to banking transactions in London appeared in the negotiations for loans between Elizabeth and the principal city merchants, but the general adoption of the system was due to the civil war, when the merchants, some of whom had already made use of the Royal Mint as a bank of deposit, and the landed proprietors, began to place their money for the sake of greater security in the hands of the goldsmiths. Some of the private banks now existing, such as Coutts's and Child's, date from the 17th century, and a new era in the financial history of London was inaugurated in 1694 by the foundation of the Bank of England, of which a full account is given in the article BANKING (vol. iii. p. 273 *sq.*). Until 1733 the business of the bank was carried on at Grocers' Hall. The present building, which covers about 4 acres, and was enlarged in 1770 and 1788 by Sir Robert Taylor and Sir John Soane, presents to the street a low triangular wall without windows, and almost entirely devoid of ornament except at the north-west corner, which was copied from the temple of the Sibyl at Tivoli. Until the establishment of the London and Westminster Bank in 1834, the Bank of England was the only joint-stock bank in London. The private and joint-stock banks which have offices in London now number over 150. The principal banks are members of the Clearing House near Lombard Street, where a daily exchange of drafts or cheques is effected. For the year ending April 30, 1882, the total amount of bills, cheques, etc., paid at the Clearing House was £6,382,645,000, the largest sum paid in any of the fifteen years for which statistics have been collected, the amount for the first year ending 1868 being only £3,257,411,000. The extent of the commercial enterprise of London is strikingly indicated by the large number of companies, with their field of operations chiefly in foreign countries, which have been projected in the City or have in it their headquarters. The foreign operations of these companies are however sometimes only nominal, their real business being wholly confined to London itself.

Brewing. The largest manufacturing industry in London is that of brewing, the number of common brewers in 1880 being 110, who made use of 9,955,177 bushels of malt, while of the 412,192 barrels of beer exported from the United Kingdom 236,206 were from London. To supply the breweries with water, wells now require to be sunk below the chalk to the greensand. According to Stow, the brewers in 1585 in London and Westminster, who then remained "near to the friendly water of Thames," numbered 26, some of them being foreigners, who first introduced the art of cultivating hops. Among the oldest and most important of the breweries now existing is that of Barclay, Perkins & Co., which covers an area of 12 acres, belonged at one time to Johnson's friend Thrale, and occupies the site of the old Globe theatre.

Miscellaneous industries. Silk weaving, which received a special impulse from the settlement of foreign refugees at Spitalfields after the revocation of the edict of Nantes, has within the last fifty years been in a stagnant condition, owing chiefly to the rivalry of Lancashire. The majority of the other manufactures are carried on in the neighborhood of the Thames. The ships built in London in 1881, which are principally yachts, numbered 64, but their total tonnage was only 2723. The principal shipbuilding yards are at the Isle of Dogs. Boat-building is extensively carried on at Chelsea and at several other places in the upper reaches of the river. There are large engineering-works at Lambeth and Millwall, potteries and glass-works at Lambeth, Whitefriars, and Southwark, tanneries at Bermondsey, chemical-works on the Lea, paper-works on the Wandle, and sugar bakeries at Whitechapel. The cabinetmakers' shops are situated principally in the neighborhood of Shoreditch, but there are several adjoining Tottenham Court Road and Hampstead Road, where upholstery warehouses are very numerous. Lucifer match making gives employment to a large number of women and children in the eastern districts. There are extensive hat manufactories in Lambeth. The special manufactures in different parts of London are too numerous for mention. The principal depôts of the carriage-builders are in Long Acre. A large trade in second-hand clothing is done by the Jews at Houndsditch, especially on Sunday morning, and on the same day of the week there are bird and fancy animal fairs at Church Street, Bethnal Green, and at St. Andrew's Street, Bloomsbury, near the Seven Dials. The centre of the wholesale book trade is in Paternoster Row, but some of the principal publishers have their premises in the neighborhood of Covent Garden and still farther west. Fleet Street is largely occupied with the offices of the London and the provincial daily newspapers, but the office of the *Times* is in Printing-house Square. The weekly newspapers have their offices chiefly in streets running off the Strand.

Poor-law unions.

Pauperism.—London since 1867 has been divided into thirty poor-law unions, which are governed by boards of guardians, for the most part elected annually by the householders and owners of property, the number of votes possessed by each owner or householder varying from one to six, according to the value of the property. A proportion of the guardians in each union are so *ex officio*, or are nominated by the Local Government Board. The Act of 1867 authorized the establishment of outdoor dispensaries in any union or parish; and in twenty-seven of the thirty unions of the metropolis there are now forty-seven of these dispensaries, the number of prescriptions made up in the year 1880 being over a million. For the maintenance of lunatics and insane poor, of patients suffering from contagious diseases, and of pauper children at school, and for the relief of casual paupers, a metropolitan common poor fund is provided, through the operation of which the cost of maintaining the poor is now equalized, to the extent of 42·3 per cent. of the whole sum applied over the metropolitan area. The good results which have followed, both in lessening expense and diminishing

TABLE XX.—*Summary of Poor Rate Returns for 1880.*

Receipts.				Expenditure.								
From Poor Rates.	In Aid of Poor Rates.		Total Receipts.	Relief of the Poor.					Unconnected with the Poor.		Partly Connected with the Poor.	Total.
	Treasury Subvention.	Other Receipts.		In-Maintenance.	Out-Maintenance.	Asylums, Work-houses, etc.	Total.[1]	Law.	Police Rate.	Other Purposes.		
£2,359,487	£112,335	£115,651	£2,587,473	£513,775	£198,422	£1,107,651	£1,817,972	£6,110	£618,444	£42,780	£110,137	£2,590,44

[1] Including £1876, the difference arising in adjusting the charge of relief.

TABLE XXI.

Unions.	Ratable Value, Year commenced 6th April, 1871.	Ratable Value, Year commenced 6th April, 1881.	Average Pauperism, 1880.		Adjusted Relief to the Poor, 1880.	Rate per £1 for Relief, 1880.
			Indoor.	Outdoor.		
West District.	£	£			£	s. d.
Kensington	935,720	1,648,187	1,370	549	92,364	1 3¼
Fulham	280,704	545,854	788	960	31,444	1 7½
Paddington	938,597	1,189,864	912	784	58,247	1 0¾
Chelsea	341,749	465,358	1,186	945	29,826	1 5¼
St. George's	1,860,033	2,280,929	2,189	1,833	128,110	1 2¼
Close of St. Peter	Nil.					
Westminster	623,041	785,466	980	858	42,074	1 2¾
Total West District	4,979,844	6,915,658	7,325	5,374	377,065	...
North District.						
St. Marylebone	1,158,979	1,383,987	2,864	1,886	92,549	1 4¾
St. Pancras	1,149,817	1,491,461	245	190	21,014	1 1¾
Hampstead	263,915	417,283	3,298	4,442	106,608	1 7½
Islington	984,041	1,445,226	1,791	3,208	81,562	1 4¾
Hackney	578,804	942,240	1,266	2,590	54,562	1 4¾
Total North District	4,135,556	5,680,197	9,464	12,311	356,295	...
Central District.						
St. Giles's and St. George's, Bloomsbury	307,192	358,418	1,142	766	31,981	1 11
Lincoln's Inn	Nil.	18,800	...	...	...	...
Strand	553,066	700,441	885	452	42,476	1 4
Holborn	723,631	918,116	3,557	4,056	101,583	2 5
Charterhouse	Nil.					
Gray's Inn	Nil.	15,208	...	...	...	...
London, City of	2,524,775	3,508,085	2,082	2,828	180,777	1 1¾
The Temple	Nil.	34,526	...	...	...	...
Total Central District	4,108,664	5,548,589	7,666	8,102	356,767	...
East District.						
Shoreditch	440,689	580,411	1,591	1,435	45,377	1 9
Bethnal Green	270,524	357,854	1,785	1,247	31,020	1 11
Whitechapel	314,850	370,384	1,350	428	31,848	1 9¾
St. George's in the East	184,175	199,287	1,486	380	23,639	2 5¾
Stepney	256,163	318,469	1,060	348	30,688	2 1
Mile End, Old Town	268,042	335,344	1,228	987	23,655	1 6
Poplar	447,652	670,476	1,456	1,673	55,063	1 10¾
Total East District	2,182,095	2,832,125	9,955	6,493	241,285	...
South District.						
St. Saviour's	724,345	989,858	3,330	3,399	77,980	1 9¼
St. Olave's	576,309	775,330	1,907	1,890	65,107	1 8¾
Lambeth	919,015	1,284,862	2,395	4,038	95,311	1 6
Wandsworth and Clapham	694,815	1,188,278	1,294	1,494	66,507	1 4¼
Camberwell	477,368	808,418	1,598	1,351	58,844	1 6
Greenwich	401,469	617,252	1,836	2,668	58,495	2 4¼
Woolwich	211,972	279,847	480	908	32,624	1 8¾
Lewisham	384,805	547,159	1,051	2,642	36,197	2 9¼
Total of South District	4,390,098	6,430,994	13,841	18,385	436,065	...
Total of the Metropolitan Unions	19,796,257	27,402,508	48,251	50,665	1,817,427	1 5¾

TABLE XXII.

Parochial Year.	Total Relief to the Poor Adjusted.	Rate per £1 on Ratable Value.	In-Maintenance.	Outdoor Relief.	Ratio of Outdoor Relief to In.	Mean Number of Paupers. Indoor.	Mean Number of Paupers. Outdoor.	Total.	Ratio per 1000 of Population.
	£	s. d.	£	£					
1871	1,646,103	1 9¼	436,208	412,299	48·6 : 51·4	36,739	116,554	153,293	47
1880	1,817,972	1 5¾	518,775	196,422	27·9 : 72·1	48,251	50,665	98,916	27

pauperism, especially outdoor pauperism, form a strong argument for the complete equalization of the rates, and the creation of a united poor-law authority for the whole metropolis. The three unions which in 1880 contributed most in aid of the poorer ones were Kensington (£27,705), St. George's (£25,299), and the City of London (£61,080); and the three unions most benefited were Holborn (£21,048), Bethnal Green (£19,835), and St. Saviour's, Southwark (£23,085); but, as will be seen from Table XXI. (p. 842), great inequality still exists in the rating, and the rate is generally higher in the poorer districts. Each poor-law union possesses one or more workhouses, but the accommodation is inadequate, and difficulty in dealing satisfactorily with applicants often follows. Several unions, by the powers granted them under the Act of 1867, have combined into districts to provide infirmaries for the sick and imbecile, there being now only three unions—Bethnal Green, Hampstead, and Lewisham—whose sick are not treated in establishments under medical supervision. In addition to this, the several unions and parishes are combined into one metropolitan asylums district, with a managing body of sixty members, fifteen of whom are nominated by the Local Government Board. The total number of persons relieved in establishments belonging to the managers of the metropolitan asylums district since the first was opened in 1870 has been more than 1200 in imbecile asylums, nearly 50,000 in hospitals for infectious diseases, and 1375 on board the "Exmouth" training ship, which was established in March, 1876. The paupers' schools fall to be noticed under another section (see below, p. 844). The amount of accommodation provided in the various establishments of the unions in July, 1870, was 35,093 beds, and in December, 1880, it was 53,332 beds. Table XX. gives a summary of the poor rate returns for 1880; Table XXI. the ratable value of the different unions in 1871 and 1881, and the average pauperism, the amount of adjusted relief, and the rate in the pound for relief in 1880; and Table XXII. various particulars in reference to metropolitan pauperism for 1871 and 1880.

Charities. The annual income of the various charitable institutions in London is now over £4,000,000, of which at least three-fourths is spent in London. That of the endowed parochial charities of the City of London in 1865 was £64,500, which by 1881 had increased to £116,960, those of Westminster being in the same years £26,555 and £33,124. The income of the charities of the Livery Companies in 1869 was stated to be £99,027, and now the 1028 charities belonging to the companies have an aggregate income of £185,829, representing a capital value of £4,456,768. The amount spent on education is £65,130, and on doles £108,498. In addition, the charities of the corporation probably possess an annual income of £30,000. The parliamentary commission appointed to inquire into the endowed parochial charities of the City of London and Westminster in the report of 1880 divides them into two classes,—those that are eleemosynary and those that are ecclesiastical. In regard to the first, it states that it is impossible to effect a satisfactory combination or readjustment of them under existing circumstances, and, in regard to the second, that they are so far liberated by altered circumstances as to require reappropriation to new charitable use.

Police. CRIME.—The London police district, or "Greater London," is divided into two police jurisdictions, that of the Metropolitan police, with an area of 440,919 acres, and that of the City police, with an area of 668 acres. The Metropolitan police force, which superseded the night watch in 1830, owes its existence to a bill introduced by Sir Robert Peel, providing for the establishment of a Metropolitan police under the control of the executive government. In 1839 the old watch was abolished within the City limits and a City police force appointed, which, however, is entirely under the control of the common council. There are two police courts within the City district, viz., Guildhall and Mansion House; and thirteen within the Metropolitan district, viz., Bow Street, Clerkenwell, Great Marlborough Street, Marylebone, Westminster, Lambeth, Southwark, Thames (Stepney), Worship Street, Woolwich, Greenwich, Hammersmith, and Wandsworth. The headquarters of the Metropolitan police are at Scotland Yard. The expenses of the two City police courts in 1880 were £10,031, and those of the Metropolitan police courts were £59,009, of which £10,527 was defrayed by fines and forfeitures. The Metropolitan police have power to regulate the street traffic, to inspect and license cabs, omnibuses, and other public conveyances, to interfere in abating smoke nuisance, and to inspect common lodging-houses. From 6158 in 1861 the Metropolitan force had in 1880 increased to 10,943, or one to every 430 of the population; the City police force from 628 to 830, or one to every 61 of the population. The increase of the City police force is necessitated wholly by the increase in the number of persons who daily frequent the City, for not only has the night population greatly diminished, but the resident criminal population has become almost extinct. The number of persons belonging to the criminal classes in the whole police district of the metropolis in 1880 was 2392, or one in 1992 of the population in 1881; the number of known thieves 1385, the number in England being 17,907; the number of indictable offences was 17,835 (of which 1137 occurred in the City), the number in England being 52,427; and the number of apprehensions 5261 (City 612), the number in England being 22,231. Of indictable offences 49 were murders, 6 attempted murders, 443 attempted suicide, 1150 burglaries, 8918 simple larcenies, 1745 larcenies from the person, and 367 utterances of counterfeit coin; 47 bodies of persons found dead and unknown were photographed and not identified. The number of offences determined summarily within the area of the Metropolitan police district was 125,302, or 11·41 to every policeman, the proportion of indictable offences to every policeman being 6·70. The number of offences determined summarily within the City area was 5649, or only 6·70 to every policeman, while the proportion of indictable offences was only ·78. The total expense of the Metropolitan police was £1,168,061, or about £106 per man; £451,334 was contributed to the expense from public revenue, and £93,071 was received for special services. The expense of the City police, £90,662 in 1880, is defrayed wholly by rate, and the cost per man is about £109.

The following table (XXIII.) gives details regarding police and crime in the Metropolitan police district since 1871, by which it will be seen that, although compared with the increase of population the total number of apprehensions has diminished, there has of late years been a considerable increase in the number of felonies, and that the amount of property lost by felonies has been increasing very seriously:—

	Total Police Force.	Apprehensions and Convictions. Persons Apprehended.	Apprehensions and Convictions. Convicted on Trial	Apprehensions and Convictions. Summarily Convicted.	Felonies. Number of Felonies.	Felonies. Apprehensions for Felony.	Felonies. First Loss.	Felonies. Amount Recovered.	Felonies. Proportion per 1000 of Population.	Persons Apprehended under Poor Law Acts.	Apprehensions for drink. Persons Apprehended.	Apprehensions for drink. Proportion per 1000 of Population.
1871	9,655	71,961	2,655	45,608	16,926	10,054	£77,828	£19,284	4·444	6,142	24,213	6·358
1872	9,761	78,203	2,456	52,472	17,651	10,271	71,794	19,106	4·549	5,676	29,109	7·502
1873	9,883	73,857	2,410	50,441	18,879	10,667	84,009	20,957	4·780	4,786	29,755	7·585
1874	9,958	67,703	2,306	45,886	17,814	9,856	77,498	18,429	4·483	4,064	26,155	6·509
1875	10,227	72,606	2,343	49,712	17,093	9,729	99,208	20,492	4·182	3,724	30,976	7·578
1876	10,268	76,214	2,476	51,880	18,893	10,210	135,570	19,998	4·486	4,152	32,328	7·676
1877	10,446	77,982	2,571	54,084	20,281	10,462	118,680	21,196	4·557	4,516	32,869	7·274
1878	10,477	83,746	2,724	57,088	21,792	10,849	157,283	19,785	4·806	4,430	35,408	7·809
1879	10.711	81,885	2,984	54,754	21,891	11,431	101,798	22,460	4·789	4,398	33,892	7·836
1880	10,943	79,490	2,609	50,490	23,920	13.336	129.687	37,881	5·061	4,594	29,888	6·345

Prisons.

The Newgate and Holloway prisons are in the hands of the Court of Aldermen. Newgate, rebuilt after the riots of 1780, is now no longer used for persons awaiting trial in the Central Court. The City prison, Holloway, which is the house of correction for City prisoners, was erected in 1851 at a cost of nearly £100,000. Bridewell, which occupied the site of a royal palace, and was granted to the city as a house of correction by Edward VI., was discontinued in 1864; the old Fleet prison was abolished in 1844, its site being now occupied by the Memorial Hall of the Congregationalists; Horsemonger Lane prison was superseded by Wandsworth prison; and the Marshalsea in Southwark, immortalized by Charles Dickens, had been discontinued long before he wrote. The house of detention for Middlesex is Clerkenwell, and its houses of correction are Coldbath Fields for male prisoners and Westminster for females. Wandsworth is the prison for Surrey. The convict prisons within the metropolitan area are Brixton, Millbank, Pentonville, Wormwood Scrubs, Woking, and Fulham.

Elementary schools.

EDUCATION.—Until the constitution of a School Board for London in 1870, the only special organizations for providing education to the poorer classes in London were the British and Foreign School Society, founded in 1808, and the National Society, founded in 1811. Many of the parish schools became amalgamated with those of the National Society, but the united efforts of these societies, and also of the Church of England, of the different denominations, and of various promiscuous charitable institutions, failed so completely to meet the necessities of the rapidly increasing population, that in 1851 the total number of scholars attending public schools was only 167,298, and that in 1871 the returns of the voluntary schools showed that there was accommodation for only 262,259 children, or 39 per cent. of the estimated population of school age. By October, 1881, the School Board had supplied accommodation for 236,024 children, which with that in voluntary schools gives a total number of places sufficient for 502,095 children, in addition to which schools are in the process of erection for upwards of 100,000 more. Up to August, 1881, 6838 children were sent to industrial schools at the instance of the board, and the board now possesses three industrial schools under its own management. The total number of children attending workhouse, separate union, and parochial and district schools in 1880 was 35,223, the amount paid to teachers in these schools being £37,110. The total expenditure of the School Board for the year ending 25th March, 1881, was £1,236,360. The amount paid by rating authorities in 1881–82 was £676,579, the rate in the pound being 6·15d., a less rate than that for 1880–81, which was 6·28d., but in all probability there may for some years be a slight increase. The average cost of the 3129 teachers in 1880 was £123. The gross cost per child has risen from £2, 4s. 9d. in 1874 to £2, 17s. 1d. in 1881, but there will probably be a considerable diminution when the schools become all fully occupied throughout a whole year. The following table (XXIV.) gives a comparison of cost between the board schools and other schools of London and of England in 1880:—

	Income per Scholar.						Education Grant per Scholar.			Expenditure per Scholar.					
	School Fees.			Voluntary Contributions.						For Salary.			Total Cost.		
Voluntary Schools:	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
London	0	18	2¾	0	9	8¼	0	15	9½	1	10	0¾	2	0	10½
England	0	10	9¾	0	7	8	0	15	5	1	7	0¾	1	14	7¾
Board Schools:				Rates.											
London	0	8	4	1	13	7	0	16	4¼	2	8	11¼	2	17	7¾
England	0	9	0	0	18	7	0	15	7¾	1	12	1¾	2	1	11¾

Grammar schools.

Fitzstephen mentions that in his time the three principal churches possessed by ancient privilege and dignity celebrated schools, and that other schools were permitted on sufferance. The churches referred to are supposed by Stow to have been St. Paul's Cathedral, St. Peter's at Westminster, and St. Saviour's, Bermondsey, in Southwark. The various other priories and religious houses which were afterwards founded had each its school, though of less fame than the earlier ones. On account of the suppression of the alien priories and religious houses by Henry V., Henry VI. in 1445 founded grammar schools at St. Martin's-le-Grand, St. Mary-le-Bow, St. Dunstan's in the West, and St. Anthony's, and in the following year others in St. Andrew's, Holborn, All Hallows the Great, St. Peter's, Cornhill, and in the hospital of St. Thomas of Acon. The custom of school disputations mentioned by Fitzstephen was continued till the time of Stow, who states that they were restrained on account of the quarrels between the boys of St. Paul's and St. Anthony's. In his time the principal schools "repairing to these exercises" were St. Paul's, St. Peter's (Westminster), St. Thomas of Acon, and St. Anthony's. The last-named, which commonly presented the best scholars, and at which Sir Thomas More, Lord Chancellor Heath, and Archbishop Whitgift received their education, had, however, latterly greatly decayed. Up to the time of the dissolution of the monasteries education in England had been in the hands of the religious houses, but, though many of the grammar schools in London were then discontinued, several were re-erected and re-endowed, and others were added in subsequent years. Of these schools there are now existing St. Paul's, St. Peter's (Westminster), Christ's Hospital (Blue Coat School), Merchant Taylors' School, Charterhouse, Mercers' School, and the City of London School.

St. Paul's School, St. Paul's Churchyard, was re-established in 1512 by Dean Colet, for the free education of one hundred and fifty-three poor children, and was endowed with lands whose original annual value was £122, 4s. 7½d., but which now yield nearly £6000 yearly. The board of governors consists of thirteen members chosen by the Mercers' Company and nine nominated by the universities. Vacancies on the foundation are filled up by competition, and the school fee for the scholars is £20. The course of study, which formerly was chiefly classical, is now specially designed to prepare for the army examinations. The site of the school will soon be changed to West Kensington, where grounds to the extent of 16 acres have been purchased.

St. Peter's School, Westminster, re-endowed by Queen Elizabeth in 1560, provides for 40 queen's scholars on the foundation; and the school is also attended by about 180 day pupils. Besides six junior exhibitions tenable at school, there are eight exhibitions to Oxford or Cambridge. The management of the school is regulated by the Public Schools Act of 1868. The school, which is in the Dean's Yard, was formerly the dormitory of the monks of the abbey.

Christ's Hospital (Blue Coat School), Newgate Street, founded by Edward VI. in 1533 on the site of the monastery of Greyfriars, has an annual income of over £60,000, and the number of children on the foundation is about 1180, including 440 at the preparatory school at Hertford, of whom 90 are girls. The school is under the management of a court of governors, to which any one may be admitted on payment of a donation of £500. The education is chiefly commercial, but four boys are annually sent to the universities. The boys still retain their ancient dress, as well as several peculiar privileges.

Merchant Taylors' School, which was formerly situated in Suffolk Lane, but in 1875 was removed to the Charterhouse, was founded by the Merchant Taylors' Company in 1561, and provides for the education of 500 boys annually on payment of 12 guineas in the lower school, and 15 guineas in the upper. The site of the present building was purchased for about £90,000, and the new school-house cost £30,000. The rooms of the pensioners of Charterhouse remain entire, as well as the chapel of the date 1512, the master's lodge, and the great chamber, the interior of which is a very fine specimen of Elizabethan work.

Charterhouse, formerly a Carthusian monastery and afterwards the seat of the Howards, was purchased by Sir Thomas Sutton, and in 1611 endowed as a school. On the foundation 80 pensioners are maintained at Charterhouse, and 60 scholars at the school at Godalming, where it was removed in 1872.

The Mercers' Grammar School, Collegiate Hill, Dowgate, was originally attached to the hospital of St. Thomas of Acon, which was sold in 1522 to the Mercers' Company on condition that they maintained the school. Of the 180 scholars 25 are free.

For the City of London School, founded by the City corporation in 1835, at Milk Street, Cheapside, to supply education to sons of respectable persons, a new building is in course of erection on the Thames embankment. There are preparatory schools in connection with University College and King's College.

Higher education.

The University of London, Burlington Gardens, instituted in 1836, and removed in 1869 to its present building in the Italian Renaissance style, is a mere examining body for conferring degrees. University College, Gower Street, founded in 1828 on undenominational principles, supplies instruction in all the branches of education—including engineering and the fine arts—that are taught in universities, with the exception of theology, and is attended by over 1500 students. The buildings, the chief feature of which is the Corinthian portico at the main entrance surmounted by a dome, were enlarged by a wing in 1881, and contain a large library, and the Flaxman gallery, with original models by Flaxman. King's College, erected by Smirke in 1828, and forming the east wing of Somerset House, provides similar instruction to University College, but with the addition of theology, and in connection with the Church of England. At Gresham College, founded in 1597 by Sir Thomas Gresham, and removed to its present building in Basinghall Street in 1843, lectures are given on law, divinity, the sciences, music, and medicine. The lectures of the London Society for the Extension of University Teaching have been instrumental in stimulating to some degree general interest in literary and scientific subjects, and in 1881 were attended by 3030 persons. The legal lectures in connection with the Inns of Court are noticed in the article INNS OF COURT, vol. xiii. p. 91 *sq.*

Medical schools.

Other scientific schools.

SCIENCE.—The great medical schools owe their fame and success to the attraction which London presents to eminent physicians and surgeons, and to the existence of extensive medical and surgical hospitals, which afford unequalled opportunities for the study of disease. In addition to the university of London, the Royal College of Physicians, founded by Linacre, physician to Henry VII. and Henry VIII., is an examining body for diplomas in medicine; and the Royal College of Surgeons, which originated in the livery company of Barber-Surgeons, formed by the incorporation of the surgeons with the barbers in 1540, has similar authority in regard to the practice of surgery. The College of Physicians, originally located in the private house of Linacre in Knight-Rider Street, and afterwards in a building designed by Wren in Warwick Lane, removed to its present site in Trafalgar Square in 1825, where a Græco-Italian structure was erected from the designs of Smirke at a cost of £30,000. The College of Surgeons, Lincoln's Inn Fields, erected 1835–37 from the designs of Barry at a cost of £40,000, contains the Hunterian Museum, purchased by parliament in 1799 (see HUNTER, vol. xii. p. 405), an extensive library, and a lecture theatre. Until the time of John Hunter the medical and surgical education obtainable in London was of a very unsystematic character, and chiefly of a private nature, the provision made for dissection being often of the meagrest kind, while the lectures on anatomy and surgery were both included in a course of six weeks. Hunter's lectures, first delivered in 1774, had a very influential effect in the development of the medical and surgical schools connected with the hospitals, but their most rapid progress has been during the present century. A full description both of these hospitals and of the hospitals for special diseases will be found in the article ENGLAND, vol. viii. p. 229 *sq.*, and the article HOSPITAL, vol. xii. p. 314 *sq.* Among the other scientific schools of London may be mentioned the Royal School of Mines, Jermyn Street; the Normal School of Science, South Kensington; the Royal Veterinary College, Camden Town; the Royal Naval College, Greenwich; the Royal Naval School, New Cross; the Royal Military Academy, Woolwich; and the School of Practical Engineering at the Crystal Palace. The Guilds of London Institute for the advancement of technical education have lately founded colleges at Finsbury and South Kensington. The foundation stone of the South Kensington Institute was laid in 1882, and the building will be opened in 1884, the cost being £75,000, making a total with the Finsbury College of £102,000, in addition to £20,000 for fittings. The amount contributed by the Livery Companies to the undertaking is £23,000.

Scientific societies.

The most influential of the scientific societies is the Royal Society, incorporated by Charles II. in 1663. Originally located near Gresham College, Crane Court, it was removed in 1780 to Somerset House, and since 1857 it has occupied rooms in Burlington House, Piccadilly. In 1854 old Burlington House, built by Richard Boyle, earl of Burlington, was purchased by the Government for £140,000, and in 1872 a new building in the Renaissance style was erected for the various societies formerly accommodated in Somerset House, viz., the Chemical Society, the Geological Society (instituted 1807, incorporated 1826), the Society of Antiquaries (1707, 1751), the Royal Astronomical Society (1820, 1831), and the Linnean Society (1788, 1802). The Royal Geographical Society (1830, 1859), occupying a commodious building in Savile Row, has within the last forty years taken a leading part in promoting geographical discovery. The Royal Asiatic Society (1823) is in Albemarle Street. The Royal Institution of Great Britain, in the same street, established in 1799 chiefly for the promotion of research in connection with the experimental sciences, possesses a large library, a mineralogical museum, a chemical and a physical laboratory, and a foundation for a course of lectures. The Society of Arts, John Street, Adelphi, established in 1754 and incorporated in 1847, for the encouragement of arts, manufactures, and commerce, offers rewards for new inventions and discoveries, and grants certificates and prizes for proficiency in commercial knowledge, the industrial arts, musical theory, and domestic economy. Among other scientific societies the principal are the Statistical, the Meteorological, the Anthropological, the Entomological, the Numismatic, the Zoological, the Botanic, the Horticultural, the Institute of Civil Engineers, and the Royal Institute of British Architects. The Zoological Society, instituted in 1826, rented in 1828 a portion of Regent's Park, where they established gardens which now contain one of the finest collections of live specimens in the world. The gardens of the Botanic Society, which occupy 18 acres of Regent's Park, are not of a strictly scientific character, being used chiefly for musical promenades and flower shows, and are to be distinguished from the Government gardens at Kew, which are noticed under KEW (*q. v.*). The Horticultural Society, founded in 1804, possesses large fruit and flower gardens at Chiswick, and in 1861 entered upon a lease of 22 acres of ground, formerly occupied by the Exhibition of 1851, which they laid out at a cost of £50,000, and where they now hold their flower shows and fêtes.

Scientific museums.

Of museums, London possesses two on a scale of unexampled vastness, the British Museum and the South Kensington Museum. The zoological collection of the British Museum is still at Bloomsbury, but the departments of geology, mineralogy, and botany were removed in 1881 to a new building in Cromwell Road, South Kensington, called the British Museum of Natural History. The British Museum at Bloomsbury, and the South Kensington Museum, which are more directly connected with art than science, are noticed under the section Art. The Museum of Practical Geology, Jermyn Street, occupies a building in the Italian Palazzo style, erected in 1850 by Pennethorne at a cost of £30,000. It was founded in 1835 in connection with the geological survey of the United Kingdom, and also contains specially fine collections illustrative of the application of the minerals and metals to the useful arts. In the Patent Office Museum at South Kensington there are many of the original examples of the greatest mechanical inventions of modern times; and the United Service Museum, Whitehall, possesses relics and models illustrative both of the art of war and of the great naval and military achievements of England.

The drama.

DRAMA.—According to Fitzstephen, London, "instead of showes upon theatres and comical pastimes," possessed in his time "holy plays and representations of miracles;" and Stow mentions that in 1391 a play by the parish clerks continued three days together, and that another in the year 1409 lasted eight days, and was "of matter from the creation of the world." In the 15th century the secular began to supersede the sacred drama; its progress in London under Elizabeth and James I. will be touched on below (pp. 857 *sq.*). After the Restoration the "king's servants" who had previously occupied the Globe and Blackfriars played first at the Red Bull, then in Vere Street, Clare Market, and in 1663 removed to the Theatre Royal in Drury Lane. For Davenant's company, known as the "duke of York's," the Lincoln's Inn theatre was built on an improved plan in 1662, and there for the first time women actors were introduced. The two companies received each special patents in the same year. Before 1672, when Drury Lane theatre was burned, Davenant had removed to a new house built by Wren in Dorset Gardens, at a cost of £8000, and spoken of by Dryden as "like Nero's palace shining all with gold;" and, as the new Drury Lane was far less magnificent in its arrangements, it generally had the worst of the costly competition in which they engaged until the union of the patents in 1682. In 1695 a license was granted to a new theatre in Lincoln's Inn Fields, and in 1705 Haymarket theatre was opened, chiefly for Italian opera. The Dorset Gardens theatre was demolished in 1709. In 1733 the Lincoln's Inn theatre was removed to Covent Garden. The Act of 1737, which forbade the granting of new licenses, gave to the patent houses a monopoly of the legitimate drama till 1843; but in the smaller houses, such as "The Little Haymarket" (erected in 1720), the Goodman's Fields theatre (1727), Sadler's Wells (1764), the Lyceum (1795), the Adelphi (about 1800), the Princess's (1830), the Strand (1831), and St. James's (built by Braham, 1835), the law was evaded by the performance of miscellaneous entertainments. The most striking feature in the dramatic entertainments of London is their variety; the old dramatic traditions of England, so closely associated with Drury Lane and Covent Garden, now exercise their influence rather in Germany than in London. London at present possesses about thirty theatres, and the plays of the older dramatists are revived only occasionally, chiefly at Drury Lane, the Lyceum, and the Princess. Melodramas and the domestic drama win large support, but many theatres rely chiefly on comedy, farce, or opera-bouffe.

Musical performances. MUSIC.—In 1673 the chequered career of English opera in London was first definitely commenced by the performance at Dorset Gardens of *Psyche*, followed by the *Tempest* and a little later *The Prophets* and *King Arthur*. For some time after the opening of the Haymarket theatre, Italian operas were varied by performances of English opera and the spoken drama, but the increasing success of the new entertainment soon led to its exclusive establishment. Since 1847 Italian opera has also been established at Covent Garden. English opera has lately been successfully revived by Carl Rosa, and Italian opera is also threatened with formidable rivalry by the performance on a scale of unexampled grandeur of Wagner's operas in German. The Academy of Ancient Concerts, established in 1710, had the honor in 1732 of introducing to the world that special development of Handel's genius, the oratorio, which still excites a wider and deeper interest in England than any other form of musical composition. The Ancient Concert Society did not find a worthy successor in its special sphere till the establishment of the Sacred Harmonic Society in 1821, which, besides its annual series of performances, formerly in Exeter Hall and latterly in St. James's Hall, has organized great triennial festivals at the Crystal Palace. Oratorio performances on a larger scale than those of the Sacred Harmonic are now given at the Royal Albert Hall, but the nature of the building renders them less successful artistically. The Philharmonic Society has since its commencement in 1813 held a leading position in the performance of great instrumental works, which previous to this had been commenced at subscription concerts conducted by private enterprise, but the orchestral performances at the Crystal Palace are of equal excellence, and of late years the Richter and Halle concerts have excited a larger amount of general interest. The Monday and Saturday popular concerts for chamber music have been the special means of introducing to London audiences instrumental performers of European fame. By the formation of Henry Leslie's choir in 1855, the standard of refinement and taste in unaccompanied part-singing has been improved throughout England, and besides reviving general interest in glees and madrigals, it has been the principal means of giving currency to the "modern part song." The choir, after the suspension of its performances since 1880, was revived in 1882; and there are also in London several local choirs which have attained nearly equal perfection in similar performances. The Bach Society devotes itself to the study and performance of the unaccompanied music of Bach and the older composers. **Concert rooms.** The earliest renderings of the great classical compositions are associated with the Hanover Square rooms, converted into a club house some years ago, and in a less degree with Willis's rooms, built in 1765, which are now used almost solely for balls and public meetings. The only concert-room in London of a convenient size for important performances is St. James's Hall, Regent Street and Piccadilly; for since the purchase of Exeter Hall, associated with the "May meetings," by the Young Men's Christian Association, its use is prohibited even to the Sacred Harmonic Society, and the Royal Albert Hall is much too large for the proper realization of the finer effects either of choral, orchestral, or solo performances. This elliptical building in the Italian Renaissance style, erected from the designs of Captain Fowke, was completed in 1871 at a cost of £200,000, and has accommodation for an audience of about 9000 and an orchestra of 1000. The Crystal and Alexandra Palaces, though they present the additional attractions of fine grounds, of scientific and art exhibitions, and of various forms of out-door amusement, base their claims to support in a great measure on their theatrical and musical performances, and, besides the large central halls for promenades, possess separate concert-rooms. The Crystal Palace, Sydenham, which has a total length of 1608 feet, and a width at the nave of 312 feet, and at the central transepts of 384 feet, was designed by Sir Joseph Paxton, and constructed in 1854 chiefly of iron and glass, out of the materials of the Exhibition building of 1851, at a cost of £1,500,000, including the adornment of the grounds, 200 acres in extent. The Alexandra Palace, Muswell Hill, situated in grounds of 300 acres, was completed in 1875, after having been burned down in 1873. It is built of brick in the form of a parallelogram, covering about 7½ acres, and consists of a central hall 386 feet by 184, two courts on each side 260 feet in length, and a concert-room and theatre detached from the main building. Miscellaneous concerts and other entertainments are given at the Royal Aquarium, Westminster, which was opened in 1876 at a cost of about £200,000.

Musical instruction. In London there are probably a larger number of eminent professors of the various branches of music than in any other city of the world, but almost no provision for public musical instruction has been made by the state. The Royal Academy of Music, instituted in 1822, and incorporated by royal charter in 1830, receives from Government only an annual grant of £500, and, though attended by over 400 students, chiefly professional, is hampered in its organization and plans by deficiency in funds. The Guildhall School of Music, in which instruction may be commenced at an earlier stage, was established by the corporation of the City in 1879, and is now attended by 1200 students. The National Training School at South Kensington, for which endowments for only five years were provided, is now discontinued, a proposal having been made to supersede it by a Royal College under the presidency of the Prince of Wales, and with endowments sufficient to afford free education to 50 pupils, as well as maintenance and education to 50 others. The Tonic Sol-Fa College, Plaistow, was incorporated in 1875 for the special purpose of training teachers of music for the elementary schools of the country, that method of instruction in music being now used in the majority of schools where systematic musical instruction is given.

Art galleries. PAINTING, SCULPTURE, AND THE APPLIED ARTS.—The most influential and the oldest institution in London connected with painting and sculpture is the Royal Academy of Fine Arts, founded in 1768, which, besides its annual exhibition of art in its new buildings in Burlington Gardens, Burlington House, erected in 1868–69, in the Italian Renaissance style from the designs of Smirke, has also organized classes for art instruction. The Society of Painters in Water-Colors, established in 1804, the Society of British Artists, founded in 1822 and incorporated in 1847, and the Institute of Painters in Water-Colors, hold each an annual exhibition. The National Gallery of Paintings originated in the purchase by parliament in 1824 of the collection of J. J. Angerstein for £57,000. The present Grecian building by Wilkins in Trafalgar Square (1832–38) was enlarged in 1860 and 1869, and in 1876 a new wing was added by Barry at a cost of over £80,000. The collection has received many additions both by purchase and bequest, and besides many noble examples of the old masters, contains some of the finest pictures of the English school, including the magnificent Turner collection. The National Portrait Gallery, the nucleus of which was formed in 1858, was removed to Exhibition Road, South Kensington, in 1870. In the Grosvenor Gallery, New Bond Street, erected by Sir Coutts Lindsay in 1877, there are annual exhibitions of works of art, and occasionally other special exhibitions. Several of the mansions of the nobility contain art galleries, which are open to the public on certain conditions. The most famous of these are perhaps the Grosvenor Gallery in the residence of the duke of Westminster, and the Bridgewater Gallery in the residence of the earl of Ellesmere.

British Museum. The British Museum, Bloomsbury, originated in the purchase by Government in 1753 of the collection and library of Sir Hans Sloane, and occupies the site of Montague House. For the reception of the Egyptian antiquities presented by George III. (1801), of the Townley marbles (1805), and of the Elgin marbles (1816), a new wing was added to the building in 1823, but after the presentation of the king's library by George IV. in the same year, it was resolved gradually to reconstruct the whole building, the first portion being finished in 1828, and the work (except the new reading-room) completed in 1852. The exterior of the building is plain, with the exception of the massive Ionic portico at the principal entrance. The contents of the museum are divided into departments, which are under the charge of a keeper and one or more assistant keepers. The departments still at Bloomsbury are those of Printed Books, Manuscripts, Oriental MSS., Zoology, Oriental Antiquities, Greek and Roman Antiquities, Coins and Medals, British and Mediæval Antiquities and Ethnography, and Prints and Drawings. The collection both as a whole and in several departments—especially Greek and Roman Antiquities and Engravings—is unequalled in the world, and in all the departments a very high degree of completeness has been attained. For the library and reading-room, see LIBRARIES, p. 514.

South Kensington Museum. South Kensington Museum, which is under the direction of the Committee of Council on Education, was originated by the late Prince Consort in 1852. The present building, to which the collection was removed from Marlborough House in 1857, is erected of red brick and terra cotta in the Italian Renaissance style, and, though still in process of construction and development, includes a fine range of apartments, the interior consisting of courts and corridors of graceful proportions, and decorated with various designs. It contains a collection of objects of ornamental art, both ancient and modern, as applied to manufactures, a national gallery of British art, in addition to the Foster and Dyce collections, and a fine collection of water-color paintings, an extensive art library, a collection of sculpture chiefly of the Renaissance period, reproductions of ancient sculptures and paintings, and collections of animal products employed in the arts, of substances used for food, and of materials used for building and construction. Some of the rooms are occupied chiefly by articles on loan. In connection with the institution there is a National Art Training School, as well as a School of Science and a School of Cookery. The Bethnal Green Museum, a branch of South Kensington Museum, opened in 1872, besides a permanent food collection, and a collection of animal products, is occupied with various collections on loan. The India Museum, which was removed in 1880 from the India Office to a building in Exhibition Road, South Kensington, and placed under the care of the South Kensington Museum directors, contains a magnificent collection of every variety of Indian art and manufacture. The Soane Museum, Lincoln's Inn Fields, bequeathed to the nation by Sir John Soane in 1837, contains an architectural library, various models of famous ancient buildings, antique sculptures, gems, vases, and bronzes, and several fine paintings. The Royal Architectural Museum, Westminster, founded in 1851, is intended specially to advance the art of architecture by examples of the works of various nations and times, and by courses of lectures, and drawing and modelling classes.

Other museums.

CLUBS. See CLUB, vol. vi. p. 40.

Churches.

ECCLESIASTICAL BUILDINGS.—Fitzstephen states that in his time there were in London and its suburbs thirteen larger conventual churches besides one hundred and twenty-six lesser parochial ones. Stow gives a list of churches existing when he wrote, mentioning those which he knew to be suppressed or united to others. He gives the names of 125 churches, including St. Paul's and Westminster Abbey; 89 of these were destroyed by the great fire, and only 45 were rebuilt.

Paul's.

St. Paul's cathedral occupies the site of a church founded in 610 by Ethelbert. After the destruction of the church by fire in 1087, a new edifice in the Norman style was commenced, which was forty years in building, and according to William of Malmesbury, "could contain the utmost conceivable multitude of worshippers." In 1240 a new Pointed Gothic choir was added, and the erection of a lofty tower begun. The work of renovation and adornment was continued until 1315, when the cathedral was declared complete. Its dimensions as given by Stow were as follows:—height of steeple 520 feet; total length of church 720 feet; breadth 130; and height of the body of the church 150 feet. In 1561 the spire was struck by lightning, and the roof of the church partly destroyed by the fire that ensued. From this time it remained in a dilapidated condition until the reign of Charles I.; and the work of restoration under the direction of Inigo Jones, who added to the west front a Corinthian portico, had not been completed when the building was destroyed by the great fire of 1666. St. Paul's cross, which stood at the north-east corner of the cathedral, was rebuilt by Bishop Kemp in the 15th century, but was removed in 1643, its place being now occupied by a fountain. At the cross great religious disputations were held and papal bulls promulgated, and in its pulpit sermons were preached before the court. The present St. Paul's, erected in 1675–97 from the designs of Sir Christopher Wren at a cost of £747,954, is built in the form of a Latin cross, the length being 500 feet, the breadth at the transepts 250 feet, and of the choir and nave 125 feet. The dome, which separates the two transepts and the nave and choir, rises to a height of 365 feet, or of 404 feet to the top of the cross by which it is surmounted, the height of the interior dome being 225 feet. The principal front to the west consists of a double portico of Corinthian pillars flanked by campanile towers 120 feet in height. The transepts are bounded by semicircular rows of Corinthian pillars. St. Paul's is remarkable chiefly for its massive simplicity and beautiful proportions. The interior is imposing from its vastness, but the designs of Wren for its decoration were never carried out. Some of the monuments of the old building are preserved in the crypt, where are also the tombs of Sir Joshua Reynolds, Dr. Samuel Johnson,[1] J. M. W. Turner, Lord Nelson, the duke of Wellington, and other distinguished men, especially admirals and generals.

Westminster Abbey.

Westminster Abbey, as the coronation church of the sovereigns of England from the time of Harold, and on account of its proximity to the seat of English government, has acquired a fame and importance which in a certain sense outvie those of St. Paul's. It occupies the sight of a chapel built by Siebert, in honor of St. Peter, on a slightly elevated spot rising from the marshy ground bordering the Thames. A church of greater pretensions was erected by King Edward about 980; but, this church being partly demolished by the Danes, Edward the Confessor founded within the precincts of his palace an abbey and church in the Norman style, which was completed in 1065, and of which there now only remain the pyx house to the south of the abbey, the substructure of the dormitory, and the south side of the cloisters. The rebuilding of the church was commenced by Henry III. in 1220, who erected the choir and transepts, and also a lady chapel, which was removed to make way for the chapel of Henry VII. The building was practically completed by Edward I., but the greater part of the nave in the Transition style, and various other improvements, were added down to the time of Henry VII., including the west end of the nave, the deanery, portions of the cloisters, and the Jerusalem chamber; while the two towers at the west end were erected by Wren, who had no proper appreciation of Gothic. The length of the church, including Henry VII.'s chapel, is 531 feet, or, excluding it, 416 feet, the breadth of the transepts 203 feet, the height of the church 102 feet, and of the towers 225 feet. The choir, where the coronation of English sovereigns takes place, is a fine specimen of Early English, with decorations added in the 14th century, and contains among other tombs those of Siebert, king of the East Saxons, Anne of Cleves, and Edmund Crouchback, earl of Leicester. The north transept is occupied principally with monuments of warriors and statesmen, and in the south transept the "poet's corner" contains memorials of most of the great English writers from Chaucer to Thackeray and Dickens. The nave, with its clustered columns, its beautiful triforium, and its lofty and finely proportioned roof, is the most impressive portion of the interior. The monuments in its north and south aisles are of a very miscellaneous character, and commemorate musicians, men of science, travellers, patriots, and adventurers. The monuments in the chapels of St. Benedict, St. Edmund, St. Nicholas, St. Paul, St. Erasmus, St. John the Baptist, and the Abbot Islip are chiefly to ecclesiastics and members of the nobility. Henry VII.'s chapel, which is remarkable for the fretted vault work of the roof, with its magical fan tracery, contains besides the monument of Henry VII. the tombs of many English sovereigns and their children, and also of various other personages of historic fame. In the chapel of Edward the Confessor are the shrine of Edward the Confessor in Purbeck marble, the altar tomb of Edward I., the coronation chairs of the English sovereigns, and the stone of Scone, the old coronation seat of the Scottish kings. In the chapter-house (1250) the meetings of the Commons took place before they were transferred to St. Stephen's Chapel; and in the Jerusalem chamber (1376–86), where Edward V. is said to have been born and Henry IV. was brought to die, the sittings of the lower house of convocation of the province of Canterbury are now held.

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[1] [Dr. Johnson's remains lie in Westminster Abbey. See Vol. XIII. p. 740. Reynolds's monument to his memory is at St Paul's. See Vol. XX. p. 517.—AM. ED.]

Conventual churches of time of Fitzstephen.

Among the conventual churches existing in the time of Fitzstephen, there were destroyed by the fire three, those of St. Thomas of Acon, St. John the Baptist, and St. Martin-le-Grand, founded in 700. Of the other churches there still remain the choir, part of the nave, and portions of the transepts of the old church of St. Bartholomew the Great dating from the foundation of the monastery by Rahere, minstrel to Henry I., included in the present church, restored 1865–69, which also contains the tomb of its founder; a pointed pier of the old church of St. Catherine Cree, which was the conventual church of St. Austin's priory of the Holy Trinity, founded in 1108, but was rebuilt by Inigo Jones; the vaults and some of the old monuments of the old church of St. James's, Clerkenwell, built in connection with the Benedictine nunnery 1100, and replaced by the present structure 1788–92; the east wall and Norman crypt of the building which in the 15th century replaced the old church of the priory of St. John's of Jerusalem, Clerkenwell, founded in 1100, and of which the south gate in the Perpendicular style, built in 1504, still remains; and the Temple church, noticed in the article INNS OF COURT. Of the ancient church of St. Saviour's, Southwark, belonging to the priory of St. Mary Overy, a few seemingly Anglo-Saxon portions were incorporated in the building in the Early English style erected in the 13th century, which has been much disfigured by reconstructions and additions, although the beautiful choir, lady chapel, and transepts remain almost entire. The church of St. Katherine's Hospital was removed in 1825 to make way for St. Katherine's docks.

Other old churches.

Of the other churches which escaped the fire the principal are the Chapel Royal, Savoy, rebuilt by Henry VII. on the site of Savoy Palace in connection with the hospital of St. John the Baptist, from 1564 to 1717 used as the parish church of St. Mary-le-Strand, constituted a chapel royal in 1773, and restored in 1865 by Smirke after partial destruction by fire; All Hallows, Barking, founded in connection with the Benedictine convent of Barking, Essex, some time before Richard I., chiefly Perpendicular, and containing several brasses; St. Andrew's Undershaft (1520–32), in the Perpendicular style, with a turreted tower, and containing among other tombs that of Stow the chronicler; St. Giles's, Cripplegate, founded 1090, rebuilt in the Gothic style after destruction by fire in 1545 (with the exception of the fine tower, added in 1660), where Cromwell was married, and Milton and Foxe the martyrologist were buried; St. Helen's, Bishopsgate Street, founded in connection with a priory of nuns (1216), chiefly in the Third Pointed style, and containing many brasses and monuments of city dignitaries; St. Margaret's, Westminster, founded by Edward the Confessor, re-erected by Edward I., and frequently restored, containing a window originally executed by Gouda for Waltham Abbey, and possessing a large number of monuments to eminent persons; St. Olave's, Hart Street, in the Gothic style, belonging to the 15th century, but much altered by restoration, containing a large number of brasses and monuments; the small church of Trinity in the Minories, formerly connected with a convent founded by Blanche, wife of Edmund Plantagenet, second son of Henry III., containing in a state of complete preservation the head of the duke of Suffolk, father of Lady Jane Grey.

Wren's churches.

That the only important external feature of Wren's churches is the tower or steeple is a peculiarity to be explained by the fact that the merit of his style consisted more in beauty of general outline than in elaboration of details, that from the amount of money placed at his disposal he was generally compelled to concentrate his chief attention on a special part of the building, and that on account of the crowding of surrounding buildings the steeple was often the only part of the church that could be made effective. His interiors, however, are finely proportioned. Among his more important churches are St. Bride's, Fleet Street, which possesses one of his finest steeples, and contains the grave of Richardson the novelist; St. Dunstan's-in-the-East, of which the only portion by Wren now remaining is the steeple, resting on quadrangular columns with a mural crown copied from St. Nicholas's, Newcastle; St. James's, Piccadilly, only remarkable for its elaborate interior and a white marble font by Gibbons; St. Lawrence, Jewry; St. Mary-le-Bow, containing the Norman crypt of the old building, which was the first church in the city built on arches (hence the name), and adorned with one of the finest of Wren's steeples, in which are the proverbial "Bow Bells;" St. Michael's, Cornhill, with perpendicular tower imitated from that of Magdalen College, Oxford; St. Mary, Aldermary, rebuilt by Wren on the Gothic model of the old church; St. Stephen's, Walbrook, with an interior similar to St. Paul's; St. Swithin's, Cannon Street, in a wall of which the famous "London Stone" is built; and St. Clement Danes, in which Dr. Samuel Johnson was accustomed to worship.

Later churches.

Of the churches of the period succeeding that of Wren, the most notable are St. George's, Hanover Square (1724), by James, with Classic portico and tower, and three painted windows of the 16th century made at Mechlin; St. Giles-in-the-Fields (1734), by Flitcroft, with tapering spire, and containing the graves of Flaxman the sculptor and Andrew Marvel; St. Martin-in-the-Fields (1726), by Gibbs, with a fine Corinthian portico, behind which the spire is awkwardly placed; St. Mary-le-Strand (1717), by Gibbs, occupying the site of the old Maypole; St. Mary-le-Bone (1817), by Hardwicke, in the Classic style, containing altarpiece presented by Wren to the old church; St. Pancras (1822), with a steeple in imitation of the Temple of the Winds, and a very elaborate interior copied from the Erechtheum at Athens; St. Paul's, Covent Garden, originally designed by Inigo Jones, and restored after a fire in 1795. The more modern churches are chiefly in the Gothic style.

Other churches and chapels.

Of the religious buildings connected with the numerous denominations and nationalities, few possess exceptional interest either of an antiquarian or architectural character. St. George's Cathedral, Southwark (1848), designed by Pugin, is said to be the largest Roman Catholic building erected in England since the Reformation; and Ely Chapel, Holborn, the only remaining relic of the palace of the bishops of Ely, has lately been purchased and restored by the Roman Catholics. Among the chapels belonging to the Protestant dissenters the best known are perhaps Mr. Spurgeon's Tabernacle, the City Temple, and Christ Church, Newington. The Dutch Church in Austinfriars was presented by Edward VI. to Dutch residents in London in 1550; the nave is in the Decorated style of the 13th century.

Lambeth Palace.

Lambeth Palace, situated near one of the old hithes or landing-places of the Thames, came into the possession of the archbishops of Canterbury in 1197. The oldest portion of the present building, including the chapel in the Early English style, was erected by Archbishop Boniface (1244–70), but the Lollards' Tower, in which the Lollards were tortured and the earl of Essex was imprisoned, was built in 1434, and the great hall with an elaborate timber roof in 1663. The inhabited portion was erected 1828–48 from the designs of Blore. The adjoining church of St. Mary, the oldest part of which dates from the 14th century, contains the tombs of several archbishops, as does also the palace chapel. The library is noticed in LIBRARIES, p. 515.

ROYAL PALACES AND GOVERNMENT BUILDINGS.—Stow mentions that in his time there was a large building called the Old Wardrobe in the Old Jewry, very ancient, but of which all that he knew was that it had been alluded to by Henry VI. as his principal palace in the Old Jewry.

Palace of Westminster.

The palace of Westminster existed at least as early as the reign of Canute, but the building spoken of by Fitzstephen as an "incomparable structure furnished with a breastwork and a bastion" is supposed to have been founded by Edward the Confessor, who built what was afterwards known as the Painted Chamber, and also the apartment afterwards used by the House of Lords. The palace was probably enlarged by William the Conqueror, and William Rufus built the great hall in 1097. The palace suffered severely from fire in 1263 and 1299, and after the great fire of 1512 it was no longer used as a royal residence, and was allowed for a time to fall into decay, with the exception of the great hall. Subsequently it was fitted up and made use of for the meetings of parliament until 1835, when again the whole, with the exception of the great hall, fell a prey to the flames. The apartment in which the House of Commons met was the beautiful St. Stephen's chapel, originally built by Stephen. Westminster Hall, which is 290 feet long, 68 feet wide, and 90 feet in height, with a carved timber roof remarkable for its beauty and the ingenuity of its construction, is used as the vestibule of the law courts and the Houses of Parliament. According to Stow the "princes" after the destruction of Westminster Palace "lodged in other places about the city, as at Baynarde's castle (which was destroyed in the great fire), at Bridewell, and Whitehall, sometimes called York Place, and sometimes at St. James's." It was at Bridewell, which occupies the site of an old Norman tower, and was for a long time the occasional residence of the kings of England, that Henry VIII., who, according to Stow, built there "a stately and beautiful house of new," was staying, on account of the destruction of Westminster Palace, when the interview took place in 1528 between him and his nobles, commemorated in the third act of Shakespeare's *Henry VIII.* **Whitehall.** After the fall of Wolsey, York House, which from 1248 had been the residence of the archbishops of York, came into the possession of the crown, and obtained the name of Whitehall. The palace was almost reconstructed by Henry VIII., who made it his principal residence, and employed Holbein in its decoration; but a new banqueting hall, erected by James I. in place of the old one burned down in 1615, was the only portion of the building which escaped the destruction caused by fire in 1691 and 1697. This hall, converted into a royal chapel by George I., is a fine specimen of Palladian architecture, and its ceiling is adorned with allegorical paintings by Rubens. Through the banqueting hall Charles I. passed on his way to execution beneath its windows, and Cromwell breathed his last within an apartment of the palace.

St. James's Palace. St. James's Palace, which after the destruction of Whitehall continued to be the principal royal residence until it was nearly all destroyed by fire in 1809, with the exception of the old gateway, the chapel adjoining, and the presence chamber, was built by Henry VIII. for a country residence instead of Kennington, on the site of an old hospital for lepers founded in the 12th century.

Buckingham Palace. Buckingham Palace, the town residence of Queen Victoria, occupies the site of Buckingham House, purchased by George III. in 1761. The present building in the Classic style was erected 1825–35 by Nash, a west wing with a dull façade 460 feet in length, facing St. James's Park, being added in 1846, and a large ball-room in 1856. The picture gallery contains a specially fine collection of pictures by the great Dutch masters.

Kensington Palace, a favorite residence of several English sovereigns, is noticed under KENSINGTON. Marlborough House, built by the first duke of Marlborough in 1710 from the designs of Wren, came into the possession of the crown in 1817, and has been occupied by the Prince of Wales since 1863.

The Tower. The Tower of London, to the east of the city on the left bank of the Thames, called by Fitzstephen the Palatine Tower, was, according to tradition, originally built by Julius Cæsar, but the nucleus of the present building was begun in 1078 by William the Conqueror, who erected the part now known as the White Tower to take the place of a portion of the walls and towers of the city which had been washed away by the Thames. This tower was completed in 1098 by William Rufus, who also began the St. Thomas Tower and the Traitor's Gate. Additions were made at various periods, especially by Henry III., who used it frequently as a residence; and it now occupies an area of 13 acres surrounded by a moat, constructed in 1190, enclosing a double line of fortifications, behind which is a ring of buildings consisting of various towers, and the barracks and military stores, while in the centre is the massive quadrangular White Tower, with Norman arches and windows, and adorned with a turret at each corner. The St. John's chapel in this tower is one of the finest and most complete specimens of Norman architecture in England. The Tower of London has an extensive collection of armor, and is the repository for the regalia of England. The execution of the long list of important political prisoners confined in the Tower took place on the neighboring Tower Hill, and most of them were buried in the chapel of St. Peter Ad Vincula.

Houses of Parliament. The new palace of Westminster (1840–67), built at a cost of about £3,000,000 from the designs of Barry, for the Houses of Parliament, on the site of the old palace destroyed by fire in 1835, is a vast and ornate building in the Tudor-Gothic style, covering altogether an area of about 8 acres. Towards the river it presents a very richly adorned and effective façade. At the north-east corner is the clock-tower, 320 feet in height, resembling the clock-tower at Bruges; above the dome over the central hall a spire rises to the height of 300 feet; and the Victoria tower, 340 feet, surmounts the royal entrance at the south-west corner. The central hall, which is entered by St. Stephen's Porch and St. Stephen's Hall, built above St. Stephen's Crypt, a portion of the old building, separates the House of Peers, which, along with the royal rooms, occupies the western portion of the building, from the House of Commons, to which the eastern portion is assigned.

Government offices. The Government offices, situated in Whitehall and Downing Street, form several miscellaneous groups erected at different periods and in very various styles of architecture. The Treasury, Whitehall (1737), containing the official residence of the premier, the Education Office, the Privy Council Office, and the Board of Trade, was improved in 1847 by the construction of a new façade designed by Barry. The Horse Guards, the headquarters of the commander-in-chief, an insignificant building with a central clock-turret, was erected in 1753 on the site of a guard-house built in 1631 for the security of Whitehall. The Admiralty, a plain structure with a Grecian façade, was erected in 1726. The new Public Offices, a fine range of buildings in the Italian style, erected from the designs of Sir Gilbert Scott at a cost of over £500,000, contain the Home, Foreign, Colonial, and Indian Offices, and various other departments. Somerset House, Strand (1776–86), a large quadrangular structure, the finest façade of which is that towards the river, occupies the site of a palace founded by Protector Somerset in 1547. It contains the Exchequer and Audit Office, the Inland Revenue Office, the Office of the Registrar-General, the Admiralty, Register, and the Prerogative Will Office, removed from Doctor's Commons in 1874. The other Government offices at present occupy unpretentious buildings in various streets, chiefly in the neighborhood of Whitehall and Westminster. Heralds' College (College of Arms), the authority in regard to pedigrees and armorial bearings, is located in Queen Victoria Street, in a building re-erected in 1683 from the designs of Wren. The General Post-Office, St. Martin's-le-Grand, City (1825–29), designed by Smirke in the Grecian style, and occupying the site of St. Martin's church and abbey, will probably soon be removed farther westwards. The General Telegraph Office, opposite the Post-Office, was erected 1870–73 at a cost of £450,000. The new Record Office in the Tudor style (1851–56) is situated in Fetter Lane.

Law courts. The law courts, which are described in the article ENGLAND, vol. viii. p. 236, and were accommodated in Lincoln's Inn and in buildings adjoining Westminster Hall, where they were first established in 1224, will soon be all removed to the New Law Courts in the Strand, designed by Street, and estimated to cost about £500,000.

Monuments. MEMORIALS AND STATUES.—The principal monuments are The Monument (1671–77), a fluted Doric column designed by Wren, and erected in commemoration of the great fire, at a cost £13,700; the Nelson Column, Trafalgar Square, by Railton, erected (1843) at a cost of £46,000, a copy in granite from the Temple of Mars Ultor, 145 feet in height, crowned with a statue of Nelson by Barry, and having at its base four colossal bronze lions modelled by Sir Edwin Landseer; the Duke of York Column, Carlton House Terrace (1833), an Ionic pillar 124 feet, designed by Wyatt, surmounted by a bronze statue by Westmacott; Westminster Column, erected to the memory of the old pupils of Westminster school who died in the Russian and Indian wars of 1854–59; the Guards Memorial, Waterloo Place, erected in honor of the foot guards who died in the Crimea; the Albert Memorial, Hyde Park, a highly decorated Gothic structure adorned with numerous rilievos and statues, erected from the designs of Sir Gilbert Scott at a cost of £120,000; Cleopatra's Needle, presented to the Government by Mehemet Ali in 1819, brought from Alexandria in 1878, and erected on the Thames embankment on a pedestal of gray granite. Temple Bar, erected by Sir Christopher Wren (1670–72), was removed in 1877, but its site is at present occupied by an erection surmounted by a griffin.

Statues. The following is a list of the principal public statues:—

Name.	Site.	Sculptor.
Achilles.	Hyde Park.	Westmacott.
Anne, Queen.	St. Paul's Churchyard.	Bird.
Beaconsfield, Earl of.	Parliament Square.	Raggi.
Bedford, John, Duke of.	Russell Square.	Westmacott.
Bentinck, Lord George.	Cavendish Square.	Campbell.
Burgoyne.	Waterloo Place.	Boehm.
Canning, George.	New Palace Yard.	Westmacott.
Charles I.	Charing Cross.	Le Sœur.
Charles II.	Chelsea Hospital.	Gibbons.
Clyde, Lord.	Waterloo Place.	Marochetti.
Cobden.	Hampstead Road.	Wills.
Cumberland, Duke of.	Cavendish Square.	Chew.
Derby, Earl of.	Parliament Square.	Noble.
Fox, Charles James.	Bloomsbury Square.	Westmacott.
Franklin, Sir John.	Waterloo Place.	Noble.
George III.	Somerset House.	Bacon.
Do.	Cockspur Street.	M. C. Wyatt.
George IV.	Trafalgar Square.	Chantrey.
Havelock.	Trafalgar Square.	Behnes.
Herbert, Lord.	Pall Mall.	Foley.
Hill, Rowland.	Royal Exchange.	O. Ford.
James II.	Whitehall.	Gibbons.
Jenner.	Kensington Gardens.	Marshall.
Kent, Duke of.	Portland Place.	Gahagan.
Mill, J. S.	Victoria Embankment.	Woolner.
Napier, Sir Charles.	Trafalgar Square.	Adams.
Outram, Sir J.	Victoria Embankment.	Noble.
Palmerston, Lord.	Palace Yard.	Woolner.
Peabody, George.	Royal Exchange.	Story.
Peel, Sir Robert.	Cheapside.	Behnes.
Pitt, William.	Hanover Square.	Chantrey.
Prince Consort.	Holborn Viaduct.	Bacon.
Richard I.	Old Palace Yard.	Marochetti.
Sloane, Sir H.	Chelsea.	Rysbraek.
Victoria.	Royal Exchange.	Lough.
Wellington, Duke of.	Green Park Arch.	Wyatt.
Do.	Tower Green.	Milnes.
Do.	Royal Exchange,	Chantrey.
William III.	St. James's Square.	Bacon.
William IV.	King William Street.	Nixon.

(T. F. H.)

HISTORY.

BRITISH AND ROMAN (TO 449 A. D.).—Bishop Stillingfleet, writing of London, stated that after the fullest inquiry he was inclined "to believe it of a Roman foundation, and no older than the time of Claudius" (*Origines Brit.*, 1685, p. 43); and several antiquaries and historians hold the same opinion.[1] Although Geoffrey of Monmouth's vision of a great British city of Troynovant, founded by Brut, a descendant of Æneas, must be relegated to the limbo of myths, we need not necessarily dispute the existence of a British London. There can be little doubt that the name of London has a Celtic origin, and therefore there is probably a grain of truth in Geoffrey's fanciful description. The place was probably very small, but it must have been chosen for its commanding position on the banks of a fine river, and there may be some truth in the assertion that one Belinus formed a port or haven on the site of the present Billingsgate, although it does not follow that "he also made a gate of wonderful structure," or "over it built a prodigiously large tower" (*Historia*, lib. iii. cap. x.). What a British town was like we learn from Julius Cæsar, who tells us that it "was nothing more than a thick wood, fortified with a ditch and rampart, to serve as a place of retreat against the incursions of their enemies" (*De Bello Gallico*, v. 21). We may therefore imagine a clearing out of the great forest of Middlesex, extending probably from the site of St. Paul's Cathedral to that of the Bank of England, with the dwellings of the Britons spread about the higher ground looking down upon the Thames. The late Mr. Thomas Lewin believed that London had attained its prosperity before the Romans came, and held that it was probably the capital of Cassivellaunus, which was taken and sacked by Julius Cæsar. Not satisfied with affirming the existence of a British London, he went further, and indicated its extent. On the hill situated between the river Flete on the west and the Walbrook on the east was seated the British town. The western gate was Ludgate and the eastern Dowgate, and much of Mr. Lewin's argument rests upon the fact that these two names are of British origin (*Archæologia*, vol. xl. p. 59). The origin of London will probably always remain a subject of dispute, for want of decisive facts. A negative fact is that few if any remains of an earlier date than the Roman occupation have been discovered;[2] but, on the other hand, London could scarcely have come to be the important commercial centre described by Tacitus if it had only been founded a few years previously, and after the conquest of Claudius. Now there can be no doubt that the Britons made considerable progress during the period between Julius and Claudius, and it seems upon the whole highly probable that London as a British settlement may have come into existence then. There is some reason to believe that there were two settlements, one on the north and the other on the south bank of the Thames. If so they would be within the territories of distinct and possibly hostile tribes. There might be a ferry, and even, as we shall mention presently, a bridge of some description towards the close of the period, but this point will come before us again.

The Roman occupation of Britain extended over a period equal to that which has elapsed since Henry VIII.'s reign. During these centuries (43–409 A. D.) there was ample time for cities to grow up from small beginnings, to overflow their borders, and to be more than once rebuilt. The earliest Roman London must have been a comparatively small place, but it probably contained a military fort intended to cover the passage of the river. The mouth of the Thames was then only a few miles off, large portions of what are now the counties of Kent and Essex being marshes overflowed with water. The original investigations of Sir Christopher Wren led him to take this view, and he expressed the opinion that "the whole country between Camberwell Hill and the hills of Essex might have been a great frith or sinus of the sea, and much wider near the mouth of the Thames, which made a large plain of sand at low water, through which the river found its way. This mighty broad sand (now good meadow) was restrained by large banks still remaining, and reducing the river into its channel; a great work, of which no history gives account; the Britons were too rude to attempt it, the Saxons too much busied with continual wars; he concluded therefore it was Roman work" (Wren's *Parentalia*, p. 285). The opinion that these embankments are Roman work is the one generally held, but so greatly does opinion vary on all these points that some have supposed that they were not built until the reign of Henry VI.[3] Neither Strabo nor the elder Pliny alludes to London, although they wrote on Britain, and the name does not occur in literature until used by Tacitus. That author distinctly says that London had not in 61 A. D. been dignified with the name of a colony (*Annal.*, xiv. 33). The Roman general Paullinus Suetonius, after marching rapidly from Wales to put down a serious insurrection, found Londinium unfitted for a basis of operations, and therefore left the place to the mercy of Boadicea, who entirely destroyed it and killed the inhabitants in large numbers. When Tacitus wrote, Verulamium and Camulodunum possessed mints, but Londinium was not so distinguished. Subsequently, however, it became a place of mintage. When the British power was finally destroyed London again grew into importance, and we find it holding an important position in the Itinerary of Antoninus, Londinium being either a starting-point or a terminus in nearly half the routes described in the portion devoted to Britain. Ptolemy mentions Londinium, but places it on the south side of the Thames; this may merely be a mistake on Ptolemy's part, but it seems more probable that he referred more particularly to Southwark, which, as has been already pointed out, may have had a distinct origin from the Londinium of the north bank of the river.

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[1] Dr. Guest affirmed that the notion of a British town having "preceded the Roman camp has no foundation to rest upon, and is inconsistent with all we know of the early geography of this part of Britain" (*Archæological Journal*, vol. xxiii. p. 180); and Mr. J. R. Green in his lately published work, *The Making of England*, expresses the same opinion (p. 101). This was not, however, Mr. Kemble's belief, for he held that it was difficult to believe that Cair Lunden was an unimportant place even in Cæsar's day (*Saxons in England*. vol. ii. p. 266).

[2] General Pitt Rivers (then Colonel Lane Fox) discovered in 1867 certain piles in excavations near London Wall and Southwark Street, possibly the remains of pile buildings, which he made the subject of a paper read before the Anthropological Society of London (*Journal*, vol. v. pp. lxxi.-lxxx.). These piles averaged 6 to 8 inches square, others of a smaller size were 4 inches by 8 inches, and one or two were as much as a foot square. They were found in the peat just above the virgin gravel, and with them were found the refuse of kitchen middens, broken pottery, etc., of the Roman period, but there was no superstructure. There is not much here upon which to found a theory, but nevertheless the fact is a valuable item of evidence in a very complicated question. If, as seems certain, these piles are remains of pile dwellings, there is every reason to believe that they were sunk by the Britons rather than by the Romans, and General Rivers thinks it probable that they are the remains of the British capital of Cassivellaunus, situated in the marshes, and of necessity built on piles.

[3] Sir George Airy holds that the embankment of the lower reaches of the Thames could not have been undertaken until after the construction of Old London Bridge, as when that was built the tide must have been small (*Proc. Inst. Civ. Eng.*, vol. xlix. p. 120). It is evident that, when the tidal water covered half a mile on both banks of the Thames for a distance of 20 miles, the river proper must have been considerably shallower than at present. Mr. J. B. Redman calculated that the quantity of water shut out by the embankments equalled from five-eighths to three-fourths of the present tidal column (*Proc. Inst. Civ. Eng.*, vol. xlix., p. 67).

Londinium was plundered in the reign of Diocletian and Maximian by the army of the usurper Allectus, but before the Franks who chiefly formed this army could fly Constantius sailed up the Thames and disembarked under the walls of the city, thus taking them by surprise. Under Julian London was the headquarters of Lupicinus in his campaign against the Scots and Picts; and in the reign of Valentinian, Ammianus tells us, Theodosius came to London from Boulogne to mature his plan for the restoration of the tranquillity of the province. It is on this occasion that Ammianus speaks twice of Londinium as an ancient town, to which the title of Augusta had been accorded. By the anonymous chorographer of Ravenna it is called Londinium Augusta. As Theodosius is said to have left Britain in a sound and secure condition, with its dilapidated places restored, it has been supposed that to him was due the wall of the later Londinium. According to old tradition, however, Constantine the Great walled the city at the request of his mother Helena, who was said to be a native of Britain. In spite of these various references we should know very little of Roman London if it had not been that a large number of excavations have been made in different parts of the city, which have disclosed a considerable amount of early history.[1] These go to prove that the early city occupied a somewhat small area, for it has been discovered that the site of the Royal Exchange was originally a gravel-pit, and had then become a dirty pond outside the walls used as a receptacle for refuse. Cemeteries also once existed in Cheapside, on the site of St. Paul's, close to Newgate, and various other places known to have been included in the later Roman London. As it was illegal in Roman times to bury within the walls, these places must at one time have been extramural. Among the large number of important sepulchral remains lately found by Mr. Taylor in Newgate Street were several *ossuaria*, or leaden vessels for the reception of the calcined bones of the dead. Little attention had been paid to these objects until Mr. Roach Smith specially alluded to them in an article on "Roman Sepulchral Remains discovered near the Minories, London" (*Collectanea Antiqua*, iii. 45-62). Subsequently Mr. Smith wrote a very elaborate article on "Roman Leaden Coffins and Ossuaria" (*Ibid.*, vii. 170-201), in which he refers to the wealth of the British mines as one of the chief incentives to the conquest of the country by the Romans, and points out that the large use of the costly metal, lead, "manufactured with such skill and so profusely as to supply not only the inhabitants of the towns, but those of villages and villas, with one of the daily requisites of advanced civilization," proves the prosperity and even luxury of the province. When Sir Christopher Wren was making excavations for his building of Bow Church he sunk about 18 feet deep through made ground, when he came upon "a Roman causeway of rough stone, close and well-rammed, with Roman brick and rubbish at the bottom for a foundation, and all firmly cemented." In consequence of this discovery the great architect came to the conclusion, which was corroborated by other reasons, that the causeway he had found continued for the whole length of the town, and formed the northern boundary—"the breadth then north and south was from the causeway now Cheapside to the river Thames, the extent east and west from Tower Hill to Ludgate, and the principal middle street or Prætorian Way was Watling Street" (*Parentalia*, p. 265).

Although it is generally agreed that this early Roman city was comparatively small, and in form an oblong square (a Londinium quadratum), its exact situation must be a matter of conjecture. The late Mr. Arthur Taylor marked out a district which should be bounded on the west by the Walbrook, on the east by Billingsgate, and on the south by the elevation of the bank of the Thames,—the northern boundary to be a line drawn below Lombard Street and Cornhill. Cannon Street and East Cheap would pass straight through the centre of this enclosure, with the other streets north and south (*Archæologia*, xxxiii. 101). In corroboration of his views, Mr. Taylor lays stress on the fact that no funeral urns have been discovered in the district he has marked out. Mr. Roach Smith agrees generally with Mr. Taylor, but includes a rather larger area. He writes,—"I should be inclined to place the northern wall somewhere along the course of Cornhill and Leadenhall Street; the eastern, in the direction of Billiter Street and Mark Lane; the southern, in the line of Upper and Lower Thames Street; and the western, on the eastern side of Walbrook. This suggested plan will give the form of an irregular square, in about the centre of each side of which may be placed the four main gates corresponding with Bridge Gate, Ludgate, Bishopsgate, and Aldgate" (*Illust. of Roman London*, p. 14). The late Mr. W. H. Black, like his predecessors, takes the Walbrook as a boundary, but, instead of making it the western limit, he makes it the eastern boundary, and places his western line at Ludgate. Newgate Street and Cheapside form the main thoroughfare of his city (*Archæologia*, xl. 41). Although Mr. Black argues his case with ability, his view is open to two principal objections,—(1) it leaves the site of London Bridge outside the enclosure, and (2) cemeteries have been discovered within the proposed limits. As to the date when the limits of this early London were lost sight of in the larger area of the better known Roman city, we have hardly sufficient data even to hazard a conjecture. There is reason to believe, as already stated, that the site of the Royal Exchange was outside the city until the early part of the 3d century, because coins of Vespasian, Domitian, and Severus have been found among the refuse of the gravel-pit. Mr. Roach Smith suggests, however, that as no coins of the period between Domitian and Severus were found it is just possible that the plated denarius of the latter emperor may not have been found in the pit itself, but in the vicinity of the houses which were built over the pit in subsequent years. On the other hand, Sir William Tite, in describing the tesselated pavement found in 1854 on the site of the Excise Office (Bishopsgate Street), expresses the opinion that the finished character of the pavement points to a period of security and wealth, and fixes on the reign of Hadrian (117-138 A. D.), to which the silver coin found on the floor belongs, as the date of its foundation. Of course this is not conclusive, as the pavement might have belonged to a villa outside the walls, but Sir William Tite places it within them. When the line of the walls which continued until the great fire was first planned out it is impossible to say with any certainty. Some antiquaries hold the opinion that these walls were post-Roman; but this is not the view of Mr. Roach Smith, one of our greatest authorities. Mr. J. E. Price, after describing "a bastion of London wall" discovered in Camomile Street, Bishopsgate, arrives at "the conclusion that these interesting relics are portions of a Roman sepulchral monument which, falling into decay, became, as years rolled on, a suitable quarry for mediæval builders, providing from its position on the spot convenient materials for the erection of a structure requiring such solidity and strength as would a bastion to the city wall." In describing the outline of the Roman city it is impossible to make ourselves intelligible unless we use names adopted subsequently. The line of the wall runs straight from the Tower to Aldgate, where it bends round somewhat to Bishopsgate. It is bordered on the east by the Minories and Houndsditch. One of the finest remaining portions of the old wall was hidden from view a few years ago when some large buildings were erected round it. The line from Bishopsgate ran eastward to St. Giles's churchyard, where it turned to the south, as far as Falcon Square, again westerly by Aldersgate under Christ's Hospital towards Giltspur Street, then south by Ludgate, and then down to the Thames. Mr. Roach Smith points out that this enclosure gives dimensions far greater than those of any other Roman town in Britain. In 1843 a portion of the old wall was exposed to view in Playhouse Yard, Blackfriars, when a Roman monument erected to a "speculator" of the second legion, named Celsus, was discovered. On the same line further north Sir Christopher Wren, while building St. Martin's, Ludgate, found a similar sepulchral monument "in the vallum of the prætorian camp" to the memory of Vivianus Marcianus, a soldier of the second legion (*Parentalia*, p. 266). In the year 1276 the old wall south of Ludgate was pulled down and a new one built to enclose a larger circuit further west for the benefit of the Black Friars. There appear to be strong reasons for believing that a wall ran along the south, and that the Romans did not consider the river sufficient protection. William Fitzstephen, a monk of the 12th century, who wrote the earliest description of London, mentions the walls and tower in the south, and Sir Christopher Wren also alludes to the colony being walled next the Thames (*Parentalia*, p. 265). The line from Lower Thames Street to Temple Street has been retrieved from the river by embankments, and in certain parts of the line the embankment was formed by substantial walling, such being found at the foot of Fish Street Hill, at the end of Queen Street, and from Broken Wharf to Lambeth Hill (Tite's *Catalogue of Antiquities found in the Excavation at the New Royal Exchange*, 1848, p. xxiv.). Mr. Roach Smith writes—"It was from 8 to 10 feet thick, and about 8 deep, reckoning the top at 9 feet from the present street level, and composed of ragstone and flint, with alternate layers of red and yellow, plain and curve-edged tiles, cemented by mortar as firm and hard as the tiles, from which it could not be separated. For the foundation strong oaken piles were used, upon which was laid a stratum of chalk and stones, and then a course of hewn sandstones from 3 to 4 feet long, by 2½ in width" (*Archæological Journal*, i. 114). The names of the gates give us no clue as to which of them existed in Roman times, but we cannot doubt that the chief traffic was carried through the city from Ludgate to Aldgate, although some antiquaries have supposed that Newgate was the chief gate on the west side, leading as it would to Holborn, where Roman remains have been discovered. Bishopsgate must have been the principal outlet to the north. Mr. Roach Smith has suggested that outside Newgate there was an amphitheatre built into a hill on the rising ground near what was lately the Little Old Bailey. He had often noticed the precipitous descent from Green Arbor Lane, opposite Newgate into Seacoal Lane and the level space by Fleet prison, and he presumed it to have been an excavation in the side of the hill. Many a smaller town than Londinium possessed a theatre in Roman times (*Middlesex Arch. Trans.*, i. 33). The name Newgate is significant of its recent erection, and it has been remarked that it stands alone among the gates as not being attached to a ward bearing the same name. It is mentioned in an ordinance of Edward I., where it is connected with Ludgate.

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[1] A chronological list of the tesselated pavements discovered in London between 1681 and 1864 is given in a paper of the late Sir William Tite (*Archæologia*, vol. xxxix. p. 491). It is impossible to say how much more remains hidden many feet below the modern streets.

A question arises as to the arrangement of the area included within the walls, the course of which has already been traced. There is a strong preponderance of evidence against the belief that the present line of streets follows that of Roman London to any considerable extent. Sir William Tite gave reasons for believing that Bishopsgate Street was not a Roman thoroughfare (*Archæologia*, xxxvi. 203), and in the late excavations in Leadenhall Mr. Loftus Brock found remains of a building which he supposed to be a basilica, apparently crossing the present thoroughfare of Gracechurch Street. Sir William Tite agreed with Dr. Stukeley's suggestion that on the site of the Mansion House (formerly Stocks market) stood the Roman forum, and he states that a line drawn from that spot as a centre would pass by the pavements found on the site of the Excise Office. Besides the forum, Dr. Stukeley suggested the sites of seven other public buildings,—the *Arx Palatina*, guarding the south-eastern angle of the city, where the Tower now stands, the grove and temple of Diana on the site of St. Paul's, an episcopal residence, etc. No traces of any of these buildings have been found, and they are therefore purely conjectural. As to the temple of Diana, Wren formed an opinion strongly adverse to the old tradition of its existence (*Parentalia*, p. 266). Although we know that the Christian church was established in Britain during the later period of Roman domination, there is little to be learnt respecting it, and the Bishop Restitutus who is said to have attended a council on the Continent is a somewhat mythical character.

After the walls the most important points for consideration in relation to Roman London are (1) the existence of a bridge, and (2) the purpose of the London Stone.

1. Dion Cassius, who lived in the early part of the 3d century (*Hist. Rom.*, lib. lx. c. 20), states that there was a bridge over the Thames at the time of the invasion of Claudius (43 A. D.), but he places it a little above the mouth of the river ("higher up"). The position is vague, but, as already stated, the mouth of the Thames in these early times may be considered as not far from where London Bridge now stands. Sir George Airy holds that this bridge was not far from the site of London Bridge (*Proceedings of Institut. Civil Engineers*, xlix. 120), but Dr. Guest was not prepared to allow that the Britons were able to construct a bridge over a tidal river such as the Thames, some 300 yards wide, with a difference of level at high and low water of nearly 20 feet. He therefore suggested that the bridge was constructed over the marshy valley of the Lea, probably near Stratford. It needs some temerity to differ from so great an authority as the late Dr. Guest, but it does strike one as rather surprising that, having accepted the fact of a bridge made by the Britons, he should deny that these Britons possessed a town or village in the place to which he supposes that Aulus Plautius retired. It may be considered certain that there was no bridge over the Thames in the time of Julius Cæsar; for he would not have marched his troops all the way to Coway Stakes in search of a ford if he could have crossed by a bridge at London.

As the Welsh word for "bridge" is "pont," and this was taken directly from the Latin, the inference is almost conclusive that the Britons acquired their knowledge of bridges from the Romans. Looking at the stage of culture which the Britons had probably reached, it would further be a natural inference that there was no such thing as a bridge anywhere in Britain before the Roman occupation; but, if Dion's statement is correct, it may be suggested as a possible explanation that the increased intercourse with Gaul during the hundred years that elapsed between Julius Cæsar's raids and Claudius Cæsar's invasion may have led to the construction of a bridge of some kind across the Thames at this point, through the influence and under the guidance of Roman traders and engineers. If so, the word "pont" may have been borrowed by the Britons before the commencement of the Roman occupation. Much stronger are the reasons for believing that there was a bridge in Roman times. Remains of Roman villas are found in Southwark, which was evidently a portion of Londinium, and it therefore hardly seems likely that a bridge-building people such as the Romans would remain contented with a ferry. Mr. Roach Smith is a strong advocate for the bridge, and remarks, "It would naturally be erected somewhere in the direct line of road into Kent, which I cannot but think pointed towards the site of Old London Bridge, both from its central situation, from the general absence of the foundations of buildings in the approaches on the northern side, and from discoveries recently made in the Thames on the line of the old bridge" (*Archæologia*, xxix. 160). Mr. Smith has, however, still stronger arguments, which he states as follows:—"Throughout the entire line of the old bridge, the bed of the river was found to contain ancient wooden piles; and, when these piles, subsequently to the erection of the new bridge, were pulled up to deepen the channel of the river, many thousands of Roman coins, with abundance of broken Roman tiles and pottery, were discovered, and immediately beneath some of the central piles brass medallions of Aurelius, Faustina, and Commodus. All these remains are indicative of a bridge. The enormous quantities of Roman coins may be accounted for by consideration of the well-known practice of the Romans to make these imperishable monuments subservient towards perpetuating the memory, not only of their conquests, but also of those public works which were the natural result of their successes in remote parts of the world. They may have been deposited either upon the building or repairs of the bridge, as well as upon the accession of a new emperor" (*Archæological Journal*, i. 113).

2. The "London Stone" has very generally been supposed to be a "milliarium" or central point for measuring distances, but Sir Christopher Wren believed it was part of some more considerable monuments in the forum, and his reason for this belief was that "in the adjoining ground on the south side (upon digging for cellars after the great fire) were discovered some tesselated pavements and other extensive remains of Roman workmanship and buildings" (*Parentalia*, pp. 265, 266). King,[1] in his *Munimenta Antiqua*, writes—"London Stone, preserved with such reverential care through so many ages, and now having its top encased within another stone in Cannon Street, was plainly deemed a record of the highest antiquity of some still more important kind; though we are at present unacquainted with the original intent and purport for which it was placed. It is fixed at present close under the south wall of St. Swithin's Church, but was formerly a little nearer the channel facing the same place,—which seems to prove its having had some more ancient and peculiar designation than that of having been a Roman milliary, even if it were ever used for that purpose afterwards. It was fixed deep in the ground, and is mentioned so early as the time of Athelstan, king of the West Saxons, without any particular reference to its having been considered as a Roman milliary stone." Holinshed (who was followed by Shakespeare in *2 Henry VI.*, act 4 sc. 4) tells us that when Cade, in 1450, forced his way into London, he first of all proceeded to London Stone, and having struck his sword upon it, said in reference to himself and in explanation of his own action, "Now is Mortimer lord of this city." Mr. H. C. Coote, in a paper published in the *Trans. London and Middlesex Arch. Soc.* for 1878, points out that this act meant something to the mob who followed the rebel chief, and was not a piece of foolish acting. Mr. G. L. Gomme (*Primitive Folk-Moots*, pp. 155, 156) takes up the matter at this point, and places the tradition implied by Cade's significant action as belonging to times when the London Stone was, as other great stones were, the place where the suitors of an open-air assembly were accustomed to gather together and to legislate for the government of the city. Corroborative facts have been gathered from other parts of the country, and, although more evidence is required, such as we have is strongly in favor of the supposition that the London Stone is a prehistoric monument.

Saxon (449-1066).—At the beginning of the 5th century the Roman legions left Britain. From this period to the arrival of the Saxons there was a space of time when the Briton was left alone, and there is no reason to believe that

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[1] [Edward (1735-1807), President of Society of Antiquaries in London, and writer on prophecy.—Am. Ed.]

London ceased to be the important commercial town which it had grown to be. After the Saxon invasion we do not hear of the city being ravaged, and it possibly held its own under the various vicissitudes it had to pass through, although Dr. Guest writes that "good reason may be given for the belief that even London itself for a while lay desolate and uninhabited" (*Archæological Journal*, xix. 219). About 449 or 450 the invaders first settled in Britain, and in 457 Hengist and Æsc fought against the Britons at Crayford, driving them out of Kent. The vanquished fled to London in great terror, and apparently found a shelter there.[1] The Saxons disliked walled towns, and in many instances they destroyed those which they conquered. This was not done in London, and it is just possible that the Britons may have been able to purchase their freedom from destruction. We have, however, little or no data upon which we can form an opinion. Mr. Kemble wrote of towns generally that the Saxons neither cared to take possession of them nor took the trouble to destroy them. They enslaved the inhabitants or expelled them, as a mere necessary precaution and preliminary to their own peaceable possession (*Saxons in England*, ii. 296). The only question is whether London, being an exceptional city, had an exceptional fate. Along the banks of the Thames are several small havens whose names have remained to us, such as Rotherhith, Lambhith (Lambeth), Chelchith (Chelsea), and it is not unlikely that the Saxon who would not settle in the city itself associated himself with these small open spots. Places were thus founded over a large space which otherwise might have remained unsettled. At what time the Saxons got over their repugnance and settled in London we cannot say, but the city is described by Bede as being in 604 the metropolis of the East Saxons, and an emporium of many peoples who came to it by sea and land. The relics of Roman London are, as we have already seen, very numerous; but we know nothing of the inhabitants. There is little human interest in the history. When we come to Saxon London this position is reversed. There are no remains worthy of notice, but there is abundance of life. London appears to have held a very exceptional position, and to have been somewhat like a German free city. The Londoner within his strong walls defied the invader, and the Dane frequently attempted to conquer the city in vain. Mr. Freeman does justice to the stout heart of the Londoner, and calls London during this period "the stronghold of English freedom." The Saxon Chronicle has little to tell of London between the 5th and 9th centuries. The great change accomplished by Augustine, in converting the Jutes and the Saxons to Christianity, is recorded in a few short lines; and we are told that in the year 604 Augustine consecrated two bishops, Mellitus and Justus, and that Ethelbert, king of Kent, gave Mellitus a bishop's see at London, then a part of the kingdom of the East Saxons, whose king, Siebert, was a tributary of his uncle the king of Kent. What became of the cathedral which we may suppose to have existed in London during the later Roman period we cannot tell, but we may guess that it was destroyed by the heathen Saxons. Bede records that the church of St. Paul was built by Ethelbert, and from that time to this a cathedral dedicated to St. Paul has stood upon the hill looking down on Ludgate. Mellitus became archbishop of Canterbury, and was succeeded in the see of London by Cedda, who was succeeded by Wina. Then came Theodore, archbishop of Canterbury, better known as the sainted Erkenwald, whose shrine was one of the chief glories of old St. Paul's. He died on April 30, 693, a day which was kept in memory in his cathedral by special offices. We must now pass over nearly a century and a half to the time when the Danes were harassing the country after the death of Egbert. The chronicler records that in the year 839 there was a great slaughter at London, but he gives no particulars. In 851 the Danes plundered the city and made themselves masters of it. Sharon Turner quotes a conveyance of a place in London dated 857, which gives a slight piece of local information (*Anglo-Saxons*, ii. 575). The name of the place was Ceolmandingehaga, and it was situated not far from the West Gate. We cannot tell whether Ludgate was meant or some other gate which marked the extent of the liberties on the west. In 871 the chronicler affirms that Alfred fought nine great battles against the Danes in the kingdom south of the Thames, and that the West Saxons made peace with them. In the next year the Danes went from Reading to London, and there took up their winter quarters. Then the Mercians made peace with them. In 886 Alfred overcame the Danes, restored London to its inhabitants, rebuilt its walls, reannexed the city to Mercia, and committed it to Ethelred, alderman of Mercia. Then, as the chronicler writes, "all the Angle race turned to him (Alfred) that were not in bondage of the Danish men." In 896 the Londoners came off victorious in their encounters with the Danes. The king obstructed the river so that the enemy could not bring up their ships, and they therefore abandoned them. The Londoners broke up some, and brought the strongest and best to London. In 912 Ethelred, the alderman of the Mercians, who had been placed in authority by Alfred, died, and Edward the Elder took possession of London and Oxford, "and all the lands which thereto belonged." Again we find a break in the continuity of the history, and pass on to the year 959, when King Edgar gave Dunstan the bishopric of Worcester, and afterwards that of London. In 962 there was a great fever and mortality in London, and St. Paul's was burnt. It was, however, founded again in the same year. In the reign of Ethelred II. the Danes were more successful in their operations against London, but the inhabitants resisted stoutly. Snorre the Icelander tells us that the Danes fortified Southwark with ditch and rampart, which the English assailed in vain. In 982 London was burnt, and in 994 Olaf and Swein (the father of Canute) came with ninety-four ships to besiege it. They tried to set the city on fire, but the townsmen did them more harm than they "ever weened." The chronicler piously adds that "the holy Mother of God on that day manifested her mercy to the townsmen, and delivered them from their foes." The Danes went from the town and ravaged the neighborhood, so that in the end the king and his witan agreed to give sixteen thousand pounds to be relieved of the presence of the enemy. In the year 1009 the Danes frequently attacked London, but they had no success, and fared ill in their attempts. The Londoners withstood Swein in 1013, but in the end they submitted and gave him hostages. Three years after this, Ethelred died in London, and such of the witan as were there and the townsmen chose Edmund Ironside for king, although the witan outside London had elected Canute. Canute's ships were then at Greenwich on their way to London, where they soon afterward arrived. The Danes at once set to work to dig a great ditch by Southwark, and then dragged their ships through to the west side of the bridge. They were able after this to keep the inhabitants from either going in or out of the town. In spite of all this, after fighting obstinately both by land and by water, the Danes had to raise the siege of London, and take the ships to the river Orwell. After a glorious reign of seven months Edmund died in London, and Canute became master of England. The tribute which the townsmen of London had to pay was £10,500, about one-seventh of the amount which was paid by all the rest of the English nation. This shows the growing importance of the town. From this time there appears to have been a permanent Danish settlement in London. There is but little more to be said of the history of Saxon London than that Edward the Confessor held his witanagemôt there, and built and consecrated the Abbey of Westminster. During the later part of the Saxon period Westminster (originally Thorney Island) had been growing into some importance. Tradition affirmed that on the site of Westminster Abbey a temple of Apollo once stood, which was destroyed by an earthquake in the reign of the emperor Antoninus Pius. Out of the ruins King Lucius founded a church, 170 A. D. Sir Christopher Wren imagined that the monks, finding that the Londoners pretended to a temple of Diana where St. Paul's now stands, did not wish to be behindhand in antiquity (*Parentalia*, p. 296). The figment respecting King Lucius is of about equal authority. There is more reason for believing that Siebert, king of the East Saxons, may have built, as Stow says he did, "a church to the honor of God and St. Peter, on the west side of the city of London." His sons relapsed into idolatry, and left the church to the mercy of the Danes. In a charter of King Edgar, dated 951, the original boundary of Westminster is clearly defined. This charter is marked by Kemble as doubtful (*Codex Dipl.*, dlxix.); but, if not of the date given, it is believed by competent authorities to be of great antiquity. Edward the Confessor took a particular interest in Westminster, and occupied much time in superintending the erection of a new church there. On Childermas Day (December 28), 1065, the monastery was consecrated, and on the following "twelfth mass eve" the king died, being buried on the next day in the new church. The abbot of Westminster's manor is fully described in Domesday, but there is no mention of a palace, so that it has been conjectured that the Confessor lived in the monastery itself. With regard to the buildings of London we are left to conjecture. As several of the Saxon kings lived in the city, we must conclude that they possessed a palace of some kind, and around this other buildings would arise. A port such as London naturally drew foreigners from all parts, and various communities of these strangers are believed to have settled here as early as the 8th century. With regard to the government of the city it is generally supposed that many of its institutions are due to Alfred the Great, although Mr. Coote with great ingenuity traces them back to the ordinances of the Roman *municipium*. The famous dooms of the city of London (Athelstan) are stated in the preamble to be the ordinance of "the bishops and the reeves belonging to London." William the Conqueror's charter, which he granted soon after his accession, is addressed to William the bishop and Godfrey the portreeve. The office portreeve had then been long established, although we know but little of its origin. It was usually an office of popular election, but the king often interfered in the appointment. Considerably more than a century had elapsed after the Conquest before the title of portreeve gave way to that of mayor, as the designation of the chief officer of the city of London.

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[1] If the London-burg here mentioned in the Saxon Chronicle is not London south of the Thames (or Southwark), the fugitives must have crossed the river, and if so this is additional reason for believing that there was then a bridge. The same reasoning will apply to what is related further on, of the Danes crossing to Surrey in the year 851, as it is not likely that a ferry would suffice on these occasions. Moreover, a bridge is shortly after especially mentioned by the chronicler.

NORMAN (1066–1154).—After the battle of Hastings certain of the defeated chiefs retired upon London and urged the men in power to resist the Norman, and set up Edgar Atheling as king, which, as the Saxon chronicler says, "was indeed his natural right." On hearing of this action William marched towards London, and was attacked by the Saxon party at Southwark, who were repulsed by the Norman horse, but with such loss to the latter that William thought it imprudent to lay siege to the city at that time. The Londoners began now to see the hopelessness of their cause, and Archbishop Eldred, and Edgar, and Earls Edwin and Morkere, and "the best men in London" repaired to Berkhampstead, where they submitted themselves and swore fealty to the Conqueror. One of the earliest acts of the Conqueror was to commence the erection of a citadel which should overawe the citizens and give him the command of the city. Some writers have supposed that King Alfred erected a palace or castle on the site of the Tower, but without sufficient authority, and a writer in the *Quarterly Review* (art. "Middlesex," vol. cl. p. 48 *note*) says "the Tower almost certainly stands on foreshore which was not dry land before the Conquest." As the Tower was situated at the eastern limit of the city, so not far from the western extremity was built a strong fortification called Baynard's Castle after its founder Baynard, one of the followers of the Conqueror. In the second year of his reign William granted the remarkable charter written in Anglo-Saxon which still exists among the archives of the city of London. There are but four lines and a quarter, and the size of the slip of parchment is only 6 inches by 1 inch. It runs thus—"William the king greets William the bishop, Godfrey the portreeve, and all the burgesses within London, both French and English. And I grant that they be all law-worth, as they were in Edward the king's days. And I will that each child be his father's heir after his father's days. And I will not suffer that any man do you wrong, God keep you." William Stigand, the bishop of London, was a Norman, and possibly had some influence with the king in obtaining this charter. A wonderful improvement in the appearance of the cities of the country almost immediately followed the advent of the civilizing Norman. Within a few years the whole area of London must have been changed, and handsome buildings arose as if by magic in all parts of the city. Many Normans had settled in London during the reign of Edward the Confessor, but after the Conquest they swarmed in and naturally became the dominant party. In August, 1077, occurred a most extensive fire, such a one, says the Chronicle, as "never was before since London was founded." This constant burning of large portions of the city is a marked feature of its early history, and we must remember that, although stone buildings were rising on all sides, these were churches, monasteries, and other public edifices; the ordinary houses remained as before, small wooden structures. The White Tower, the famous keep of the Tower of London, was commenced by Gundulph, bishop of Rochester, about the year 1078. In 1083 the old cathedral of St. Paul's was commenced on the site of the church which Ethelbert is said to have founded in 610. But four years afterwards the chronicler tells us "the holy monastery of St. Paul, the episcopal see of London, was burnt, and many other monasteries, and the greatest and fairest part of the whole city." In this same year (1087) William the Conqueror died. In 1090 a tremendous hurricane passed over London, and blew down six hundred houses and many churches. The Tower was injured, and a portion of the roof of the church of St. Mary-le-Bow, Cheapside, was carried off and fell some distance away, being forced into the ground as much as 20 feet, a proof of the badness of the thoroughfares as well as of the force of the wind. William Rufus inherited from his father a love for building, and in the year 1097 he exacted large sums of money from his subjects with the object of carrying on some of the undertakings he had in hand. These were the walling round of the Tower, the rebuilding of London Bridge, which had been almost destroyed by a flood, and the erection of the great work with which his name is most generally associated, Westminster Hall. In 1100 Rufus was slain, and Henry I. was crowned in London. This king granted to the citizens their first real charter, in which he promised to observe the laws of the Confessor and to redress many special grievances; but he paid little attention to his engagements, and constantly violated the articles of his charter. When Stephen seized the crown on the death of Henry I., he tried successfully to obtain the support of the people of London. He published a charter confirming in general terms the one granted by Henry, and commanding that the good laws of Edward the Confessor should be observed. The citizens, however, did not obtain their rights without paying for them, and in the year 1139 they paid Stephen one hundred marks of silver to enable them to choose their own sheriffs. In this reign all the all-powerfulness of the Londoners is brought very prominently forward. Stephen became by the shifting fortune of war a prisoner, and the empress Matilda might, if she had had the wisdom to favor the citizens, have held the throne, which was hers by right of birth. She, however, made them her enemies by delivering up the office of justiciary of London and the sheriffwick to her partisan Geoffrey, earl of Essex, and attempting to reduce the citizens to the enslaved condition of the rest of the country. This made her influential enemies, who soon afterwards replaced Stephen upon the throne. The Norman era closes with the death of Stephen, 1154.

We have already alluded to the great number of ecclesiastical foundations which marked the Norman period, and will here note some of the chief of these, to show how completely the new buildings must have changed the whole appearance of London, and raised it from a mean congregation of houses to the rank of a city, having features of considerable architectural merit. The college of St. Martin-le-Grand within Aldersgate was founded in the year 1056, and its rights were confirmed by the Conqueror in the second year of his reign. He gave the dean and secular priests more land, and added to their privileges. A nunnery of the Benedictine order, dedicated to St. Leonard, near Bromley, was founded in the reign of William the Conqueror by William, bishop of London, for a prioress and nine nuns, and in Stephen's reign Sir William Mountfitchet founded an abbey at Stratford Langton, which was subsequently known as West Ham Priory. In 1082 a convent of monks dedicated to St. Saviour was founded at Bermondsey by Alwin Child, a wealthy citizen, and seven years afterwards some Cluniac monks came from France and settled in the new convent, of which one of them was chosen the first prior. In 1094 William Rufus added the manor of Bermondsey to the other benefactions of this fortunate monastery, which became very powerful, and was frequently used as a royal residence. At Clerkenwell two religious houses were established in the year 1100, viz., the Knights Hospitallers of St. John of Jerusalem and the priory of St. Mary for nuns of the Benedictine order. It was said that the number of monasteries built in the reign of Henry I. was so great that almost all the laborers became bricklayers and carpenters, and there was some discontent in consequence. Matilda or Mande, the wife of Henry I., was much interested in the foundation of these religious houses. She established the priory of Holy Trinity, called Christ Church, which was situated to the north of Aldgate, in 1108, and about 1110 two hospitals, one for lepers at St. Giles's-in-the-Fields, and the other for cripples at Cripplegate. The priory of St. Bartholomew was founded a few years earlier, and the Benedictine nunnery of St. John the Baptist at Halliwell near Shoreditch soon afterwards. The Knights Templars made their first habitation in the neighborhood of London in 1118, and did not remove from Holborn to Fleet Street until nearly seventy years afterwards. The royal hospital of St. Katherine's at the Tower was originally founded by Matilda, wife of King Stephen, and the famous St. Stephen's chapel at Westminster owes its origin to the king himself. It was, however, rebuilt by Edward II. It will be seen from the above list that a large proportion of these buildings were outside the walls, and this shows how extensive the outskirts of the city had become in Norman times. No doubt many of these religious persons sought out somewhat quiet neighborhoods, but around each of them would naturally grow up villages formed by those who were chiefly dependent upon the monks and nuns.

Plantagenet (1154–1485).—Henry II. appears to have been to a certain extent prejudiced against the citizens of London on account of their attitude towards his mother, and he treated them with some severity. On several occasions he exacted large sums from the city, which, although they were euphemistically styled *dona*, cannot be considered as free gifts. The severity appears to have been necessary, and was attended with good results. The streets were in a most dangerous condition at night, and bands of a hundred and more would sally forth to rob the houses of the wealthy. In 1175 some of these men were taken prisoners, and one of them was found to be a citizen of good credit and considerable wealth named "John the Olde." He offered the king five hundred marks for his life, but Henry was inflexible, and after the man had been hanged the city became more quiet. In 1176 the rebuilding of London Bridge with stone was commenced by Peter of Colechurch. This was the bridge which after much subsequent tinkering was pulled down early in the present century. It consisted of twenty stone arches and a drawbridge. There was a gatehouse at each end and a chapel or crypt in the centre, dedicated to St. Thomas of Canterbury, in which Peter of Colechurch the architect was buried in 1205. In 1184 the Knights Templars removed from Holborn to the New Temple in Fleet Street, and in the following year the beautiful Temple church was built. All this activity of building proves that the citizens were wealthy and their city handsome. This is corroborated by the interesting work of Fitzstephen, the monk of Canterbury, which was written at this time. Fitzstephen has left us the first picture of London, and a very vivid one it is. He speaks of its wealth, commerce, grandeur, and magnificence,—of the mildness of the climate, the beauty of the gardens, the sweet, clear, and salubrious springs, the flowing streams, and the pleasant clack of the water-mills. Even the vast forest of Middlesex, with its densely wooded thickets, its coverts of game, stags, fallow deer, boars, and wild bulls is pressed into the description to give a contrast which shall enhance the prosperous beauty of the city itself. Fitzstephen's account of the sports of the people is particularly interesting. He tells how, when the great marsh that washed the walls of the city on the north (Moorfields) was frozen over, the young men went out to slide and skate and sport on the ice. Skates made of bones have been dug up of late years in this district. This sport was allowed to fall into disuse, and was not again prevalent until it was introduced from Holland after the Restoration. In the first year of Richard I. the court of aldermen ordained that for the future houses should not be built of wood, but that they should have an outside wall of stone raised 16 feet from the ground, and be covered with slate or baked tile. This ordinance must have fallen into desuetude, for the houses continued largely to be built of wood. We learn that most of the houses were plastered and whitewashed. One of the earliest objections which the Londoners made to the use of sea-coal was that the smoke from it blackened the white walls of their buildings. The first mayor of London was Henry Fitz Alwin, who was elected in 1189, and held the office until 1212.[1]

London had to pay heavily towards Richard's ransom and, when the king made his triumphal entry into London after his release from imprisonment, a German nobleman is said to have remarked that had the emperor known of the wealth of England he would have insisted on a larger sum. The Londoners were the more glad to welcome Richard back in that the head of the regency, Longchamp, bishop of Ely, was very unpopular from the encroachments he made upon the city with his works at the Tower. The first charter by which the city claims the jurisdiction and conservancy of the river Thames was granted by Richard I. John granted several charters to the city, and it was expressly stipulated in Magna Charta that the city of London should have all its ancient privileges and free customs. The citizens opposed the king during the wars of the barons. In the year 1215 the barons having received intelligence secretly that they might enter London with ease through Aldgate, which was then in a very ruinous state, removed their camp from Bedford to Ware, and shortly after marched into the city in the night-time. Having succeeded in their object, they determined that so important a gate should no longer remain in a defenceless condition. They therefore spoiled the religious houses and robbed the monastery coffers in order to have means wherewith to rebuild it. Much of the material was obtained from the destroyed houses of the unfortunate Jews, but the stone for the bulwarks was obtained from Caen, and the small bricks or tiles from Flanders. The church of St. Mary Overy (now St. Saviour's), Southwark, was begun in the year 1206, and in 1221 the foundation stone of the lady chapel at Westminster Abbey was laid by Henry III. We have alluded to the great change in the aspect of London and its surroundings made during the Norman period by the establishment of a large number of monasteries. A still more important change in the configuration of the interior of London was made in the 13th century, when the various orders of the friars established themselves there. The Benedictine monks preferred secluded sites; the Augustinians did not cultivate seclusion so strictly; but the friars chose the interior of towns by preference. The Black, Preaching, or Dominican Friars settled near Holborn, in what was afterwards Lincoln's Inn, in 1221, and removed to the ward of Castle Baynard in 1276, when the city wall was rebuilt to enlarge their boundaries. The district where the friary was built still retains its name. In 1224 John Iwyn or Ewin made over to the Grey Friars (or Franciscans) an estate situated in the ward of Farringdon Within and in the parish of St. Nicholas in the Shambles, and on this site the first convent of the order was erected. The site is now occupied by the Blue Coat School. In 1241 the White Friars or Carmelites settled in a precinct or liberty between Fleet Street and the Strand, which still retains their name. In 1253 the Austin Friars or Friars Eremites were founded in Broad Street ward, and the last of these friaries to be established was that of the Crutched or Crossed Friars in 1298. By the establishment of these religious houses two-thirds of the entire area of London was occupied by convents and hospitals. This is the most marked characteristic of Plantagenet London. We have no record of the date at which Temple Bar first marked out the extent of the liberties of the city, but as late as the end of the 14th century Fleet Street was described as being in the suburbs. During the Norman period the road from the city to Westminster was quite open, but soon afterwards a commencement was made in building. The Savoy was built in 1245 by Peter, earl of Savoy and Richmond, uncle of Eleanor, wife of Henry III.; and in this king's reign the friars of the order of St. Mary de Arena are supposed to have established themselves near the site of Durham House (now the Adelphi). About the same time William Marshal, earl of Pembroke, founded and endowed a hospital and convent called St. Mary Rouncivale at the village of Charing, so that in Henry III.'s reign there must have been several houses on the line of route to Westminster. Fitzstephen describes the latter place as follows:—"On the west also, higher up the bank of the river, the royal palace rears its head, an incomparable structure, furnished with a breastwork and bastions, situated in a populous suburb, at a distance of two miles from the city." In the reign of Edward I. the mayor offended the king, and the citizens were for a time deprived of their right of electing their chief magistrate. Gregory de Rokesley the mayor, the sheriffs, the aldermen, and other dignitaries of the city were summoned to appear on the 29th June, 1285, before John de Kirkeby, treasurer, and the other justiciars of the king in the Tower of London for the purpose of holding inquests there. Now the mayor held that he was not bound to answer such a summons as this unless he had forty days' notice, so he resigned his mayoralty at Allhallows, Barking, and delivered the common seal of the city to Stephen Aswy and other aldermen, and then entered the Tower with the rest as an alderman only. This action incensed the king greatly, and John de Kirkeby was commanded to take over the mayoralty, a warden being appointed by the royal authority. This arrangement continued until 1297, when Edward granted the prayer of the citizens, and allowed them again to elect a mayor. Royal wardens had filled the mayor's seat from 1265 to 1268, but in the first charter of Edward I. the following concession was made: "Also that the liberties of the city of London shall not be taken into the hand of his lordship the king for any personal trespass or personal judgment of any officer of the said city; and that no warden shall in the same on such pretext be appointed" (*Liber Albus*, translated by Riley, pp. 14, 131). In 1285 the first attempt was made to supply London with water artificially, and the great conduit in West Cheap (or Cheapside) was commenced. This lead cistern, which was castellated with stone, was supplied with water conveyed in leaden pipes from Tyburn. Soon afterwards a nobler building was erected in Cheapside. In 1290 the beloved Eleanor of Castile died, and her husband erected stone crosses where her body had rested. Two of these crosses were in London, and there is some little difficulty in understanding why the two stations were so near each other. It has been suggested that the body really rested at St. Paul's Cathedral. Cheapside Cross was erected by Michael of Canterbury, and cost £300, and Charing Cross, the most sumptuous of the series, cost £450. It was commenced by Richard de Crundale, and completed after his death by Roger de Crundale. In this same year (1290) the Jews were expelled from England. The district in London in which they had lived since William the Conqueror's day came to be called the Old Jewry, but when the Jews returned to England after many centuries of exile most of them settled in the neighborhood of Aldgate.

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[1] He was first admitted to the chief magistracy as bailiff, and there appears to have been considerable variety in the titles used at this time. We learn from the *Liber Albus* that the chief officer was sometimes called "justiciar" and "chamberlain."

Smithfield is mentioned by Fitzstephen as a market for horses, and from this writer we obtain its correct etymology (the smooth field). As early as the reign of Henry III. it had become known as the place for executions. Close by a grove of elm trees that gave their name to the place Sir William Wallace was executed in the year 1305, and there also Mortimer experienced a similar fate five and twenty years afterwards. The history of Smithfield from that day has been a record of executions, jousts, and markets.

In 1313 the celebrated order of the Knights Templars fell, and Edward II. gave their house in Fleet Street to Aymer de Valence, earl of Pembroke. At the earl's death the property passed to the Knights of St. John of Jerusalem, who leased the Inner and Middle Temples to the students of the common law and the Outer Temple to Walter Stapleton, bishop of Exeter, and lord treasurer. The Charterhouse stands on a piece of ground which had been used in 1349 as a burial-place for the thousands who died in that year of the plague. In 1371 Sir Walter Manny founded there a priory of Carthusian monks.

One of those pageants for which the streets of London were so famous took place in 1356 when Edward the Black Prince brought the French king John a prisoner from the battle of Poitiers. It is not necessary to do more than allude to this here, as the incident is a part of English history.

We have now arrived at the period of one of the greatest Londoners that ever lived. The life of Geoffrey Chaucer throws a living interest around the several places with which he was associated. His father was a vintner in Thames Street, the garden of whose house was bounded by the Wall Brook. In 1374 Chaucer was appointed comptroller of the customs, and in the same year he went to live in the dwelling-house above the gate of Aldgate. In 1389 he was appointed clerk of the works at Westminster, the Tower of London, and other places. In March, 1390, we find him on the Thames bank repair commission, and in May of the same year he was employed in setting up scaffolds in Smithfield for Richard II. and his queen (Anne of Bohemia) to see the jousts at that place. His duties took him to the mews for the king's falcons at Charing Cross, and in 1390 he was robbed of some of the king's money on the high road at Westminster. We thus see that traces of the "morning star of English poetry" are to be found in all parts of London.

In 1381 another of the stirring incidents of English history occurred in London. The threatening insurrection of Wat Tyler was suppressed when the leader was killed by Sir William Walworth in Smithfield. Before that the rebels had done great damage to property in London and Southwark. About this time two very important public works were commenced. Westminster Hall was repaired by Richard II. in 1397; the walls were carried up 2 feet higher, the windows were altered, and a new roof constructed. In 1411 the Guildhall was built, and the courts were removed from Aldermanbury.

During the troubles of the 15th century the authorities had seen the necessity of paying more attention to the security of the gates and walls of the city, and when Thomas Nevill, son of Thomas, Lord Fauconbergh, made his attack upon London in 1471 he experienced a very spirited resistance. He first attempted to land from his ships in the city, but the Thames side from Baynard's Castle to the Tower was so well fortified that he had to seek a quieter and less prepared position. He then set upon the several gates in succession, and was repulsed at all. On the 11th of May he made a desperate attack upon Aldgate, followed by 500 men. He won the bulwarks and some of his followers entered into the city, but the portcullis being let down these were cut off from their own party and were slain by the enemy. The portcullis was drawn up, and the besieged issued forth against the rebels, who were soon forced to fly.

When Richard, duke of Gloucester, laid his plans for seizing the crown, he obtained the countenance of the lord mayor, Sir Edmund Shaw, whose brother Dr. Shaw praised Richard at Paul's Cross. Crosby Hall, in Bishopsgate Street, then lately built, was made the lodging of the Protector. There he acted the accessible prince in the eyes of the people, for the last of the Plantagenets was another of the usurpers who found favor in the eyes of the men of London. His day, however, was short, and with the battle of Bosworth ends Plantagenet London.

TUDOR (1485–1603).—It was during this period that the first maps of London were drawn. No representation of the city earlier than the middle of the 16th century has been discovered, although it seems more than probable that some plans must have been produced at an earlier period.[1] The earliest known view is the drawing of Van den Wyngaerde in the Bodleian Library (dated 1550). The so-called Aggas map is a few years later in date; Braun and Hagenberg's map was published in 1572–73; and Norden's maps of London and Westminster are dated 1593. These maps were pasted upon walls, and must have been largely destroyed by ordinary wear and tear. It is curious that the only two existing copies of Aggas's map[2] were published in the reign of James I., although apparently they had not been altered from the earlier editions of Elizabeth's reign which have been lost. By the help of these maps we are able to obtain a very clear notion of the extent and chief characteristics of Tudor London. Henry VII. did little to connect his name with the history of London with the exception of the erection of the exquisite specimen of florid Gothic at Westminster Abbey, which is known by his name. Soon after this king obtained the throne he borrowed the sum of 3000 marks from the city, and moreover paid it at the appointed time. The citizens were so pleased at this somewhat unexpected occurrence that they willingly lent the king £6000 in 1488, which he required for military preparations against France. In 1497 London was threatened by the rebels favorable to Perkin Warbeck, who encamped on Blackheath on the 17th of June. At first there was a panic among the citizens, but subsequently the city was placed in a proper state of defence, and the king himself encamped in St. George's Fields. On June 22 he entirely routed the rebels; and some time afterwards Perkin Warbeck gave himself up, and was conducted in triumph through London to the Tower.

About this time and in several subsequent years the sweating sickness raged in London. This disease (*Sudor Anglicus*) was considered peculiar to England. The sanitary condition of the houses at the time must have been most deplorable, and the plague and other diseases were constantly reappearing until the great fire cleared away all the abominable buildings that formed centres of infection.

During the reign of Henry VII. as well as during that of his son London was constantly the scene of gorgeous pageants. In 1512 the greater part of the palace of Westminster was burned, and Henry VIII. had no suitable residence until 1529, when he obtained Wolsey's magnificent house called York Place, and named it Whitehall. That much of the present London was at this time in a wild and uncultivated condition is proved by a proclamation of Henry VIII., the object of which was "to preserve the partridges, pheasants, and herons from his palace at Westminster to St. Giles's-in-the-Field, from thence to Islington, Hampstead, and Hornsey Park."

As the chief feature of Norman London was the foundation of monasteries, and the chief feature of Plantagenet London was the establishment of friaries, so Tudor London was specially characterized by the suppression of the whole of these religious houses, and also of the almost numberless religious guilds and brotherhoods. When we remember that about two-thirds of the area of London was occupied by these establishments, and that about a third of the inhabitants were monks, nuns, and friars, it is easy to imagine how great must have been the disorganization caused by this root and branch reform. One of the earliest of the religious houses to be suppressed was the hospital of St. Thomas of Acon (or Acre) on the north side of Cheapside, the site of which is now occupied by Mercers' Hall. The larger houses soon followed, and the Black, the White, and the Grey Friars, with the Carthusians and many others, were all condemned in November, 1538.

Love of show was so marked a characteristic of Henry VIII. that we are not surprised to find him encouraging the citizens in the same expensive taste. On the occasion of his marriage with Catharine of Aragon the city was gorgeously ornamented with rich silks and tapestry, and Goldsmiths' Row (Cheapside) and part of Cornhill were hung with golden brocades. When on the eve of St. John's Day, 1510, the king in the habit of a yeoman of his own guard saw the famous march of the city watch, he was so delighted that on the following St. Peter's Eve he again attended in Cheapside to see the march, but this time he was accompanied by the queen and the principal nobility. The cost of these two marches in the year was very considerable, and, having been suspended in 1528 on account of the prevalence of the sweating sickness, they were soon afterwards forbidden by the king, and discontinued during the remainder of his reign. Sir John Gresham, mayor in 1548, revived the march of the city watch, which was made more splendid by the addition of three hundred light horsemen raised by the citizens for the king's service.

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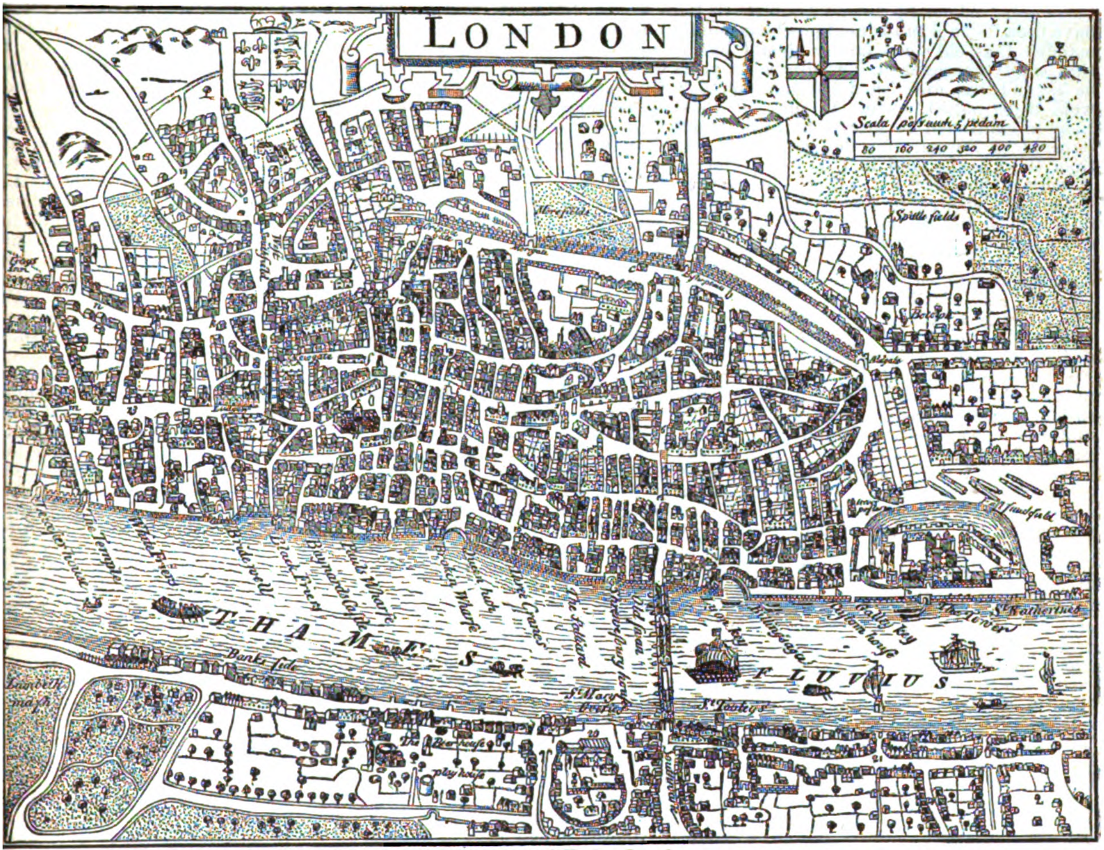
[1] "A map of London engraved on copper-plate, dated, 1497," which was bought by Ferdinand Columbus during his travels in Europe about 1518-25, is entered in the catalogue of Ferdinand's books, maps, etc., made by himself and preserved in the Cathedral Library at Seville, but there is no clue to its existence. If it could be found it would be eagerly scanned by topographers, although possibly there would be little difference from the later maps that we possess, for the town did not extend very rapidly in those early times.

[2] One is in the Guildhall Library, and the other among the Pepysian maps in Magdalene College, Cambridge.

The best mode of utilizing the buildings of the suppressed religious houses was a difficult question left unsolved by Henry VIII. That king, shortly before his death, founded St. Bartholomew's Hospital, "for the continual relief and help of an hundred sore and diseased," but most of the large buildings were left unoccupied to be filled by his successor. The first parliament of Edward's reign gave all the lands and possessions of colleges, chantries, etc., to the king, when the different companies of London redeemed those which they had held for the payment of priests' wages, obits, and lights at the price of £20,000, and applied the rents arising from them to charitable purposes. In 1550 the citizens purchased the manor of Southwark, and with it they became possessed of the monastery of St. Thomas, which was enlarged and prepared for the reception of "poor, sick, and helpless objects." Thus was founded St. Thomas's Hospital, which was moved to Lambeth in 1870-71. Shortly before his death Edward founded Christ's Hospital in the Grey Friars, and gave the old palace of Bridewell to the city, "for the lodging of poor wayfaring people, the correction of vagabonds and disorderly persons, and for finding them work." On the death of Edward VI. Lady Jane Grey was received at the Tower as queen, she having gone there by water from Durham House in the Strand. The citizens, however, soon found out their mistake, and the lord mayor, aldermen, and recorder proclaimed Queen Mary at Cheapside. London was then gay with pageants, but when the queen made known her intention of marrying Philip of Spain the discontent of the country found vent in the rising of Sir Thomas Wyat, and the city had to prepare itself against attack. Wyat took possession of Southwark, and expected to have been admitted into London; but finding the gates shut against him and the drawbridge cut down, he marched to Kingston, the bridge at which place had been destroyed. This he restored, and then proceeded towards London. In consequence of the break down of some of his guns he imprudently halted at Turnham Green. Had he not done so it is probable that he might have obtained possession of the city. He planted his ordnance on Hay Hill, and then marched by St. James's Palace to Charing Cross. Here he was attacked by Sir John Gage with a thousand men, but he repulsed them and reached Ludgate without further opposition. He was disappointed at the resistance which was made, and after musing a while "upon a stall over against the Bell Savadge Gate" he turned back. His retreat was cut off, and he surrendered to Sir Maurice Berkeley. We have somewhat fully described this historical incident here because it has an important bearing on the history of London, and shows also the small importance of the districts outside the walls at that period.



Norden's Map of Tudor London.

We now come to consider the appearance of London during the reign of the last of the Tudors. At no other period were so many great men associated with its history; the latter years of Elizabeth's reign are specially interesting to us, because it was then that Shakespeare lived in London, and introduced its streets and people into his plays. In those days the frequent visitation of plagues made men fear the gathering together of multitudes. This dread of pestilence, united with a puritanic hatred of plays, made the citizens do all they could to discountenance theatrical entertainments. The queen acknowledged the validity of the first reason, but she repudiated the religious objection, provided ordinary care was taken to allow "such plays only as were fitted to yield honest recreation and no example of evil." On April 11, 1582, the lords of the council wrote to the lord mayor to the effect that, as "her Majesty sometimes took delight in those pastimes, it had been thought not unfit, having regard to the season of the year and the clearance of the city from infection, to allow of certain companies of players in London, partly that they might thereby attain more dexterity and perfection the better to content her Majesty" (Analytical Index to the *Remembrancia*). When theatres were established the lord mayor took care that they should not be built within the city. The "Theatre" and the "Curtain" were situated at Shoreditch; the "Globe," the "Rose," and the "Hope" on the Bankside; and the Blackfriars theatre, although within the walls, was without the city jurisdiction.

In 1561 St. Paul's steeple and roof were destroyed by lightning, and the spire was never replaced This circumstance allows us to test the date of certain views; thus Wyngaerde's map has the spire, but Aggas's map is without it. In 1566 the first stone was laid of the "Burse," which owed its origin to Sir Thomas Gresham, and in 1571 Queen Elizabeth changed its name to the Royal Exchange, "so to be called from thenceforth and no otherwise."

A proclamation was issued in 1580 prohibiting the erection within 3 miles of the city gates of any new houses or tenements "where no former house hath been known to have been." In a subsequent proclamation the queen commanded that only one family should live in one house, that empty houses erected within seven years were not to be let, and that unfinished buildings on new foundations were to be pulled down. In spite of these restrictions London continued to grow. In 1568 a conduit was constructed at Dowgate for the purpose of obtaining water from the Thames, and in 1580 Peter Moris, an ingenious Dutchman, brought his scheme for raising the Thames water high enough to supply the upper parts of the city under the notice of the lord mayor and aldermen, and in order to show its feasibility he threw a jet of water over the steeple of St. Magnus's Church (see page 834). The maps show us much that remains somewhat the same as it was, but also much that has greatly altered. St. Giles's was literally a village in the fields; Piccadilly was "the waye to Redinge," Oxford Street "the way to Uxbridge," Covent Garden an open field or garden, and Leicester Fields lammas land. Moorfields was drained and laid out in walks in Elizabeth's reign. At Spitalfields crowds used to congregate on Easter Monday and Tuesday to hear the Spital sermons preached from the pulpit cross. The ground was originally a Roman cemetery, and about the year 1576 bricks were largely made from the clayey earth, the recollection of which is kept alive in the name of Brick Lane. Citizens went to Holborn and Bloomsbury for change of air, and houses were there prepared for the reception of children, invalids, and convalescents. In the north were sprinkled the outlying villages of Islington, Hoxton, and Clerkenwell. The Strand was filled with noble mansions washed by the waters of the Thames, but the street, if street it could be called, was little used by pedestrians. Londoners frequented the river, which was their great highway. The banks were crowded with stairs for boats, and the watermen of that day answered to the chairmen of a later date and the cabmen of to-day. When Shakespeare and his companions went to act at the Globe Theatre they did not cross London Bridge, but took boat at Blackfriars Stairs, and were landed opposite at the Paris Garden Stairs on the Bankside. The Bankside was of old a favorite place for entertainments, but two only—the bull-baiting and the bear-baiting—were in existence when Aggas's map was first planned. On Norden's map,[1] however, we find the gardens of Paris Garden, the bearhouse, and the playhouse.

The settled character of the later years of Elizabeth's reign appears to have caused a considerable change in the habits of the people. Many of the chief citizens followed the example of the courtiers, and built for themselves country residences in Middlesex, Essex, and Surrey; thus we learn from Norden that Alderman Roe lived at Muswell Hill, and we know that Sir Thomas Gresham built a fine house and planned a beautiful park at Osterley.

STUART (1603-1714).—The Stuart Period, from the accession of James I. to the death of Queen Anne, extends over little more than a century, and yet greater changes occurred during those years than at any previous period. The early years of Stuart London may be said to be closely linked with the last years of Elizabethan London, for the greatest men such as Raleigh, Shakespeare, and Ben Jonson lived on into James's reign. Much of the life of the time was then in the City, but the last years of Stuart London take us to the 18th century, when social life had permanently shifted to the west end. In the middle of the period occurred the civil wars and then the fire which changed the whole aspect of London. When James came to the throne the term suburbs had a bad name, as all those disreputable persons who could find no shelter in the city itself settled in these outlying districts. Then the line of the Strand was almost the only respectable outskirt. Stubbs denounced suburban gardens and garden houses in his *Anatomy of Abuses*, and another writer observed "how happy were the cities if they had no suburbs."

The preparations for the coronation of King James were interrupted by a severe visitation of the plague, which killed off as many as 30,578 persons, and it was not till March 15, 1604, that the king, the queen, and Prince Henry passed triumphantly from the Tower to Westminster. The lord mayor's shows, which had been discontinued for some years, were revived by order of the king in 1609. The dissolved monastery of the Charterhouse, which had been bought and sold by the courtiers several times, was obtained from Thomas, earl of Suffolk, by Thomas Sutton for £13,000. The new hospital chapel and schoolhouse were commenced in 1611, and in the same year Sutton died. Somerset House was occupied by Anne of Denmark, and in 1616 James I. commanded it to be called Denmark House. In 1619 Inigo Jones commenced the Banqueting House at Whitehall, which was only part of a proposed vast palace, but which has remained to our time to be one of the chief ornaments of the town. The fatal vespers at Blackfriars threw a gloom over the year 1623. A large and mixed congregation of Protestants and Roman Catholics had gathered together one Sunday evening at the house of Count de Tillier, the French ambassador, to hear Father Drury (a converted Protestant) preach. As many as were able crowded into the room on the upper floor for that purpose, but those who could not get in were fain to remain on the floor below and listen to a preacher on the sacrament of penance. The floors both gave way, and a large number of persons were precipitated to a great depth and killed, both preachers being among the dead. With the death of James I. in 1625 the older history of London may be said to have closed. During the reign of his successor the great change in the relative positions of London within and without the walls had commenced. Before going on to consider the chief incidents of this change it will be well to refer to some features of the social life of James's reign. Ben Jonson places one of the scenes of *Every Man in his Humor* in Moorfields, which at the time he wrote the play had lately been drained and laid out in walks. Beggars frequented the place, and travellers from the village of Hoxton, who crossed it in order to get into London, did so with as much expedition as possible. Adjoining Moorfields were Finsbury Fields, a favorite practising ground for the archers. Mile End, a common on the Great Eastern Road, was long famous as a rendezvous for the troops. These places are frequently referred to by the old dramatists; Justice Shallow boasts of his doings at Mile End Green when he was Dagonet in Arthur's show. Fleet Street was the show-place of London, in which were exhibited a constant succession of puppets, naked Indians, and strange fishes. The great meeting-place of Londoners in the day-time was the nave of old St. Paul's. Crowds of merchants with their hats on transacted business in the aisles, and used the font as a counter upon which to make their payments; lawyers received clients at their several pillars; and masterless serving-men waited to be engaged upon their own particular bench. Besides those who came on business there were gallants dressed in fashionable finery, so that it was worth the tailor's while to stand behind a pillar and fill his table-books with notes. The middle or Mediterranean aisle was the Paul's Walk, also called the Duke's Gallery from the erroneous supposition that the tomb of Sir Guy Beauchamp, earl of Warwick, was that of the "good" Humphrey, duke of Gloucester. After the Restoration a fence was erected on the inside of the great north door to hinder a concourse of rude people, and when the cathedral was being rebuilt Sir Christopher Wren made a strict order against any profanation of the sacred building. Another of the favorite haunts of the people was the garden of Gray's Inn, where the choicest society was to be met. There, under the shadow of the elm trees which Bacon had planted, Pepys and his wife constantly walked. Mrs. Pepys went on one occasion specially to observe the fashions of the ladies because she was then "making some clothes."

In those days of public conviviality, and for many years afterwards, the taverns of London held a very important place. The Boar's Head in Great Eastcheap was an inn of Shakespeare's own day, and the characters he introduces into his plays are really his own contemporaries. The "Mermaid" is sometimes described as in Bread Street, and at other times in Friday Street and also in Cheapside. We are thus able to fix its exact position; for a little to the west of Bow church is Bread Street, then came a block of houses, then Friday Street. It was in this block that the "Mermaid" was situated, and there appear to have been entrances from each street. What makes this fact still more certain is the circumstance that a haberdasher in Cheapside living "'twixt Wood Street and Milk Street," two streets on the north side opposite Bread and Friday Streets, described himself as "over against the Mermaid tavern in Cheapside." The Windmill tavern occupies a prominent position in the action of *Every Man in his Humor*.[1] The Windmill stood at the corner of the old Jewry towards Lothbury, and the Mitre close by the Mermaid in Bread Street. The Mitre in Fleet Street, so intimately associated with Dr. Johnson, also existed at this time. It is mentioned in a comedy entitled *Ram Alley* (1611), and Lilly the astrologer frequented it in 1640. At the Mermaid Ben Jonson may be supposed to have had such rivals as Shakespeare, Raleigh, Beaumont, Fletcher, Carew, Donne, Cotton, and Selden, but at the Devil in Fleet Street, where he started the Apollo Club, he was omnipotent. Herrick, in his well-known *Ode to Ben*, mentions several of the inns of the day.

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[1] This map of London by Norden is dated 1593, as stated above. The same topographer published in his *Middlesex* a map of Westminster as well as this one of the City of London.

Under James I. the theatre, which established itself so firmly in the latter years of Elizabeth, had still further increased its influence, and to the entertainments given at the many playhouses may be added the masques so expensively produced at court and at the inns of law. In 1613 "The Masque of Flowers" was presented by the members of Gray's Inn in the Old Banqueting House in honor of the marriage of the infamous Carr, earl of Somerset, and the equally infamous Lady Frances, daughter of the earl of Suffolk. The entertainment was prepared by Sir Francis Bacon at a cost of about £2000.

Charles I. and his councillors were filled with the same fear of the increasing growth of London which showed itself in the prohibitory proclamations of his two predecessors. In 1630 a proclamation was issued in which "the erection of any building upon a new foundation, within the limits of 3 miles from any of the gates of the City of London, or palace of Westminster," was forbidden. The privy council in the following year put this question to the lord mayor—"What number of mouths are esteemed to be in the City of London and the liberty?"—the answer to which was 130,268. These prohibitions were not allowed to remain a dead letter, and in 1632 Mr. Palmer, a large landholder in Sussex, was fined by the Star Chamber in the sum of £1000 for living in London beyond the period prescribed in the proclamation of June 20th of that year. In April, 1635, information was filed against Sir John Suckling the poet and others in the Court of Star Chamber for continuing to reside in London and Westminster. It was during this reign that the first great exodus of the wealthy and fashionable was made to the West End. The great square or piazza of Covent Garden was formed from the designs of Inigo Jones about 1632. The neighboring streets were shortly afterwards built, and the names of Henrietta, Charles, James, King, and York Streets were given after members of the royal family. Great Queen Street, Lincoln's Inn Fields, was built about 1629, and named in honor of Henrietta Maria. Lincoln's Inn Fields had been planned some years before.

When the civil war broke out London took the side of the parliament, and an extensive system of fortification was at once projected to protect the town against the threatened attack of the royal army. A strong earthen rampart, flanked with bastions and redoubts, surrounded the City, its liberties, Westminster and Southwark, making an immense enclosure. Mount Street, Grosvenor Square, marks the spot of one of these fortifications called Oliver's Mount. In 1650 Cromwell allowed the Jews to return to England after a banishment of centuries, and those who settled in London mostly chose the neighborhood of Aldgate as a place of residence. With the Restoration the separation of fashionable from city life became complete, and the West End grew into a formidable rival of the older London. In 1635 the game of pall mall was played in St. James's Fields, on the site of St. James's Square and Pall Mall, but during the Commonwealth this was discontinued, and some houses were built round about. The square was planned out in 1663, and it soon became the most fashionable place in London. A mall was then prepared in St. James's Park which still retains its name. About the same time the great houses in Piccadilly were built. Clarendon, Berkeley, and Burlington houses all appeared on the north side of that street about 1665.

London had been ravaged by plague on many former occasions but the pestilence that commenced in December, 1664, will ever live in history as "the Plague of London." On the 7th of June, 1665, Samuel Pepys for the first time saw two or three houses marked with the red cross and the words "Lord, have mercy upon us," on the doors. The deaths daily increased, and business was stopped. Grass grew in the area of the Royal Exchange at Whitehall, and in the principal streets of the city. On the 4th of September, 1665, Pepys writes an interesting letter to Lady Carteret from Woolwich:—"I have stayed in the city till above 7400 died in one week, and of them about 6000 of the plague, and little noise heard day or night but tolling of bells." . . . The plague was scarcely stayed before the whole city was in flames, a calamity of the first magnitude, but one which in the end caused much good, as the seeds of disease were destroyed, and London has never since been visited by such an epidemic. On the 2d of September, 1666, the fire broke out at one o'clock in the morning at a house in Pudding Lane. A violent east wind fomented the flames, which raged with fury during the whole of Monday and great part of Tuesday. On Tuesday night the wind fell somewhat, and on Wednesday the fire slackened. On Thursday it was extinguished, but on the evening of that day the flames again burst forth at the Temple. Some houses were at once blown up by gunpowder,and thus the fire was finally mastered. Many interesting details of the fire are given in Pepys's *Diary*. The distress of those who were made houseless by this calamity was great. The river swarmed with vessels filled with persons carrying away such of their goods as they were able to save. Some fled to the hills of Hampstead and Highgate, but Moorfields was the chief resort of the houseless Londoner. Soon paved streets and two-story houses were seen in that swampy place. The people bore their troubles heroically, and Henry Oldenburg, writing to the Hon. Robert Boyle on September 10, says, "the citizens, instead of complaining, discoursed almost of nothing but of a survey for rebuilding the city with bricks and large streets." Within a few days of the fire three several plans were presented to the king for the rebuilding of the city, by Christopher Wren, John Evelyn, and Robert Hooke. Wren proposed to build main thoroughfares north and south, and east and west, to insulate all the churches in conspicuous positions, to form the most public places into large piazzas, to unite the halls of the twelve chief companies into one regular square annexed to Guildhall, and to make a fine quay on the bank of the river from Blackfriars to the Tower. His streets were to be of three magnitudes—90 feet, 60 feet, and 30 feet wide respectively. Evelyn's plan differed from Wren's chiefly in proposing a street from the church of St. Dunstan's in the East to the cathedral, and in having no quay or terrace along the river. In spite of the best advice, however, the jealousies of the citizens prevented any systematic design from being carried out, and in consequence the old lines were in almost every case retained. But, though the plans of Wren and Hooke were not adopted, it was to these two fellows of the Royal Society that the labor of rebuilding London was committed. Wren's great work, which has covered his name with renown, was the erection of the cathedral of St. Paul's, and the many churches ranged round it as satellites. Hooke's task was the humbler one of arranging as city surveyor for the building of the houses. He laid out the ground of the several proprietors in the rebuilding of the city, and had no rest early or late from persons soliciting him to set out their ground for them at once. The first great impetus of change in the configuration of London was given by the great fire, and Evelyn records and regrets that the town in his time had grown almost as large again as it was within his own memory. Although for several centuries attempts had been made in favor of building houses with brick or stone, yet the carpenters continued to be the chief house-builders. As late as the year 1650 the Carpenters' Company drew up a memorial in which they "gave their reasons that tymber buildings were more commodious for this citie than brick buildings were." The Act of Parliament "for rebuilding the city of London," passed after the great fire, gave the *coup de grace* to the carpenters as house-builders. After setting forth that "building with brick was not only more comely and durable, but also more safe against future perils of fire," it was enacted "that all the outsides of all buildings in and about the city should be made of brick or stone, except doorcases and window frames, and other parts of the first story to the front between the piers," for which substantial oaken timber might be used "for conveniency of shops." A third severe blow in addition to the plague and the fire overtook London in the reign of Charles II. The king and his brother had long entertained designs against the liberties of the city, and for the purpose of crushing them two pretexts were set up—(1) that a new rate of market tolls had been levied by virtue of an act of common council, and (2) that a petition to the king, in which it was alleged that by the prorogation of parliament public justice had been interrupted, had been printed by order of the Court of Common Council. Charles directed a writ *quo warranto* against the corporation of London in 1683, and the Court of King's Bench declared its charter forfeited. Soon afterwards all the obnoxious aldermen were displaced and others appointed in their room by royal commission. A new lord mayor and recorder and new sheriffs were appointed in the same manner. This decision of the Court of King's Bench was reversed in 1690. In the winter of 1683–84 a fair was held for some time upon the Thames. The frost, which commenced about seven weeks before Christmas and continued for six weeks after, was the greatest on record; the ice was 11 inches thick.

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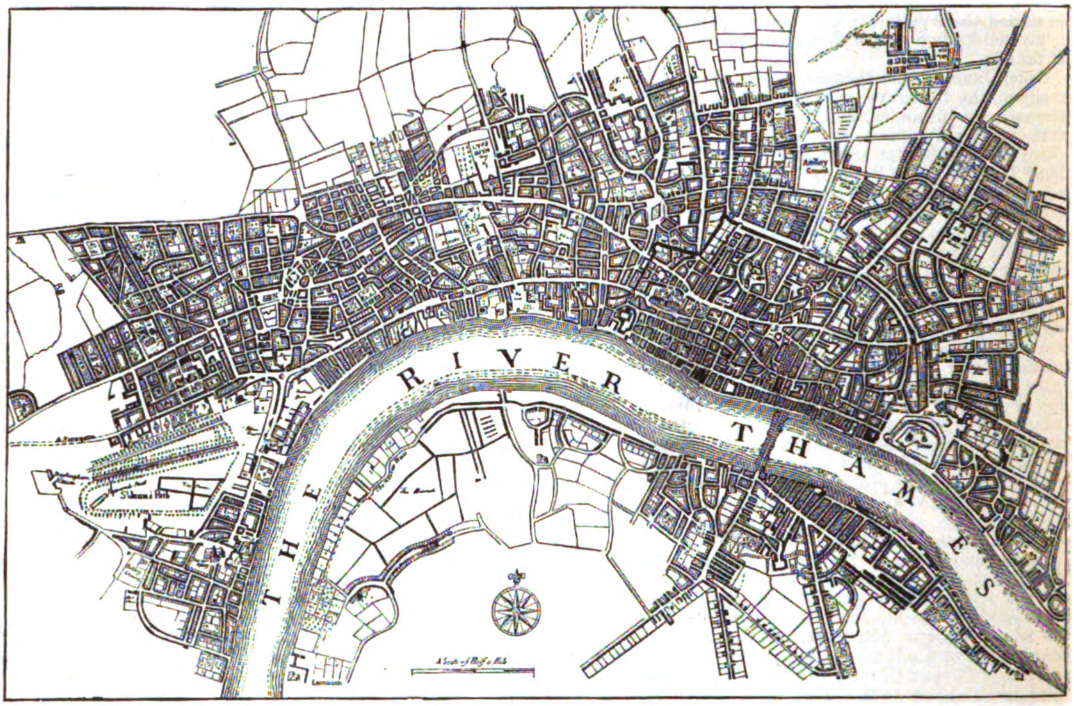
[1] Various changes in the names of the taverns are made in the folio edition of this play (1616) from the quarto (1601); thus the Mermaid of the quarto becomes the Windmill in the folio, and the Mitre of the quarto is the Star of the folio.

The revocation of the edict of Nantes in October, 1685, and the consequent migration of a large number of industrious French Protestants, caused a considerable growth in the east end of London. The silk manufactories at Spitalfields were then established.

During the short reign of James II. the fortunes of the city were at their lowest, and nowhere was the arrival of the prince of Orange more welcomed. One of the first acts of James was to cause an indictment for high treason to be prepared against Alderman Cornish, who had been a zealous supporter of the Exclusion Bill. Sir John Eyles, who had never been sheriff nor was even a freeman of the city, was appointed lord mayor by the king in 1688 in succession to Sir John Shorter. When James found the danger of his position, and learned that William had landed, he sent for the mayor and aldermen and informed them of his determination to restore the city charter and privileges.

William III. cared little for London, the smoke of which gave him asthma, and when a great part of Whitehall was burnt in 1691 he purchased Nottingham House and made it into Kensington Palace. For convenience of communication with London he had a broad road made through Hyde Park, which was lighted by lanterns at night. Kensington was then an insignificant village, but the arrival of the court soon caused it to grow in importance.



London in 1720. Reduced Facsimile of Map by J. Senex.

Although the spiritual wants of the city were amply provided for by the churches built by Sir Christopher Wren, the large districts outside the City and its liberties had been greatly neglected. The Act passed in the reign of Queen Anne for building fifty new churches (1710) not only helped to supply this want, but also gave a special architectural character to the suburbs.

Eighteenth Century.—With the accession of George I. a considerable change in the habits of all classes was introduced. At no previous time probably was public taste so low or manners more depraved. These two evils naturally were felt over the whole kingdom, but nowhere was their baneful influence more apparent than in the capital. Public buildings of the most tasteless character were raised, and streets of private houses were built that were positively painful in their ugliness. London thus grew to be the ugliest of cities, a character which it is only now beginning to throw off. London had gradually grown up by the side of the Thames and extended itself along the river's banks, which were skirted by a succession of handsome palaces. The inhabitants moved from place to place in boats, and the river was the chief highway. In the 18th century this state of things had ceased, and other parts of the town were more largely built upon. The inhabitants used coaches and chairs more than boats, and the banks of the river were neglected. London could no longer be seen as a whole, and it grew into a mere collection of houses. In spite of all this the 18th century produced some of the most devoted of Londoners,—men who considered a day lived out of London as one lost out of their lives. Of this class Dr. Johnson and Hogarth are striking examples. The exhibitions of vice and cruelty that were constantly to be seen in the capital have been reproduced by Hogarth, and had they not been set down by so truthful an observer it would have been almost impossible to believe that such enormities could have been committed in the streets of a great city. A few days after his accession George I. addressed the representatives of the city in these words—"I have lately been made sensible of what consequence the city of London is, and therefore shall be sure to take all their privileges and interests into my particular protection." On the following lord mayor's day the king witnessed the show in Cheapside and attended the banquet at Guildhall. Queen Anne and the first three Georges were all accommodated, on the occasions of their visits to the City to see the show, at the same house opposite Bow church. In the time of Queen Anne and George I. David Barclay (the son of the famous apologist for the Quakers) was an apprentice in the house, but he subsequently became master, and had the honor of receiving George II. and George III. as his guests. There was a large balcony extending along the front of the house which was fitted with a canopy and hangings of crimson damask silk. The building, then numbered 108 Cheapside, was pulled down in 1861. In September, 1720, the bursting of the South Sea Bubble created the most fearful panic that London has ever seen. Trade was at a standstill, and many of the chief merchants, goldsmiths, and bankers stopped payment, thus causing ruin to numberless families.

Early in the 18th century there was a considerable exnsion of building operations in the West End. About the ar 1716 the earl of Burlington commenced building on e Ten Acres Field at the back of the gardens of Burlingn House, and shortly afterwards the City authorities, who ere proprietors of the Conduit Mead (containing 27 acres), llowed his example. On June 1, 1717, the *Weekly Journal* nnounced that "the new buildings between Bond Street nd Mary-le-Bone go on with all possible diligence, and e houses even let and sell before they are built." The arish of St. George's, Hanover Square, was constituted in 725. In 1715 Cavendish Square and the neighboring reets had been planned out, but it was several years bere the plan was completed. The foundation stone of arcourt House (duke of Portland's) on the west side of e square, which is now about to be destroyed, was laid in 722; and the north side, which was originally intended to e occupied by the mansion of the duke of Chandos, was ill unfinished in 1761. St. Peter's chapel in Vere Street, riginally Oxford chapel, was built by Gibbs about 1724.

Still, however, the north of London remained unbuilt pon, and the open character of this part is well shown in e map given above. In 1756 and for some years subseuently the land behind Montague House (now the British useum) was occupied as a farm, and when in that year a proosal was made to plan out a new road the tenant and the uke of Bedford strongly opposed it. In 1772 all beyond ortland Chapel in Great Portland Street was country. Portan Square was laid out about 1764, but it was nearly twenty ears before the whole was finished. It was built on high round with an open prospect to the north, which gave it name as a peculiarly healthy part of London. Mrs. Monagu called it the Montpellier of England, and said she never enjoyed such health as since she came to live in it." n a map of London dated 1773 the villages of Hackney, tepney, Islington, Hoxton, Pancras, Marylebone, Padington, Knightsbridge, and Chelsea are all shown as ountry outskirts of the town. Bedford House in Bloomsury Square had its full view of Hampstead and Highgate rom the back, and Queen's Square was built open to the orth in order that the inhabitants might obtain the same rospect. Dr. Heberden recommended South Lambeth as health resort on account of its situation on the banks of a idal river with the south-west wind blowing fresh from he country and the north-east softened by blowing over he town.

In 1737 the Fleet ditch between Holborn Bridge and leet Bridge was covered over, and Stocks market was reoved from the site of the Mansion House to the present arringdon Street, and called Fleet market. On October 5, 1739, the first stone of the Mansion House was laid. reviously the first magistrates lived in several different ouses. In 1750 Westminster Bridge was opened for pasengers, and London Bridge ceased to be the only means of rossing the Thames at London. Blackfriars Bridge folowed in 1769. A frost almost as severe as the memorable ne of 1683-84 occurred in the winter of 1739-40, and the hames was again the scene of a busy fair. In 1758 the ouses on London Bridge were cleared away, and in 1760-62 everal of the city gates were taken down and sold. Moorate is said to have fetched £166, Aldersgate £91, Aldgate 177, Cripplegate £90, and Ludgate £148. The statue of ueen Elizabeth which stood on the west side of Ludgate as purchased by Alderman Gosling and set up against the ast end of St. Dunstan's church in Fleet Street, where it till remains.

The need of improving and opening out many of the treets of London was felt in the 18th century, but little or othing was done, and the work was left to be accomplishd in the present century. John Gwynn, a friend of Dr. ohnson, paid considerable attention to this subject, and ublished in 1766 a work entitled *London and Westminster mproved, Illustrated by Plans*. Many of the author's sugestions have not been carried out, although they would ften have been improvements upon what has been since ttempted. Of such alterations as have subsequently been xecuted we may note here the widening of Swallow treet, a much-needed improvement, which was not carried ut until the beginning of the present century, a square here Trafalgar Square now stands and some straight treets on the site of Durham House now the Adelphi, and bridge where Waterloo Bridge was afterwards built.

Robert Adam and his brothers, Scotsmen who came to ondon under the protection of the earl of Bute, made a onsiderable improvement in the appearance of certain arts of London during the second half of the 18th century y the adoption of a combined system of architecture, in hich several separate houses were grouped together to ive the appearance of a continuous building. The Adelhi and Portland Place still remain good examples of their ystem. The brothers Adam were leaders in the revival of taste, and the interiors of their buildings are executed with much elegant detail. We have now come to a period when London outside the City may be considered as more important in many points than London within the liberties. "Why, sir," said Dr. Johnson to Boswell, "Fleet Street has a very animated appearance, but I think the tide of human existence is at Charing Cross." This speech was made in 1775, and in spite of the vast increase of London in every direction Charing Cross still retains this preeminent position.

The latter years of the 18th century were somewhat troublous ones for London, but it is only necessary here to barely mention the divisions between the court and the City relating to the election of Wilkes, and the Gordon riots of 1780, when the gates of Newgate were thrown open, and much property was destroyed by the mob.

NINETEENTH CENTURY.—It is impossible to give here anything like a full account of the history of London during the 19th century. Since 1800 the City itself has been almost entirely rebuilt, and the suburbs on all sides have been vastly extended. Russell Square was built about 1804, and the district north of Bloomsbury was laid out at the same time. Bloomsbury Square had been built in 1665, and Bedford Square at the end of the 18th century. Alexander Gibson Hunter, in a letter to Constable the publisher written in March, 1807, says, "Young Faulder and I walked over all the duke of Bedford's new feuing grounds, Russell Square, Tavistock Place, Brunswick Square, etc. The extent of them, and the rapidity of the buildings, is beyond all comprehension." Bedford and Russell Squares were for some years the favored place of residence for the judges. To show how late has been the growth north of the New Road we may mention that at the beginning of the century grapes were ripened by the sun in the open air in gardens in Gower Street, and twenty-five dozen of nectarines were gathered in 1800 from three completely exposed trees in a garden in Upper Gower Street. Still later the richest flavored celery was gathered in abundance in the same place. When duelling was in fashion the duellists naturally chose out the most unfrequented places, and we thus obtain an idea where these places were situated. Chalk Farm for some years rivalled in popularity Wimbledon Common, where the duke of York fought Colonel Lennox in 1789, Battersea Fields, where the duke of Wellington fought the earl of Winchelsea in 1829, and Putney Heath, where Pitt met Tierney in 1798, and Castlereagh and Canning fought in 1809. As late as 1843 a duel was fought at Chalk Farm between Lieutenant Monroe and Colonel Fawcett, when the latter was killed.

In 1806 London saw the public funerals of three of England's greatest men. On the 8th February the body of Nelson was borne with great pomp from the Admiralty to St. Paul's Cathedral, where it was interred in the presence of the prince of Wales and the royal dukes. Pitt was buried on 22d February, and Fox on the 10th October, both in Westminster Abbey.

The first exhibition of Windsor's system of lighting the streets with gas took place on the king's birthday (June 4) 1807, and was made in a row of lamps in front of the colonnade before Carlton House. Finsbury Square was the first public place in which gas lighting was actually adopted, and Grosvenor Square the last. On October 11, 1811, the first stone of Waterloo Bridge was laid, and on June 18, 1817, it was publicly opened. Southwark Bridge, was opened in April, 1819, and new London Bridge, the first stone of which had been laid on June 15, 1825, on August 1, 1831. Westminster and Blackfriars Bridges have been rebuilt within the last few years, and thus not one of the London bridges dates back farther than the present century. One of the greatest improvements in the West End was the formation of Regent Street, intended as a communication between Carlton House and the Regent's Park, which had been planned in 1812. An Act of Parliament was obtained in 1813 for the purpose of carrying out Nash's design. In the winter of 1813-14 the Thames was again frozen over. The frost commenced on the evening of December 27, 1813, with a thick fog. After it had lasted for a month, a thaw of four days, from the 26th to the 29th of January, took place, but this thaw was succeeded by a renewal of the frost, so severe that the river soon became one immovable sheet of ice. There was a street of tents called the City Road, which was daily thronged with visitors. The fashionable Belgravia was built about 1825, over the squalid Five Fields, long known as a dangerous district. Belgrave Square was commenced in 1825, and Eaton Square was set out in 1827, but not wholly completed until 1853. It was about 1829, soon after Carlton House was pulled down, that the line of palatial club-houses in Pall Mall was commenced. In 1827 the Turnpike Act came into operation, and twenty-seven turnpikes were removed in one day. In 1838 the second Royal Exchange was destroyed by fire; and on October 28, 1844, the Queen opened the new Royal Exchange, which was built by Mr. (afterwards Sir William) Tite. On April 27, 1840, the first stone of the new Houses of Parliament to be erected by Charles Barry was laid on the site of the old buildings which had been burnt in October, 1834. An Act of Parliament was passed in 1847 for the purpose of widening and lengthening Cannon Street, and subsequently the street was extended to St. Paul's Churchyard. In 1848 London was in danger from the threatened attack of the Chartists, and defensive preparations were extensively arranged. On the 10th of April, the mob having met on Kennington Common, was prevented from returning to London over the bridges, and no more was heard of any rising. The Great Exhibition of 1851 brought a larger number of visitors to London than had ever been in it before at one time. In 1852 the duke of Wellington's lying in state at Chelsea Hospital, and his public funeral at St. Paul's, were two of the grandest London sights of the present century. On the occasion of the marriage of the Prince of Wales, the streets of London were illuminated as they never had been before. In 1864 Queen Victoria Street, a new thoroughfare from Blackfriars Bridge to the Mansion House, was begun, and in 1870 the northern shore of the river was embanked. The erection of the Thames Embankment, which was carried out at great expense, has shown itself to be the greatest improvement ever made in London. The river, which had been too long neglected, was again raised to its natural position as the chief ornament of London as well as the cause of its prosperity.

Perhaps the most distinguishing characteristic of London life in the latter half of the 19th century is the rush of Londoners which takes place each day after business hours from the centre of the town to the outskirts. This daily exodus has been chiefly caused by the facilities offered by the various railway companies. The first emigration of the London merchants westward was about the middle of last century, but only those who had already secured large fortunes and possessed the highest reputations ventured as far as Hatton Garden. At the beginning of the present century it had become common for the tradesmen of the City to live away from their business, but it was only about thirty years ago that it became at all usual for those in the West End to do the same.

One point worthy of special mention in connection with the modern growth of London is the larger use of stone in building than at any previous period. The reason of this is that the increase in the value of land has made it worth the builder's while to spend more money on the building he raises. We might parody the remark on Augustus's influence in Rome and say—the 19th century found London brick and will leave it stone.

Literature.—The books written upon London are so numerous that they would form a library by themselves; it is impossible here to do more than indicate some of the most important. The earliest description of London is that written by Fitzstephen, in the reign of Henry II., but first printed with Stow's *Survey*, in 1598. Arnold's *Chronicle, or the Customs of London*, was first published in 1502. The first history was *A Survey of London*, by John Stow, 1598, 1603. The author died in 1605, and his work was continued by Anthony Munday and others (1618, 1633), and in the next century by J. Strype (1720, 2 vols. fol.; 1754-55, 2 vols. fol.). This last edition remains the standard history, and the remarks of Strype are very often quoted as those of Stow. E. Hatton's *New View of London* (1708) is very useful on account of its alphabetical list of streets, etc. Maitland's *History of London* was first published in 1 vol. folio in 1739, and was republished in 1756, 1760, 1769, and 1775—each edition in 2 vols. folio, the last being edited by the Rev. J. Entick. Entick had himself published previously *A History and Survey of London*, etc., 1766. *A New and Complete History and Survey of the Cities of London and Westminster*, etc., by a society of gentlemen, revised by H. Chamberlain, appeared in 1770, and again, revised by W. Thornton, etc., in 1784; *A New History of London*, by J. Noorthouck, in 1773; and *A New and Universal History, etc., of London and Westminster*, etc., in 1775, fol. The first edition of Pennant's *London*, the most popular book ever written upon the subject, appeared in 1790. It has been frequently reprinted, and an index to the 4th edition was compiled by T. Downes, and published in 1814. A German translation was published at Nuremberg in 1791. *Antiquities of London and its Environs*, by John T. Smith, appeared in 1791-1800. Smith also published *Antiquities of the City of Westminster*, 1807, new edition, 1837, 4to; *Ancient Topography of London*, 1815; *Vagabondiana*, 1815-17; *Cries of London*, 1839; and *Antiquarian Rambles in the Streets of London*, edited by C. Mackay, 1846. Other works are J. P. Malcolm's *Londinium Redivivum, or an Ancient History and Modern Description of London*, 1803-7; *Anecdotes of the Manners and Customs of London during the 18th Century*, 1808, 1810; and *Anecdotes from the Roman Invasion to 1700*, 1811; David Hughson's [E. Pugh's] *London*, 1806-9, and *Walks through London*, 1817; B. Lambert's *History and Survey of London*, 1806; *Microcosm of London*, 1808-9; H. Hunter's *History of London*, 1811, 4to; *Beauties of England and Wales*, 1814-16, vol. x., "London and Middlesex;" R. Wilkinson's *Londina Illustrata*, 1819; Thomas Allen's *History and Antiquities of London, Westminster, and Southwark*, 1827-29, a most valuable work, with much information not to be found elsewhere; and E. W. Brayley's *Londiniana*, 1829. *London* (edited by Charles Knight, 1841-44; revised by E. Walford, 1875-77) contains articles of considerable interest, but these are badly arranged, and the whole work is incomplete. Leigh Hunt's *The Town* (1848; new ed., 1859) is an interesting work, but without original research. *A Handbook for London* (by Peter Cunningham, 1849; new ed., 1850) is an indispensable work of the highest value; a new edition has been promised by Mr. Murray for many years. The various works on London by J. H. Jesse and John Timbs are interesting, but wanting in accuracy. *The Curiosities of London* by the latter is of value. Cassell's *Old and New London* (1873-78, in 6 vols. 8vo; vols. i.-ii. by Walter Thornbury, vols. iii.-vi. by E. Walford) is of special value on account of the illustrations, many of them copied from Mr. Crace's collection. Dickens's *Dictionary of London* is a useful handbook for London as it is. Besides these general works there are several *Chronicles of London* at various periods, some of which have been published by the Camden Society. The *Transactions of the London and Middlesex Archæological Society* contain papers on various places in London. Newcourt's *Repertorium Ecclesiasticum Parochiale Londinense* (1708-10) still contains the best history of the parishes of London. On Roman remains the chief works are *An Account of some Roman Urns digged up near Bishopsgate*, by J. Woodward, 1713; and *Illustrations of Roman London*, by C. Roach Smith, 1859.

The best books on the environs as a whole are D. Lyson's *Environs of London* 1792-96; *Parishes in Middlesex not included in the Environs*, 1800; James Thorne's *Handbook to the Environs of London*, 1876; and W. Howitt's *The Northern Heights of London*, 1869.

The titles of the leading works on special subjects are subjoined under the several heads:—CHARITIES.—A. Highmore, *Pietas Londinensis—History of Public Charities in London*, 1814; and Herbert Fry, *Royal Guide to the London Charities* (annual). CHURCHES.—*The Churches of London*, by George Godwin, assisted by J. Britton, 1839: and *Guide to the Churches of London and its Suburbs*, by Charles Mackeson (annual). CLIMATE.—Luke Howard, *The Climate of London*, 1818-20; 2d ed., 1833. COMPANIES.—William Herbert, *History of the Twelve Great Livery Companies of London*, 1837. Separate Histories have been also written of the following companies:—Artillery (Highmore, 1804; Raikes, 1878); Carpenters' (Jupp, 1848); Coopers' (Firth, 1848); Founders' (Williams, 1867); Grocers' (J. B. Heath, 1829, 1854); Ironmongers' (Nicholl, 1866); Leathersellers' (Black, 1871); Merchant Taylors' (Clode, 1875); INNS OF COURT.—William Herbert, *Antiquities of the Inns of Court and Chancery*, 1804. MUNICIPALITY.—J. F. B. Firth, *Municipal London*, 1876, 8vo. PARKS.—Jacob Larwood, *The Story of the London Parks*, 1872. POLICE.—Patrick Colquhoun, *Treatise on the Police of the Metropolis*, 1796; 8th ed., 1806. POOR.—H. Mayhew, *London Labor and the London Poor*, 1851; Greenwood, *The Wilds of London*, 1874. POPULATION.—Graunt's *Observations on the Bills of Mortality*, 1876. PRISONS.—Hepworth Dixon, *London Prisons*, 1851. THEATRES.—E. W. Brayley, *Historical and Descriptive Accounts of the Theatres of London*, 1826. WATER.—W. Matthews, *Historical Account of the Waterworks of London*, 1835; J. Prestwich, *Geological Inquiry respecting the Water-bearing Strata of the Country round London*, 1851.

There is no complete catalogue of books relating to London, but useful lists will be found in Anderson's *Book of British Topography*, 1881, and in Lowndes's *Bibliographer's Manual*, 1860. (H. B. W.)

LONDON, a city and port of entry in the Dominion of Canada, the chief town of the county of Middlesex, Ontario, and the see both of a Roman Catholic bishop and of the Anglican bishop of Huron, lies 25 miles north of Lake Erie and 32 miles south-east of Lake Huron, in the midst of a fine agricultural country in the angle made by the confluence of the two branches of the Thames. It is a station on the main line of the Great Western Railway, and the terminus of a branch of the Grand Trunk Railway from St. Mary's, a line from Port Stanley on Lake Erie, and the London, Huron, and Bruce Railway. The local nomenclature of London is in great measure a reproduction of that of the great city whose name it has ambitiously borrowed; the Thames is again spanned by a Westminster and a Blackfriars Bridge, and it has a Hyde Park, a Covent Garden Market, a Crystal Palace, a Tower of London (its jail and court-house), a St. Paul's Cathedral, with Pall Mall, Piccadilly, Cheapside, etc. Among the more important buildings are the city-hall, the court-houses, the city hospital, the lunatic asylum, the orphan asylum, the Roman Catholic convent. The educational institutions include the Collegiate Institute, Hellmuth Ladies' College, the Academy of the Sacred Heart, and the newly-founded Western University. The chief industry is oil-refining—the crude oil being brought from Enniskillen Wells, a distance of 40 miles. There are also railway-car works, boiler and stove and other iron works, and chemical works; and furniture, farming implements, carriages and wagons are manufactured on an extensive scale. The value of the imports has increased from £176,400 in 1861 to £522,391 in 1881; and the value of the exports from £76,000 to £131,141. Three daily and five weekly newspapers and three monthly periodicals issue from the local press. The city is divided into seven wards, and is governed by a mayor and aldermen. First laid out in 1825–6, it returned a member in 1836, and was incorporated in 1840. The population was 15,826 in 1871, and 19,746 in 1881; but the East, West, and South London suburbs—really part of the city, though not yet included within the municipal boundaries—have a population of upwards of 10,000.

LONDONDERRY, a maritime county in the province of Ulster, Ireland, is bounded on the N. by the Atlantic, on the W. by Lough Foyle and Donegal, on the E. by Antrim and Lough Neagh, and on the S. by Tyrone. It has an irregular oval form, its greatest length being about 50 miles, and its greatest breadth about 40. The area comprises 513,388 acres, or about 802 square miles. The county consists chiefly of river valleys surrounded by elevated table-lands rising occasionally into mountains, while on the borders of the sea-coast the surface is generally level. The principal river is the Roe, which flows northward from the borders of Tyrone into Lough Foyle below Newtown-Limavady, and divides the county into two unequal parts. Further west the Faughan also falls into Lough Foyle, and the river Foyle passes through a small portion of the county near its north-western boundary. In the south-east the Moyola falls into Lough Neagh, and the Lower Bann from Lough Neagh forms for some distance its eastern boundary with Antrim. The only lake in the county is Lough Finn on the borders of Tyrone, but Lough Neagh, which is included in Antrim, forms for about 6 miles its south-eastern boundary. The valley of the Roe is a line of division between two entirely different geological structures. To the east there is a basaltic tract in all respects similar to that in Antrim, except that on the Londonderry side of the Bann the dip of the strata is reversed and lies north-east. At Benyevenagh, which has an elevation of 1262 feet, the basalt reaches a thickness of 900 feet. It is succeeded by chalk lias, limestone, and red sandstone, the whole resting on primitive rock. The remainder of the county consists chiefly of mica-slate and primitive limestone, and includes the mountain of Sawel, with an elevation of 2236 feet, as well as other eminences approaching 2000 feet in height. Hornblende and granite frequently emerge above the slate, and limestone is not uncommon. Sandstone crops to the surface throughout nearly the whole of the valley of the Roe. Fine rock crystals are found in Finglen, near Dungiven, and in several other districts. Iron was at one time worked at Slieve Gullion, and is obtained in abundance in the bogs. There are a few unimportant veins of copper and lead.

Agriculture.—The excessive rainfall and the cold and uncertain climate are unfavorable for agricultural operations, and except in the valleys the soil is unsuitable for tillage. In the basalt region large tracts are partially submerged, and the hard and firm portions consist chiefly of rock. Along the sea-coast there is an extensive district of red clay formed by the decomposition of sandstone, and near the mouth of the Roe there is an extensive tract of a marly nature. Along the valleys the soil is often very fertile, and the elevated districts of the clay-slate region afford rich pasture for sheep.

In 1880 181,239 acres were under tillage, 206,044 were pasture, 5305 plantation, and 120,451 waste. The total number of holdings in the same year was 17,351, of which 1877 were under 1 acre. More than half of the total number were included in those between 5 and 15 acres and those between 15 and 30 acres, which numbered 5467 and 4848 respectively. The preceding table shows the area under the principal crops in 1855 and 1881.

	Wheat.	Oats.	Other Cereals.	Potatoes.	Turnips.	Other Green Crops.	Flax.	Meadow and Clover.	Total.
1855	8,291	91,990	2,664	31,968	11,451	1,454	11,786	20,379	174,287
1881	1,817	74,686	3,103	34,487	12,491	3,290	18,989	38,062	186,918

The increase in the area under crops is due chiefly to the increase in that under flax and meadow, although there is an increase in all other crops except wheat and oats.

The number of horses since 1855 has increased very slightly—from 20,331 to 20,749, of which 17,053 were used for agricultural purposes. Cattle in 1855 numbered 102,185, and in 1881 only 96,693, an average of 25 to every 100 acres under cultivation, the average for Ireland being 25·8. The number of milch cows was 39,393. Sheep numbered 29,888 in 1855, and 30,161 in 1881, pigs in the same years numbering 22,828 and 23,946. Goats in 1881 numbered 4666, and poultry 368,436.

According to the latest return, the land in 1873 was divided amongst 2178 proprietors possessing 511,838 acres, with a total annual value of £364,732, the annual value per acre being 14s. 3d. Of the owners about 36 per cent. possessed less than 1 acre. As many as 153,419 acres were possessed by the Irish Society and seven of the livery companies of London—the Irish Society possessing 6075 acres; the Drapers' Company, 27,025; the Fishmongers', 20,509; the Grocers', 11,638; the Ironmongers', 12,714; the Mercers', 21,241; the Salters', 19,445; and the Skinners', 34,772. In addition to this Sir H. H. Bruce owned 20,801 acres, S. C. Bruce 13,651, the representatives of T. R. Richardson 18,159, Church Temporalities Commissioners 13,413, C. S. M'Causland 12,886, and J. B. Beresford 10,420.

Manufactures.—The staple manufacture of the county is linen. In 1880 the number of scutching mills was 185. The manufacture of coarse earthenware is also carried on, and there are large distilleries and breweries and some salt-works. There are important fisheries of salmon and eels on the Bann.

Railways.—The only railways in the county are those which skirt its northern and western boundary,—the Belfast and Northern Counties line passing by Cookstown and Coleraine to Londonderry, and another line connecting Londonderry with Enniskillen.

Administration and Population.—The county comprises 6 baronies, with 43 parishes and 1202 townlands. It is in the north-west circuit. Assizes are held at Londonderry, and quarter sessions at Coleraine, Londonderry, Magherafelt, and Limavady. Within the county there are 14 petty sessions districts. It includes two poor-law unions and portions of other three. Londonderry is in the Belfast military district and Omagh subdistrict. The county is represented in parliament by two members, and the boroughs of Londonderry (28,947) and Coleraine (6684) by one each. The population of the county, which in 1760 was only 46,182, had increased by 1821 to 193,869, and by 1841 to 222,461, but in 1851 had diminished to 192,269, in 1871 to 173,906, and in 1881 to 164,714, of whom 79,138 were males and 85,576 females. From the 1st May, 1851, to 31st December, 1881, the number of emigrants was 73,725. For every 1000 of the population the death-rate in 1880 was 19·2, the marriage-rate 4·2, and the birth-rate 23·2.

History and Antiquities.—At an early period the county was inhabited by the O'Cathans, or O'Catrans, who were tributary to the O'Nials or O'Neils. Towards the close of the reign of Elizabeth the county was seized with the purpose of checking the power of the O'Neils, when it received the name of Coleraine, having that town for its capital. In 1609, after the confiscation of the estates of the O'Neils, the citizens of London obtained possession of the towns of Londonderry and Coleraine and adjoining lands, 60 acres out of every 1000 being assigned for church lands, and certain other portions to three native Irish gentlemen. The common council of London undertook to expend £20,000 on its reclamation, and elected a body of twenty-six for its management, who in 1613 were incorporated as the Irish Society, and retained possession of the towns of Londonderry and Coleraine, the remainder of the property being divided among twelve of the great livery companies of the city. Notwithstanding the expenditure of large sums by these companies in its management, their estates were afterwards sequestrated by James I., and in 1637 the charter of the Irish Society was cancelled. Cromwell restored the society to its former position, and Charles II. at the Restoration granted it a new charter, and confirmed the companies in the possession of their estates. In the insurrection of 1641 Moneymore was seized by the Irish, and Magherafelt and Bellaghy, then called Vintner's Town, burned, as well as other towns and villages. The most remarkable ancient ruin is that of the Cyclopean fortress of the Giant's Sconce or Ring, situated in the pass between Drumbo and Largentea, the interior of which, 600 feet in diameter, is partly hollowed out of a knoll of basalt, by which it is enclosed on all sides except the north-east, where it is defended by a wall of great thickness, with access for only one person in a stooping posture. The most remarkable of the Druidical circles is that at Slacht Manus. There are a large number of artificial caves. The most ancient castle of Irish origin is that of Carrickreagh; and of the castles erected by the English those of Dungiven, Salterstown, and Muff are still in good preservation. The old abbey of Dungiven, founded in 1109, and standing on a rock about 200 feet above the river Roe, is a very picturesque ruin.

LONDONDERRY, or DERRY, a county of a city, parliamentary borough, and the chief town of the county of Londonderry, is situated on an eminence rising abruptly from the west side of the river Foyle to the height of about 120 feet, 4 miles from the junction of the river with Lough Foyle, and 80 miles north-north-west of Belfast. It is still surrounded by an ancient rampart about a mile in circumference and having seven gates, but the buildings now extend considerably beyond this boundary. The summit of the hill, which is at the centre of the town, is occupied by a quadrangular area from which the main streets, which for the most part are spacious, diverge at right angles. Some of the original houses with high pyramidal gables remain, but they have been much modernized. The river is crossed by an iron bridge 1200 feet in length. The cathedral in the Later English style, and consisting of nave and aisles separated by pointed arches, with tower and spire at the west end, was completed in 1633 at a cost of £4000, contributed by the city of London. The building is 240 feet in length with a breadth of 62 feet, and the height of the tower and spire is 228 feet. The spire was added in 1788, when the old tower was raised 21 feet, and in 1802 the spire was rebuilt. The bishop's palace, erected in 1716, occupies the site of the abbey founded by Columba. The abbot of this monastery, on being made bishop, erected in 1164 Temple More or the "Great Church," one of the finest buildings in Ireland previous to the Anglo-Norman invasion. The original abbey church was called the "Black Church," but both it and the "Great Church" were demolished in 1600, and their materials used in fortifying the city. There is a large Roman Catholic cathedral. The court-house was completed in 1824 at a cost of about £34,000. For the free grammar school, founded in 1617, a new building was erected in 1814 at a cost of over £14,000. There are a number of charitable foundations. The staple manufacture of the town is linen, and there are also shipbuilding yards, iron-foundries, saw-mills, manure-works, distilleries, breweries, and flour-mills. The salmon fishery on the Foyle is also very valuable. The river affords facilities for a secure and commodious harbor, its greatest depth being 33 feet, with a depth of 12 feet at low water. The port has a considerable coasting trade with Great Britain, exporting agricultural produce and provisions. For the last five years its imports have averaged over £600,000 (chiefly grain and provisions), and its exports, which vary very greatly, over £10,000. In 1880 the number of vessels that entered the port was 1569, with a total tonnage of 335,544, the number that cleared 1452, with a tonnage of 326,178. Londonderry returns one member to parliament. The population of the city, which in 1857 was 19,399, had increased in 1871 to 25,242, and in 1881 to 28,947.

Derry, the original name of Londonderry, is derived from *Doire*, the "place of oaks." It owes its origin to the monastery founded by Columba in 546. From the 9th to the 11th century the town was frequently in the possession of the Danes, and was often burned and devastated, but they were finally driven from it by Murtagh O'Brien about the beginning of the 12th century. In 1311 it was granted by Edward II. to Richard de Burgo. After the Irish Society of London obtained possession of it, it was in 1613 incorporated under the name of Londonderry. The fortifications, which were begun in 1600, were completed in 1618 at a cost of nearly £9000. Its charter was confirmed in 1662 by Charles II. From April 18, 1690, the Protestants of the north defended themselves within its walls against James II. until the siege was raised in the following August. See the *History* by Hempton (1861).

LONDONDERRY, ROBERT STEWART, SECOND MARQUIS OF (1769–1822), better known by his courtesy title of Viscount Castlereagh, which he held until the last year of his life, the statesman who brought about the union with Ireland, who was foreign minister for ten eventful years, who represented England at the congress of Vienna, and who was the recognized leader of the aristocratic and reactionary party which owed its being to the excesses of the French Revolution, was born on June 18, 1769, and was thus one year older than his great rival George Canning. His father, Robert Stewart of Ballylawn in the county of Londonderry, and Mount Stewart in Down, had represented the latter county in two Irish parliaments; and his marriage with Lady Sarah Seymour Conway, daughter of the earl of Hertford, in 1766, had brought him into connection with many of the great Whig families of England, as did also his second marriage with the eldest daughter of Lord Camden. His elder son, the future minister, was educated at a school in Armagh, and proceeded in 1786 to St. John's College, Cambridge. He spent only a single year at the English university, and was on his grand tour through Europe when he was summoned home by his father, who had just been created Lord Londonderry in the peerage of Ireland, to stand for the county of Down as the candidate of the smaller landholde[illegible]gainst the influence of the marquis of Downshire. The election cost the new Lord Londonderry £60,000, a sum which crippled him for his whole life. But he was successful, and the young Stewart entered the Irish parliament as one of the few really independent members who sat there, bound by no ties to a great lord, but the representative of three thousand freeholders of the richest county of the most educated province of Ireland. He joined the opposition, like his father before him, and eagerly pressed for the extension of the franchise to the Roman Catholics, even going so far, said his enemies later, as to become a contributor to the *Northern Star* of Belfast, the organ of the seditious party in Ulster; but the great events of the French Revolution soon showed their influence on his opinions, as on those of most landed proprietors. His thoughts on politics already clearly pointed towards the necessity of a union between England and Ireland, a necessity by this time obvious to all political thinkers and practical politicians. But for the time he held firmly to the popular side, voting for the removal of Catholic disabilities, and the right of Irishmen to trade with India. At last, however, Lord Camden came over to Ireland, in March, 1795, as lord-lieutenant, with Mr. Pelham as his secretary, on a mission to tell the Catholics and reformers that they must expect no further relief and no further reform. He took much notice of his sister's step-son, young Robert Stewart, who was quite willing to be won over from the opposition, and who had in the previous year married Lady Emily Hobart, daughter of the late earl of Buckinghamshire, a near relative of many great political personages. Lord Camden used his influence to obtain for his brother-in-law a viscountcy as Viscount Castlereagh in October, 1795, and in the following August an earldom as earl of Londonderry. In that same August, 1796, he made Robert Stewart, who by his father's promotion had become Viscount Castlereagh, keeper of his signet, an honorary post which merely marked his accession to the Government, and in February, 1797, acting secretary in the place of Mr. Pelham. Taking office at a time when everything was at the height of confusion, Lord Castlereagh soon began to show his splendid administrative genius, which, indeed, consisted in his "infinite capacity for taking pains" and careful mastery of details. During the rebellion of 1798, when Lord Camden resigned in panic, Castlereagh showed all the qualities of a splendid minister of police, and heartily co-operated with the wise measures of Lord Cornwallis, by which the rebellion was soon brought to an end. He was equally use-l to Cornwallis in the second part of his mission to eland, namely, the union with England. The meas- e was to be carried; the means were bribery whether honors or in money. The details of the passage of e measure through the House can be studied in the rrespondences of Cornwallis and Castlereagh, in which pear clearly the utter disgust of Cornwallis at the rk he was doing and the country he was in, and Cas- reagh's pride in his successful manipulation of men. he Union carried (1800), then came the fulfilment of omises made to secure support or disarm opposition, d first in importance those to the Catholics. It was oroughly understood between Pitt, Cornwallis, and astlereagh that full rights of citizenship were to be ven to the Catholics as a reward for the loyal behav- r of the greater men during the rebellion, and to in- ice them not to oppose the Union. But the promise as not fulfilled. Pitt had indeed promised to carry e measure; but the king's conscience was worked oon by Lord Loughborough, and to Pitt's surprise and sgust his resignation was accepted, and immediately llowed by that of the abler half of the cabinet, and ecessarily of Cornwallis and Castlereagh. With his signation ends the first epoch of Castlereagh's politi- l life. On very many occasions in his correspondence ornwallis mentions him with warm praise of his "tal- its, temper, and judgment," and only qualifies his pinion in one place, when he says, on July 3, 1800, at "Littlehales very much surpasses Lord Castlereagh the private management of mankind from his good umor and kind attention to everybody." Here Corn- allis touches the greatest political fault of Castlereagh, hich destroyed his popularity, and ruined his reputa- on—his want of sympathy for human weaknesses.

Castlereagh was sworn of the English privy council December, 1799, and returned to the first united arliament for the county of Down. He had no inten- on of permanently losing office by his advocacy of the atholic claims, and therefore, instead of going into olent opposition like Canning and others of the late lministration, he supported the weak Addington min- try, and in June, 1802, was appointed president of e Board of Control. On Pitt's return to power in ecember, 1804, he kept Castlereagh in office, and in 305 made him secretary of state for war and the colo- ies, as well as president of the Board of Control. For e six months he held the war office he was Pitt's ght hand in administration, as Canning was in debate. e now prepared a great expedition of thirty thousand ien, who were to land in Hanover and make a diver- on in northern Germany in favor of the Russians and ustrians. The expedition was too late to be of any se, but it deserves notice as illustrating Castlereagh's vorite idea that England should carry on "grande uerre," which was to appear to a greater extent later. lis present tenure of office was but short, for Pitt's overnment resigned on his death in January, 1806.

When Pitt died, Castlereagh was prime mover in the ttempt to make Lord Hawkesbury premier, and when at failed, sooner than give up all hope of place, he eclared that he and his friends "looked to" Lord renville. Grenville, however, formed his ministry of all the talents" out of the sections which followed ox, Windham, and Sidmouth. The opposition was d in the House of Commons by Castlereagh and Can- ing. Now began the close association of these two elebrated men, each of whom hoped to lead the Tory arty, and who did so in turn, both Irishmen from the ame county of Londonderry, both in the prime of life, nd distinguished—the one for his surpassing eloquence, he other for his administrative powers. Each rival espised the other: Castlereagh, conscious of his high irth and noble connections, looked down on the son f the actress; Canning, conscious on his side of his reat talents for debate, looked down on the clumsy ebater and laborious parliamentary tactician, who ooked to governing the country rather by a careful anipulation of boroughs and patronage than by eloquence and statesmanship. Castlereagh again, proud of his position as an ex-cabinet minister, pretended to lead Canning, who had held but inferior posts; while Canning, in his ardent devotion to the memory of Pitt, sneered at the man who had taken a seat in Addington's cabinet. This rivalry was increased almost to personal dislike by the marriage of Castlereagh's sister to the son and heir of that uncle of Canning's, Paul, in whose favor his own father had been disinherited, and who some years later was made Lord Garvagh. The rivals were not long in opposition, the new ministry resigning in 1807. The duke of Portland formed a new administration on strictly anti-Catholic principles, in which Castlereagh and Canning, both advocates of the Catholic claims, were secretaries of state, the former for war and the colonies, the latter for foreign affairs. During the two years they remained in office together each chafed at the other. The chief events connected with the war office during this tenure of office were the expeditions to Copenhagen, the Peninsula, and Walcheren. Of the Copenhagen expedition the chief credit or discredit must rest with Canning, but the merits of its execution rest entirely with Lord Castlereagh, who showed himself a war minister far superior to Dundas and Windham, and despatched in perfect secrecy a large military and naval expedition, which was swiftly and entirely successful. On the subject of the Portuguese expedition and the assistance to be afforded to the Spanish insurgents, the two secretaries were of different opinions. Canning sent the Spaniards officers, money, and arms in profusion, but was reluctant to send a great army, while Castlereagh planned the Portuguese expedition, chose Sir A. Wellesley to command it, and deserves the credit of Vimiera. Napier in his *Peninsular War* proves how wrong Canning was, how impossible it was to organize out of the Spaniards a force able to resist Napoleon, and how right Castlereagh was in believing in the efficacy of a British army. The Walcheren expedition went far utterly to ruin Castlereagh's reputation, and completed the difference between Canning and himself. Yet the conception was good. Castlereagh prepared the expedition with skill and secrecy, though with slight regard for men's lives, as appeared in his choice of the unhealthy island of Walcheren for debarkation, in his refusal to send enough doctors or hospital ships, and in his appointment of Lord Chatham to command in chief. In this appointment of Chatham appears the radical vice of his war administration: he looked before giving a command on active service to parliamentary influence, not tried ability. The failure of the expedition brought about a crisis in the cabinet. In April, 1809, Canning had sent in his resignation to the duke of Portland, declaring that he could no longer serve with Castlereagh, but the matter was put off from time to time, and at length Canning consented to wait till the Walcheren expedition was over. In September he insisted once for all that something must be done, and then for the first time Castlereagh heard that his dismissal had been determined on for some months. He was naturally indignant, and being unable to challenge Lord Camden, his benefactor, who had really behaved worst to him, or the old duke of Portland, he challenged Canning, who had throughout protested against the manner in which Castlereagh had been treated. On September 21 they met on Putney Heath, when Canning was slightly wounded in the thigh, and Castlereagh had a button shot off his coat. After this duel both resigned, and remained out of office two years, but Castlereagh did not intend to remain so, and through the influence of his aunt, old Lady Hertford, with the prince regent he was, after the refusal of Canning, offered the secretaryship of state for foreign affairs in March, 1812, in the room of Lord Wellesley. On Perceval's assassination in May, 1812, the leadership of the House of Commons was given to Castlereagh. The first ten years of Lord Liverpool's administration were the palmy days of the Tory aristocracy, and during them Lord Castlereagh was the guiding spirit of foreign policy in the cabinet, and the faithful interpreter of Lord Sidmouth's home policy in the House of Commons. Once in power, he perceived that Napoleon must be beaten in Germany, and that, though Lord Wellington's army in Spain must be supported to maintain the credit of English soldiers, and occupy as many French troops as possible, the important point was for the Russian and Prussian monarchs to be joined by the Austrian emperor, and follow up the blow Napoleon had dealt himself in his invasion of Russia. To bring Austria into the field, manage the crown prince of Sweden, maintain the alliance of the great powers and the harmonious working of their armies and policies, Castlereagh gave the English ambassadors at the courts of Austria, Russia, and Prussia, full powers to correspond with each other, and follow the allied forces. The ability with which these instructions were carried out is to be read in the history of the whole campaign of 1813, and of the congresses of Mannheim and Frankfort. When the allies entered France, Castlereagh himself left England to attend the congress of Chatillon. He remained with the armies of the allies, entered Paris with them, and signed the preliminaries of peace. Great was the applause he received on his return from the people, and above all in the House of Commons. The prince regent made him a Knight of the Garter, an honor which had only been conferred on two commoners, Sir R. Walpole and Lord North, for the last two hundred years, and when the allied sovereigns visited London they treated him with marked favor, so that it was no wonder, when he started to take his seat as British plenipotentiary at the congress of Vienna, he believed himself to be a great diplomatist. That he was mistaken in this was conclusively proved by that congress where, as Von Gentz said, England could have done anything, and did nothing. Throughout he supported Metternich, partly because Metternich's nature had mastered him, but more because he had imbibed a blind distrust of Russia. When the return of Napoleon from Elba put an end to the quarrels which were nearly ending in a general war between Prussia and Russia on the one side and England, France, and Austria on the other, and united all parties against him, Castlereagh returned to England, and expressed his confidence in a speedy termination of the new struggle, which indeed was closed at Waterloo. He signed the second peace of Paris on behalf of England, and on his return his father was created marquis of Londonderry. From this time his career can be sketched very shortly. At home the grand harvest of 1815 was followed by very bad ones, and great discontent existed both among the agricultural and manufacturing classes. The Government pursued the same tactics which had in 1793 united nearly all the upper classes in a fever of reaction; they established a secret committee which declared the existence of a widespread conspiracy, and it was often their spies who threw into the meetings of the discontented sufficient politics to make them look like conspiracies. The bad feeling existing came to a climax with the Peterloo massacre, and Lord Sidmouth introduced his Six Acts to check a network of conspiracies which mostly did not exist. Castlereagh had to introduce the Six Acts in the House of Commons, and as usual spoke of the people with the air of hauteur and contempt which made him so particularly obnoxious to them. His foreign policy during these years was chiefly inspired by a real desire to maintain the peace of Europe, which he believed was only to be preserved by the harmony of all the monarchs and their foreign ministers, and to preserve this harmony he was so loth to differ from them on any subject that it was commonly believed among the people that he had signed the Holy Alliance. At the congress of Aix-la-Chapelle in 1818 it was for this reason that he recommended that France should be freed from the army of occupation. The death of George III. in January, 1820, made no difference to Castlereagh, who was greatly in the favor of the new king, and who had no difficulty in supporting the Bill of Pains and Penalties against the queen. Scarcely was the excitement of the queen's trial and the king's coronation over, when Lord Londonderry, for he had succeeded to that title in this very year, accompanied the king to Hanover in October, 1821, to discuss the revolutions in Greece and Spain with Metternich. The interviews which then took place are fully described in Metternich's *Autobiography* (vol. iii. pp. 552-560), and exhibit clearly the paramount influence of Metternich over Lord Londonderry, whom he persuaded to take part in a congress at Verona in the following year. While he was making preparations to start, he became possessed by many strange delusions, which clearly indicated that his mind was unhinged by overwork, as it had been once before after the passing of the Union with Ireland. This soon became obvious to every one; the king noticed it; and the duke of Wellington sent a physician down to Foots Cray to see him. The doctor found him suffering from melancholia, and ordered his razors to be taken away, but in spite of all precautions he procured a penknife and committed suicide on August 12, 1822. His body was conveyed to London to be buried in Westminster Abbey, and just as it was being lowered into the grave a cry of exultant hatred arose from that rabble he had so despised.

Castlereagh's character illustrates the strange difference which in corrupt times can exist between public and private morality. In private life he was a strictly honorable and affectionate man; he was a good husband, a good son, a good brother, and a good master; but even in his private relations that want of warmth which made Cornwallis declare he was utterly unlike an Irishman, and Wilberforce liken him to a fish, seems to have existed, and seems to have been part of his temperament. In public life he played quite a different part, and, though he had one or two firm political principles, as appears in his steady advocacy of Catholic emancipation, he seems as a rule to have regarded politics as a game, in which all means were fair to win, and very extraordinary some of his means appear to be. Though a very bad and confused speaker, he was very successful as a parliamentary leader, from the care with which he used his patronage, and the amount of votes he won by it. While not a great diplomatist, as the mastery Metternich obtained over him clearly proved, as an administrator he deserves the highest praise, steadily punctual to his work, never allowing arrears to accumulate, and never neglecting a detail; but his parliamentary necessities stood in his way; every appointment was given from a party point of view, and if, as in the case of Sir A. Wellesley, chance sometimes led him right, jobbing more often led him wrong. But the chief interest which centres in Lord Londonderry is that he was the last leader of an extinct class. The old aristocrats who lived by politics, and thought all means fair in politics, are gone for ever, and with Londonderry's death the unnatural tension of the reaction from the excesses of the French Revolution ceased, and modern Conservatism, containing indeed many prejudices and an exaggerated admiration for what is fixed, came into being with its real sympathy for all mankind, which the old Tories, and more especially Lord Londonderry, would have despised.

The best materials for studying Bondonderry's life and opinions are his *Despatches* edited by his brother, the third marquis, in 12 volumes. They are, however, very incomplete from the loss of the most valuable at sea in the wreck of the ship which was taking Mr. Turner, Lord Londonderry's chosen biographer, to India. The *Cornwallis Correspondence* for his Irish work. and the supplementary *Wellington Despatches* should also be used. Alison's *Lives* of Lord Castlereagh and Sir Charles Stewart are interesting reading, but abound with that celebrated author's usual faults, and should be corrected by Walpole's *History of England* from 1815. Of contemporary diaries, Rose's, Lord Colchester's, Romilly's, and Wilberforce's, with Pellew's *Life of Lord Sidmouth*, should be consulted, and Metternich's *Autobiography* for the later foreign policy. Mr. Thornton has a short biography in his *Lives of the Foreign Secretaries from 1800*, which is chiefly valuable from his access to the unpublished memoranda of Lord Bexley, who as Mr. Vansittart was chancellor of the exchequer, and helped to lead the Commons from 1812 to 1822. (H. M. S.)

LONG, George, an English scholar (1800–1879), was born at Poulton in Lancashire, on the 4th of November, 1800. From Macclesfield grammar school he went to Trinity College, Cambridge, in 1818. He was elected Craven University scholar in 1821, together with Lord Macaulay and Professor Malden, took his degree in 1822 as wrangler and senior chancellor's medallist, and the next year gained a fellowship over the heads of his two distinguished rivals. In 1824 Long went out to be professor of ancient languages in the new university of Virginia. There he married his first wife, the widow of Colonel Selden. In 1828 he returned to England to accept the Greek professorship in the newly-founded university of London. His introductory lecture in 1828 was followed in 1830 by another entitled *Observations on the Study of the Latin and Greek Languages.* The etymological appendix to this lecture is of interest in the history of classical philology in England, as illustrating the scientific comparative method of teaching the Greek and Latin languages first adopted in the London university by himself and his colleague, Professor Key. He published a *Summary of Herodotus* (1829), and editions of Herodotus (1830–33) and Xenophon's *Anabasis* (1831). He was one of the founders of the Royal Geographical Society in 1830, and was for twenty years a member of the council, or officer of the society; in the same year he joined the committee of the Society for the Diffusion of Useful Knowledge, and was till 1846, when the society was dissolved, one of its most active workers. In 1831 he resigned his professorship and became editor of the society's *Quarterly Journal of Education* (1831–35), for which he wrote many articles. He wrote for the society's Library of Entertaining Knowledge the two volumes of *The British Museum; Egyptian Antiquities* (1832–36), and edited, improved, and wrote parts of the companion volumes *Elgin and Phigaleian Marbles* (1833), and *Townley Marbles* (1836). He planned and edited for the Library of Useful Knowledge a *Geography of America and the West Indies* (1841), of which he wrote a small part, and a *Geography of Great Britain: Part I. England and Wales*, part of which he also wrote himself. He contributed two maps of Egypt and Persia, ancient and modern, to the society's Atlas (1831). From 1833 to 1846 he was engaged on the great labor of his life, the editing of the twenty-nine volumes of the *Penny Cyclopædia*, to which he was also an extensive contributor of articles. The committee appointed Long and Charles Knight editors, but after the publication of a few numbers Knight took no part in the superintendence of the work, and all the editorial labor was done by Long,

A more colossal and the final venture of the society was its *Biographical Dictionary*, of which Long was also appointed editor. He wrote numerous articles in the seven volumes which appeared (1842–44), but the great expense did not allow it to proceed beyond the letter A. Long was also a member of the committee of the Society for Central Education, instituted in London in 1837, and contributed two essays to its *Second and Third Publications* (1838–39). In 1837 he was called to the bar of the Inner Temple. He accepted in 1842 the professorship of Latin in University College, vacated by his friend Mr. Key, which he resigned in 1846, on being appointed by the benchers of the Middle Temple their reader on jurisprudence and the civil law. *Two Discourses delivered in the Middle Temple Hall, with an Outline of the Course*, were published in 1847. He wrote all the articles on Roman law in the *Dictionary of Greek and Roman Antiquities*, edited by Dr. William Smith (1842), and contributed also to the companion *Dictionaries of Biography* (1844–49), and *Geography* (1854–57). His translation of thirteen of Plutarch's *Lives*, with copious notes, first came out in five of Knight's weekly volumes under the title of *The Civil Wars of Rome* (1844–48). He planned and edited Knight's *Political Dictionary* (1845–46), a revision of articles from the *Penny Cyclopædia*. Knight published in parts his *History of France and its Revolutions, 1789–1848* (1850).

In 1849 he left London and went to Brighton College, where he was classical lecturer until midsummer 1871. He was an excellent teacher, and was beloved by both masters and pupils. Whilst here he edited, at first jointly with the Rev. A. J. Macleane, and after that gentlemen's death by himself, the *Bibliotheca Classica* series, to which he himself contributed the edition of Cicero's *Orations* (1851–62), a task for which his legal knowledge eminently qualified him. He also revised, making many corrections and additions, Macleane's editions of Juvenal and Persius (1867), and Horace (1869). He made for Bell's Grammar School Classics editions, with introductions and notes, of Cicero's *De Senectute* and *De Amicitia*, with a selection from his *Epistolæ* (1850), Cæsar's *Gallic War* (1853), and Sallust's *Catilina* and *Jugurtha* (1860). He also edited an *Atlas of Classical Geography* (1854). His translation of the *Thoughts of the Emperor M. Aurelius Antoninus* was published in 1862. The same year appeared anonymously the amusing and instructive little volume called *An Old Man's Thoughts about Many Things.* He was sixty-four when he issued the first of the five large octavo volumes of his *Decline of the Roman Republic.* In 1871 he resigned his post at Brighton College, and retired to Portfield, Chichester, to take a rest well-earned but from labors ill-rewarded. In 1873 the Queen, on the recommendation of Mr. Gladstone, granted him a pension of £100 a year. At Portfield he completed his *Roman History* (1874), and translated *The Discourses of Epictetus, with the Encheiridion and Fragments* (1877). This was the last work of his laborious and useful life. He died after a long and painful illness on the 10th of August, 1879.

In addition to the works already noticed, Long was the author of two papers in the *Journal of the Royal Geographical Society*, a few in the early numbers of the *Penny Magazine*, and several in the *Classical Museum* and *English Journal of Education.* He also wrote on "Grammar Schools," in Knight's *Store of Knowledge.*

Long has exercised by his writings, and indirectly through some of his London university pupils, a wide influence on the teaching of the Greek and Latin languages in England. The publication of the *Bibliotheca Classica* (begun in 1851) did important service, and set English scholars an excellent example, at a time when editions with English notes containing accurate learning and sound scholarship were, with a very few exceptions, not to be found. Some of the volumes of this series still remain the standard English editions. In the knowledge of Roman law Long stood by himself amongst English scholars, and his well-known articles on that subject were the first valuable contribution to the study from any English writer. He had also a profound knowledge of ancient geography. He was an excellent French, German, and Italian scholar, and also read Spanish. His extensive and accurate learning may be explained from the combination of a tenacious memory with a clear judicial intellect. His character was as elevated as his intellect. Its simplicity and manly independence may be seen partly in his writings. His faculty for discriminating evidence and his strong common sense appear in everything that he wrote. (H. J. M.)

LONG BRANCH, a fashionable seaside resort of the United States, in Ocean township, Monmouth county, New Jersey. The old village lies about a mile inland, but the watering-place proper is for the most part situated on the bluffs and plateau immediately above the beach. The bathing grounds are excellent; there are fine drives along the beach in the vicinity; upwards of twenty thousand visitors can find accommodation in the hotels alone, of which there are no less than thirty-three; and there are besides hundreds of private residences occupied mainly by the wealthier classes from New York and Philadelphia. Since 1874 it can be reached directly from New York both by railway and by steamers. Long Branch has a corporation of seven commissioners. Its permanent population in 1880 was 3833, in 1882 about 5000.

LONGEVITY is a term that may be applied to express either the length or duration of life of any organism, or the prolongation of life to an advanced age. The first meaning is the more scientific of the two, as it may be applied to the duration of the life of any organism, although that duration may be relatively short; thus, we may contrast the longevity of the mould which lives only a few hours with that of the forest tree which has survived for centuries, or the longevity of the ephemeral insect with that of an eagle or swan, whose lives may be prolonged to over a century. On the other hand, the second meaning is the more common, as when an instance of very advanced age is spoken of as an example of great longevity.

The information we possess as to the natural duration of life of the lower forms of plants and animals is very meagre, and it can scarcely be asserted that in all there is a natural period of life. A simple organism composed of cells, or even one more complicated but still having the organs necessary to life constructed upon a simple type, may continue to live and grow so long as external conditions are favorable. There may be no tendency to decay of tissue inherent in the organism, so that life may be prolonged until a change in external conditions, quickly or slowly, so affects the processes of nutrition as to make the continuance of life impossible beyond a certain time. It is also highly probable that in both the animal and vegetable worlds comparatively few individuals are permitted to live undisturbed for a sufficient length of time to allow any inherent tendencies to decay to show themselves. In the struggle for existence few individuals even reach maturity; at an early period they are used to support the lives of other and perhaps stronger organisms.

Excluding the lower forms of plants, as to the duration of whose lives we know nothing, the higher plants may be classed, according to duration of life, as follows:—*annuals*, or *semi-annuals*, which grow up in spring and die in autumn; *biennials*, which die at the end of the second year; and *perennials*, the duration of which may last from four to thousands of years. Succulent plants have a short life, lasting only one or two years; the formation of wood is necessary for prolonged vegetable existence. It has been pointed out that strongly scented plants have often a longer duration of life than those destitute of smell. Thus thyme, mint, hyssop, marjoram, sage, etc., can live for two years or longer; whilst lettuce, wheat, oats, barley, live no more than a year. Trees of rapid growth, such as fir, birch, horse-chestnut, form soft wood, and have a comparatively short life; whilst hard-wood trees, such as the oak, grow slowly and live long. It is not, however, an invariable rule that trees yielding hard wood live longest. The beech, cypress, juniper, walnut, and pear all form hard wood, but they do not live so long as the lime, which forms a softer wood. Trees which are long in producing leaves and fruit, and which also retain these for a long time, live longer than those in which these changes occur quickly. Fruit-bearing trees, producing a sour harsh fruit in the wild state, have longer lives than those bearing sweet fruits in the cultivated state. By skilful pruning, or lopping off the branches and buds, the term of life of even short-lived plants may be lengthened.

According to Hufeland, the chance any plant has of attaining a great age depends on the following conditions:—(1) it must grow slowly; (2) it must propagate slowly and late in life; (3) it must have a certain degree of solidity and hardness in its organs, a sufficiency of wood, and the sap must not be too watery; (4) it must be large and have a considerable extent of surface; and (5) it must rise into the atmosphere. If we view a tree as consisting of an enormous number of buds clustered on a common stem in which the vessels or channels for the circulation of the sap remain pervious, and in which also new wood is formed annually, there seems to be no limit to age provided external conditions are favorable. Many large trees have reached a vast age, as shown by the following table compiled by De Candolle:—

	Years.
Elm (*Ulmus campestris*)	335
Cypress (*Cupressus sempervirens*)	350
Cheirostemon platanoides	400
Ivy (*Hedera Helix*)	450
Larch (*Larix europæa*)	576
Chestnut (*Castanea vesca*)	600
Orange (*Citrus Aurantium*)	630
Palms (*Ceroxylon* and *Cocos*)	600-700
Olive (*Olea europæa*)	700
Oriental plane (*Platanus orientalis*)	720
Cedar (*Cedrus Libani*)	800
Lime (*Tilia europæa*)	1076-1147
Oak (*Quercus Robur*)	810, 1080, 1500
Yew (*Taxus baccata*)	1214, 1458 2588, 2880
Taxodium distichum	3000-4000
Baobab[1] (*Adansonia digitata*)	5000

In the animal kingdom there is great variety as regards the duration of life, but no accurate data have yet been collected. Certain *Infusoria* have been watched during the whole period of their existence, which has not lasted more than forty-eight hours; on the other hand, *Actiniæ*, or sea anemones, may live to a long age, as shown by the case of a specimen of *Actinia mesembryanthemum*, still alive in Edinburgh, which belonged to Sir John Dalyell, and which must be at least about seventy years of age. It is highly probable that cold-blooded animals, such as fishes, frogs, toads, in which tissue-changes go on with extreme slowness, especially during a period of muscular inactivity, may live for many years. In the imperial fish-ponds of ancient Rome lampreys were said to have attained their sixtieth year; pike and carp have been ascertained to live a hundred and fifty years; tortoises have reached the age of one hundred years; and it is alleged by natives of India that the crocodile may live for at least a hundred years, and that there seems to be no limit to its time of growth. Many birds have a long period of life. Eagles and crows have been known to live a hundred years, and parrots have been kept in confinement for sixty years. Peacocks attain an age of twenty years; barn-door fowls live for a much shorter period, from six to twelve years. Small birds seem to have shorter lives than large ones. Blackbirds, goldfinches, and canaries have been known to live for twenty years; but many of the smaller birds attain an age of only five or six years.

Amongst mammals, the elephant is supposed to attain the greatest age, reaching above a hundred years; the camel generally lives to fifty years, and may live to eighty; the horse does not live more than forty years; the deer, thirty years; the ox, fifteen to twenty years; sheep, goats, foxes, hares, rabbits, from seven to ten years; and dogs and pigs from fifteen to twenty years. Certain general statements may be made, which do not deserve to be termed laws, but which briefly express relations that undoubtedly exist in many cases between the degree of longevity enjoyed by any species of animal and the conditions of its existence.

1. A relation can often be traced between the duration of life and the time of the development of the animal *in utero*. To this statement there are many exceptions, as will be apparent from the following table, in which the periods of gestation are given on the authority of Professor Owen (*Comp. Anat. and Phys. of Vertebrates*, vol. iii.):—

Name.	Period of Gestation in Days.	Longevity in Years.	Name.	Period of Gestation in Days.	Longevity in Years.
Elephant	608	100	Monkey (*Cebus*)	160	30
Giraffe	440	Not known.	Pig	120	15-20
Mare and Ass	330	30-40	Marmoset	120	Not known.
Cow	286	15-20	*Lemur albifrons*	105	Not known.
Human Being	280	80-100	Wolf, Jackal, Dog	63	15-20
Roe Deer	280	20	Cat	56	15-20
Red Deer Fallow Deer	245	20	Bat (*Vespertilio noctula*)	40	Not known.
Hippopotamus	234	Not known.	Kangaroo	38	Not known.

In the case of birds no relation of this kind can be discovered. For times of incubation of many birds see Owen, *op. cit.*, vol. ii. p. 257.

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[1] [The Baobab is now known to be a fast-growing, short-lived tree.—AM. ED.]

2. It would appear that the sooner a being attains maturity the sooner it propagates, and the shorter will be the duration of its life. The reproductive act may be regarded as the culminating act of the organism, requiring the highest degree of vitality, and involving the largest expenditure of energy. This act will therefore be performed when the organism has reached maturity; in some cases the animal reaches maturity late, in other cases early; but in all the epoch of maturity may be taken as about a fifth part of the whole duration of life. Thus the elephant and the human being do not reach maturity till say the twentieth year, and the period of longevity is about a hundred years; the horse, ass, and bull are mature in the third or fourth year, and live from fifteen to twenty years; sheep come to maturity in the second year, and live from eight to ten years; whilst rabbits and guinea pigs are mature within one year, and live only from four to five years. Here again there are exceptions, as, for example, the cat is mature before the end of the first year, and still it may live to the age of twenty years. Much information is still required on these points before a law can be formulated.

The question of longevity, however, probably presents the greatest interest in its relation to man. It is still a popular belief that the earliest inhabitants of the world possessed an incredible strength, were of an enormous size, and lived to a very great age; and the ages of the patriarchs before the flood are often taken literally, although the conditions making such long lives possible are at variance with those of human existence at the present day. In ancient history there are instances given of heroes who attained the age of several hundred years, but these must be regarded as mythical. For an interesting account of these, see Hufeland's *Art of Prolonging Life*, p. 62 *sq.*

The following are a few instances of extreme longevity which have been placed on record:—Margaret Patten, 137; the countess of Desmond, 145; Thomas Parr, 152; Thomas Damme, 154; John Rovin, 172; and Peter Torton, 185. There can be little doubt that the ages of these persons have been much exaggerated. They lived at a time when no accurate chronological records were kept, and when it was the habit to fix the dates of occurrences by comparing them in the memory with other events believed to have happened about the same time. Thus there were many sources of fallacy, although the narrators no doubt believed their statements to be quite accurate. Still these were instances of prolongation of human life far beyond the usual limits, and there is no reason for doubting that they all lived till they were upwards of a hundred years of age.

Perhaps the best authenticated instance of this kind is that of the famous Thomas Parr of Shropshire. "He was a poor farmer's servant, and obliged to maintain himself by daily labor. When above one hundred and twenty years of age he married a widow for his second wife, who lived with him twelve years, and who asserted that during that time he never betrayed any signs of infirmity of age. Till his one hundred and thirtieth year he performed all his usual work, and was accustomed even to thresh. Some years before his death his eyes and memory began to fail, but his hearing and senses continued sound to the last. In his one hundred and fifty-second year his fame had reached London; and, as the king was desirous of seeing so great a rarity, he was induced to take a journey thither. This, in all probability, shortened his existence, which he otherwise might have preserved some years longer; for he was treated at court in so royal a manner, and his mode of living was so totally changed that he died soon after, at London, in 1635. He was one hundred and fifty-two years and nine months old, and had lived under nine kings of England. What was most remarkable in regard to this man, is that, when his body was opened by Dr. Harvey (the discoverer of the circulation of the blood), his internal organs were found to be in the most perfect state, nor was the least symptom of decay to be discovered in them. His cartilages even were not ossified, as is the case in all old people. The smallest cause of death had not yet settled in his body; and he died merely of a plethora, because he had been too well treated."—Hufeland, p. 71.

The late Sir George Cornewall Lewis attempted to show that all such narratives were so inaccurate as to reduce the ages of the parties to something under a hundred years, and he was disposed to think that there had been no instance of a human being attaining the age of a hundred years. But subsequent cases have shown that a few have attained that great age. In these cases the evidence has not been of a collateral kind, nor has it depended on human memory, but it has been established by written records. Scarcely a year passes without instances occurring in which the evidence that the deceased attained a hundred years cannot be controverted, and there is no doubt that, when a sufficient time from the beginning of the system of registration of births has elapsed, such cases will be more common.

The average duration of life in Europe is about thirty-four years. It oscillates between 28·18 years (Prussia) and 39·8 years (Schleswig-Holstein, Lauenburg). In Naples it is quoted at 31·65 years. This falls far short of the possible longevity, a circumstance chiefly to be accounted for by the great mortality in the early years of life. According to De Quatrefages, the duration of life is almost universally the same amongst the best known peoples. Laplanders live to a great age, men of from seventy to ninety years of age being common among them. The American Indians have apparently as long a life, on the average, as the white men living in the same locality. It would appear to be the same in the case of the negro. Prichard quotes from an official document of the State of New Jersey, showing that the census gave one negro centenarian in the 1000, but only one white centenarian in 150,000; on the other hand, the negro of the Senegal ages early, and does not live long. In his native place he is exposed to unhealthy influences which tell upon him, although he resists the bad effects of these longer and better than the white man; but when he is transplanted to America he enjoys a longer life.

The manner of life and nature of the occupation, apart from hereditary and special causes, have a most important influence on the duration of life. Few emperors or kings have attained the age of eighty; and, of more than three hundred popes, only six have exceeded the age of eighty. It would seem that brain work is not unfavorable to longevity. It is almost proverbial that statesmen and judges often reach an advanced age. Many men famous in literature and science have lived to an old age. Thus from fifty to sixty we have Tasso, Virgil, Shakespeare, Molière, Dante, Pope, Ovid, Horace, Racine, Demosthenes; from sixty to seventy, Lavater, Galvani, Boccaccio, Fenelon, Aristotle, Cuvier, Milton, Rousseau, Erasmus, Cervantes; from seventy to eighty, Dryden, Petrarch, Linnæus, Locke, Handel, Galileo, Swift, Roger Bacon, Charles Darwin; from eighty to ninety, Thomas Carlyle, Young, Plato, Buffon, Goethe, Franklin, Sir W. Herschel, Newton, Voltaire, Halley; and from ninety to one hundred, Sophocles, Leeuwenhoek, Michelangelo, Titian. Physicians are often long lived: Boerhaave, Haller, Gall, Darwin, Van Swieten, Fallopius, Jenner, Cullen, Galen, and Spallanzani died between seventy and eighty years of age, and Harvey, Duhamel, Pinel, Morgagni, Heberden, and Ruysch between eighty and ninety; whilst the father of medicine, Hippocrates, is credited with one hundred and nine years.

A valuable set of statistics have been collected by Hirt (*Die Krankheiten der Arbeiter*) regarding the influence of trades on longevity. An abstract of these will be found in Buck's *Hygiene and Public Health*, vol. ii. pp. 71, 72.

The best indication of longevity in a community is given by the expectation of life from any given age. It is obtained by adding together the number of years which the entire population live from any specified age, and dividing the resulting total "years of life" by the number living at the year of age for which the expectation of life is desired (*English Life Table*, p. xxxiii.). Thus we may find the duration of the portion of human life which an individual at any age may expect to enjoy. Such calculations are of great value in connection with assurance, and indeed in all pecuniary transactions in which the value of life contingencies are taken into account. They are the bases of all systems of life assurance. Life assurance companies have now been able to collect sufficient numbers of cases of their own experience on which to find trustworthy calculations showing the expectation of life at different ages. Such tables have really been compiled from selected cases, namely, from those who have assured, and consequently differ somewhat from those compiled on the broader data obtained from the whole population. The following table, derived from both sources of information, is given briefly to indicate the expectation of life, or the longevity, from various ages, reference being made for details to the article INSURANCE. The table to be read thus: a person thirty years of age has an average expectation of living 33·3 years longer, or of attaining the age of 63·3 years.

Ages.	England and Wales. Farr, 1838–54.	Combined Experience of 17 English Offices, 1843.	Ages.	England and Wales. Farr, 1838–54.	Combined Experience of 17 English Offices, 1843.
0	40·9	...	60	13·9	13·77
10	47·4	48·36	70	8·7	8·54
20	39·9	41·49	80	5·1	4·78
30	33·3	34·43	90	2·9	2·11
40	26·7	27·28	95	2·2	1·28
50	20·1	20·18			

What are the physiological conditions in the human being that determine longevity? In the first place, there is the influence of heredity. Certain peculiarities of tissue are transmitted from parent to offspring that determine whether or not the tissue will remain for a lengthened period of time in a normal condition, or whether it will quickly yield to external influences and take on an abnormal action. As the life of the body is really the sum of the lives of its constituent parts, or in other words, of the cellular elements composing it, it is evident that anything affecting the healthy action of these elements will affect the life of the body as a whole. In some individuals the tissues have what may be termed a hereditary taint, by which is meant a want of stability, so that they pass readily from a normal into an abnormal condition; and this is unfavorable to longevity.

In the next place, even healthy tissues capable of resisting ordinary influences may be unable to resist long-continued unfavorable conditions. In course of time slow changes begin in the tissue; these in turn affect the organ in which the tissue exists, and the organ, by improperly performing its functions, injures the organism. Thus it is that habitually breathing an impure atmosphere, eating improper food, saturating the body with drugs or with alcohol, over-exerting the nervous system by excitement or prolonged brain-work or worry, and sexual excesses debilitate the body by working slow but sure changes in the tissues which will inevitably tell upon the longevity of the individual.

But even in the most favorable conditions there seems to be a limitation to the healthy action of tissues, and old age comes on. Whether this is or is not the result of long hereditary transmission it is not of much practical importance to ask, as it is a state of things all flesh is heir to. But, if it be hereditary, as is highly probable, there is the satisfaction of knowing that hereditary states can be slowly influenced by individuals living in the best possible conditions and transmitting the influences of good moral and physical hygiene. If bad hereditary qualities are transmitted, good qualities have even a better chance of being perpetuated, as they favor the individual in the struggle for existence. Thus a race which has a low degree of longevity may acquire, by persistent attempts to live in the best conditions, a long average duration of life. This is also true, though to a less extent, of an individual life.

Each tissue has a life of its own; it is developed, reaches maturity, declines, and dies. It may be replaced by successive generations of similar tissues, but the power of reproduction of tissue becomes weakened, and by slow degrees the tissue may disappear, or it may become so altered as to be quite unlike what it was at first. By these tissue-changes functional changes of great importance to the body are brought about. Thus, as age comes on, the blood becomes poorer; respiration is less active; the vital capacity of the chest, that is the working-quantity of air, is diminished; the temperature of the body is slightly increased, so that the aged are more sensitive to cold; the digestive organs are less vigorous; the walls of the arteries become hardened by earthy matter, and lose their elasticity; the veins become dilated, and the circulation is not efficiently performed; the teeth decay and disappear; the cartilages become calcified and hard; the skin is shrivelled and dry, and cutaneous respiration and excretion are less perfect; the hair whitens or falls off; the stature and the weight diminish. By and by muscular movements are less energetic and less precise; the hands tremble and the head shakes; and there is a tottering gait. The cartilages of the larynx ossify, the vocal cords lose their elasticity, and the voice becomes a shrill treble. Then the involuntary muscular tissues are affected so that the bladder is less powerful and defæcation is feeble. The transparent media of the eye become dimmed, the near point of vision is pushed back so that the old man becomes presbyopic, or far-sighted, and the power of accommodation, or focussing of the eye, is entirely lost; the delicate mechanism of the drum and bones of the ear is impaired, so that deafness results; and even touch becomes less delicate. Slowly the intellectual faculties become weakened, the emotions are blunted, and the memory becomes by degrees less trustworthy, and at last vanishes. Much of the time is now spent in sleep, and unless some intercurrent disease snaps the thread of life there is a slow ebbing of existence into natural death. Essentially these phenomena are due to delicate changes in the tissues, visible only with the aid of the microscope. These changes are those of wasting or atrophy, meaning a failure of nutrition, or fatty changes, or those caused by infiltration into the tissue of earthy matter, which soon destroys its healthy functions.

Literature.—Elliotson, *Human Physiology*; Hufeland, *Art of Prolonging Life*; P. Flourens, *De la Longévité Humaine, et de la Quantité de Vie sur la Globe*; Quetelet, *Physique Sociale*, vol. i. p. 308; De Quatrefages, *The Human Species*; *An Account of Persons remarkable for their Health and Longevity, by a Physician*, London, 1829; Sir G. Cornewall Lewis's *Letters*; Thoms, *On Longevity*.

(J. G. M.)

LONGFELLOW.

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LONGFELLOW, HENRY WADSWORTH, the foremost of American poets, was born on February 27, 1807, "in a square wooden house on the edge of the sea," in the city of Portland, Maine — Maine then being a Province of the State of Massachusetts. The family from which he sprang was one of distinction. It was founded in America by William Longfellow, of Hampshire England, a man of property and culture, who came to this country in 1676, at the age of twenty-five years, and settled at Newbury, Massachusetts. He was drowned off the coast of the desolate island of Anticosti, Canada. His son, Stephen Longfellow, was a blacksmith by trade, and some family traditions of him are supposed to have suggested to the poet portions of his familiar poem "The Village Blacksmith." Stephen Longfellow married Abigail Thompson, daughter of Edward Thompson, of Marshfield, Massachusetts, who bore him ten children. In 1745 he removed from Newbury to Portland, Maine, where the family remained. His son, Stephen Longfellow 2nd, was educated at Harvard, and showed much intellectual ability, and his son, Stephen Longfellow 3rd, was also graduated from Harvard in 1798. The last named was the father of Henry Wadsworth Longfellow. A sister of Stephen Longfellow was married to Samuel Stephenson, a wealthy merchant of Portland, and as her husband was called to the West Indies for the winter of 1806–7, she invited her brother and his family to spend the winter with her, in the Stephenson mansion, one of the largest and finest in the city. They did so, and thus it came to pass that the poet was born in that house. He was named Henry Wadsworth after his mother's brother, Lieutenant Henry Wadsworth, of the United States navy, who was one of the heroes of the war with Tripoli and lost his life in it, on September 4, 1804, in a most gallant enterprise. It may be added that Stephen Longellow, the poet's father, was for some years a member of Congress and occupied a distinguished place in the community. Mrs. Longfellow, the poet's mother, was descended from John Alden, of Plymouth, whom Longfellow celebrated in one of his best known narrative poems, "The Courtship of Miles Standish."

The childhood of the poet was spent in Portland, and his environment there doubtless strongly inluenced his impressible mind. For Portland was then, as it is now, a place of rare and compelling beauty. Seated upon a throne of hills, overlooking Casco Bay and its more than a hundred islands and the Atlantic Ocean beyond, with a prospect across he plains and lakes of Maine bounded by the maestic wall of the White Mountains, and with broad, elm-shaded streets and stately colonial mansions, here are few American cities that can compare with it in charm. It was a charm that Longfellow elt keenly all his life, and in his poems there are more than a few direct or indirect references to "the beautiful town that is seated by the sea," and o the fresh, fair domes of Deering's Woods. There he learned to love the sea, and there he saw and became familiar with the sea in all its Protean phases. There he became familiar with ships, and with seamen from strange lands. These and a housand other details his poetic soul took in, even n childhood, inclining him resistlessly to poetry and romance.

He did not follow his father and grandfather to Harvard College, but went to old and honored Bowdoin, in the State of Maine. There he was graduated a Bachelor of Arts in 1825, when he was only eighteen years old. In college he was a fine tudent, particularly excelling in language and litrature, and during his under-graduate days he wrote a number of poems which have been retained among his writings as of permanent value. Among hese are the "Hymn of the Moravian Nuns," "The Spirit of Poetry," and "Sunrise on the Hills." These and other early poems were first printed in *The United States Literary Gazette.* He did not, howver, at first contemplate a literary career, but after graduation entered his father's law office and began a course of legal studies. From that place he was soon called to the professorship of Modern Languages in his Alma Mater. To fit himself for uch duties he went abroad and spent some time in France, Spain, Italy and Germany, pursuing philoogical studies, and also completed a course in the University of Göttingen. These early experiences n Europe also left deep marks upon his mind, and races thereof are easily discernible in his poems n 1829 he began the work of his professorship at Bowdoin. Two years later he married Miss Mary S. Potter, of Portland, a woman of much charm. She died a few years later, while travelling in Euope, and in 1843 he married again. His second wife was Miss Frances Elizabeth Appleton, daugher of Nathan Appleton, a prominent citizen of Boston. She was a woman of exceptional beauty of both body and mind, and a fitting companion for Longfellow, who was a singularly handsome man. She bore him five children, and then met a tragic death, through the burning of her clothing.

As Professor of Modern Languages at Bowdoin the poet was eminently successful, and the fame of his ability as an instructor became noised abroad. At the same time he won much favorable notice as a writer for *The North American Review* and other publications. His writings included both prose and poetry. One of his early efforts was a translation from the Spanish of "Las Coplas de Don Jorge Manrique," a scholarly and beautiful piece of work. He accompanied it with an essay on Spanish poetry. In 1835, when only twenty-eight years old, he published his delightful "Outre Mer," in two volumes, the story of his travellings in Europe. During the next twenty years more than 7,000 copies of it were sold, a phenomenal sale for such a book in those times. Better still, it won high critical commendation. *The Athenaeum*, perhaps the foremost literary journal of London, said of it: "If Longfellow had come before Irving, his fame would be that of a founder of a school, so far as America is concerned, rather than one of the scholars." That was not so many years after Sydney Smith's scornful demand, "Who reads an American book?" Among those who were quick to appreciate Longfellow's genius was George Ticknor, the Professor of Modern Languages at Harvard College. He paid a high tribute to Longfellow's translations from the Spanish, and proved his faith in the young poet and professor by recommending him to be chosen as his own successor at Harvard when he retired in 1836. This call was extended to Longfellow, and was accepted. He at once went abroad, early in 1836, to prepare himself with further study. His wife, who accompanied him, died at Rotterdam, but he continued his journey, seeking to find in hard study solace for his grief. In October he returned home and entered upon his professorship at Harvard, in which place he remained for seventeen years. Three years after settling at Harvard he published "Hyperion: A Romance," a story of personal experiences and marked with a fine mingling of pathos and gentle humor—two qualities which were woven together all through the poet's life and works.

Meantime he had been writing many poems, which were published in that rich treasury of American literature, *The Knickerbocker Magazine*, and elsewhere, and in 1839 he published a collection of them in a volume, entitled "Voices of the Night." Probably no other such book of American poetry was at once so favorably received. It sprang into instant popularity, and some of its contents have from that day to this been familiar as household words throughout America, and indeed throughout the English-speaking world. Scarcely one of these poems is marked with much originality, or with the supreme touch of genius. But they have the faculty of speaking directly to the heart. The human element in them is convincing and irresistible. Two years later appeared a second volume of poems, in which were "The Wreck of the Hesperus," "The Skeleton in Armor," and "The Village Blacksmith." In 1842 appeared a third volume, chiefly of anti-slavery poems, and in 1843 "The Spanish Student," a poetical drama. Of the last-named work a distinguished critic, Edwin P. Whipple, has said that "none of Longfellow's other pieces so well illustrates all his poetical qualities. It seems to comprehend the whole extent of his genius."

Longfellow paid another visit to Europe in 1842, and spent the summer at Boppard, on the Rhine. Some of the fruits of this visit appeared in his next volume of poems, in 1846, which contained "The Belfry of Bruges." Then, in 1847, appeared one of his greatest poems, and one which almost marked an epoch in American literature. This was "Evangeline: A Tale of Acadie." It was a narrative poem of considerable length, in English hexameters, of course without rhyme. It was not the first poem ever written in English hexameters, but it was the first such poem to attain and to retain great popularity. Of its popularity and permanent fame there can be no question. For more than half a century it has been among the accepted masterpieces of American literature, and each year adds to rather than detracts from the esteem in which it is held. It has, it is true, been the subject of much controversy, and of some unfavorable comments. *The Athenaeum* of London suggested that with the sorrows of its heroine "a simpler rhythm would have been more in harmony," and that "the real charm of the tale lay in its insulated pictures of scenery." There can be no question that it does contain some of the most perfect world-landscapes ever penned. But foreign critics generally hailed the poem as a beautiful composition, full of original charm indigenous to American soil. Dr. Felton, the eminent Greek scholar and critic, declared that in it Longfellow had shown "as perfect a mastery over the dactylic hexameter as anyone has ever acquired in our language."

At about the same time Longfellow wrote a delightful New England tale in prose, entitled "Kavanagh." Lowell, in *The North American Review*, called it a daguerreotype, so photographically exact a picture of New England life and manners did it present to his critical eye. In the same year appeared "The Seaside and the Fireside," another volume of minor poems, twenty in number. In 1851 appeared "The Golden Legend," one of his more important works, though not one of his most popular. In it, said Ruskin, the poet entered more closely into the temper of the monk, for good and for evil, than ever any theological writer or historian had done, even though they may have devoted their lives' labor to the task. Several other volumes of fugitive and minor poems were also published before the year 1854, which marked a new epoch in his life. In that year he resigned his professorship at Harvard, to be succeeded by James Russell Lowell, and thereafter devoted himself exclusively to literature. He continued, however, to make his home in the famous old Craigie House at Cambridge, which had formerly been Washington's headquarters, and which had already become one of the historic shrines of New England. After Longfellow's long residence there it became more noted and loved as his home than as the temporary home of the Father of His Country.

The fruits of this retirement from professional cares were soon apparent, and were most gratifying. In the very next year, 1855, appeared "The Song of Hiawatha: An Indian Edda," perhaps the best-known if not the most meritorious of all Longfellow's long poems. Its phenomenal popularity may be reckoned from the fact that ten thousand copies of it were sold within four weeks of its publication. It, too, met with all sorts of comments, chiefly, however, favorable and often enthusiastic. Its peculiar metre above all attracted attention and aroused comment. It consists of trochaics, rhymeless and without alliteration, but with innumerable repetitions of phrases. It did not take long for critics to discover that its style was very much like that of the "Kalevala," the national epic of Finland. The metre is the same, the repetition of phrases is the same, and the theme—the life and worship of the aborigines—is the same. To what extent Longfellow was indebted to the Finnish epic for his inspiration, it is impossible to say. To charge him with anything remotely resembling plagiarism would be absurd—as absurd as to charge Byron with plagiarism in adopting the Spenserian stanza for his "Childe Harold's Pilgrimage." Freiligrath declared "Hiawatha" to be written "in a modified Finnish metre, modified by the exquisite feeling of the American poet, according to the genius of the English language and the wants of modern taste." That was a just judgment. Longfellow was not the first to adopt this Finnish metre into English poetry. That had been done as early as 1827, by Sir John Bowring in an article in *The Westminster Review*. But as in the case of the hexameters, Longfellow was the first to make it popular, and to give it a permanent place in our literature. We may, indeed, doubt whether any other single poem, not excepting even Byron's, in the whole range of English literature, ever aroused more general interest immediately upon its appearance than did "Hiawatha." That was because partly of its metrical form, partly of its ethnological, philological and other qualities. It is indeed an almost inexhaustible mine of wealth for the antiquarian, the philologist, the historian, the naturalist, the painter, the sculptor, and, as we have recently seen, the musician. No poem in the world makes so varied an appeal to human interest. In Europe the poem was as widely noticed as here. John Bright quoted from it in a speech in Parliament. Cardinal Wiseman publicly praised it. Four months after its appearance in America, two German translations of it were published, one of them by Frederick Freiligrath. Whether fortunately or unfortunately, the style of the poem made it peculiarly susceptible to being parodied—a fate which it shared with most other great poems. *Punch*, of London, printed one of the most notable of these, in form an exact imitation of Longfellow's work, in substance a cordial eulogy of it. It has been estimated, with reason and judgment, that this poem has done more to instruct Americans in the folk-lore and traditions of the aborigines of the continent, than all other writings upon the subject put together.

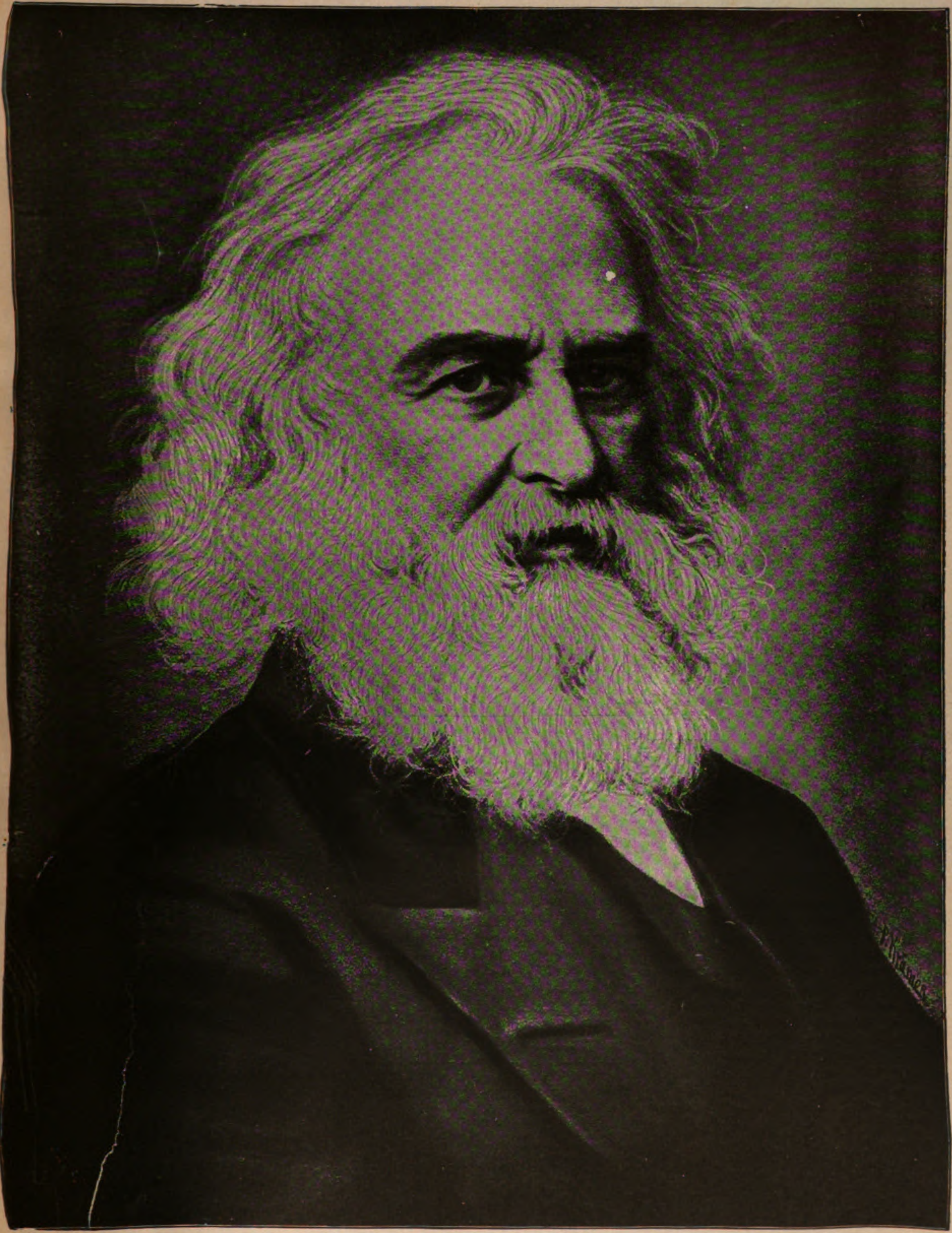
After this monumental production, the poet was well entitled to a rest. He did not lapse into idleness, however. In 1858 he published his "Courtship of Miles Standish," another poem in hexameters, scarcely inferior in execution to "Evangeline," and not inferior to it in popularity. In that he renewed his picturing of Indian customs, incidentally, as in "Hiawatha," and also and more especially his exquisite portrayal of early colonial times, as in "Evangeline," and his marvelous word-painting of scenes and scenery. The poem has a certain personal interest, too, arising from the author's own direct descent from John Alden, who shares with Standish the distinction of being the hero of the romance. The "Tales of a Wayside Inn," of which there are two series, appeared in 1863, and in them Longfellow displayed a fine blending of narrative, dramatic and lyrical power. One of the "Tales," "The Ride of Paul Revere," has long and deservedly been one of the most popular ballads in English literature, while "The Saga of King Olaf," the longest and most elaborate of the "Tales," stands unique and supreme as an unrivalled rendering of Scandinavian legends into varied English lyrics. "Flower de Luce" was published in 1867, and "New England Tragedies" a year later. Parts of the years 1868 and 1869 were spent in Europe, where he was received with distinguished honors wherever he went. The University of Oxford conferred upon him its most coveted degree, that of Doctor of Civil Law. The University of Cambridge had already given him that degree, and Harvard had given him that of Doctor of Laws. Numerous other seats of learning also bestowed upon him their highest academic honors.

None of these things, however, served to dull the keen edge of his creative zeal. He kept at work as earnestly in the triumph-crowned maturity of his career as ever when he was first struggling for recognition. He published "The Divine Tragedy," a sacred drama, in 1872, and a miscellaneous collection of poems entitled "Aftermath" in 1874. In 1867-70, also, he published a translation of Dante's "Divina Commedia" in English verse, which met with wide acceptance and elicited much favorable comment. Still another little volume of poems was entitled "Places." One of the most noteworthy of his later poems was "Morituri Salutamus," written for and read at the fiftieth anniversary celebration of the graduation of his class at Bowdoin, a simple yet majestic composition describing and discussing the advent of old age and exhorting his comrades, with himself, to maintain their activities to the last. In 1876 he wrote a poem on the centenary of the Declaration of Independence, which was published in *The Atlantic Monthly*, and ranked high among the Centennial literature of that year.

Thereafter his health and strength declined and he was able to do little. His last public appearance was on the occasion of the 250th anniversary of the settlement of Cambridge, Massachusetts, when he made, in Sander's Theatre, a brief address to the children of the public schools of that city. That was in December, 1880. In December, 1881, he was stricken with a severe attack of vertigo, which left him much enfeebled, though occasionally able to go out of doors. On March 18, 1882, he ventured to go out for a time, and became chilled in the cold, raw air which then prevailed. That night he was seized with a fever and much pain. Two days later peritonitis was developed, accompanied with bronchitis, and he steadily sank. On the afternoon of March 24 he died. He was surrounded at the end by his five children, Alice, Anna, Edith, Ernest, and Charles; his nephews, William T. and Wadsworth Longfellow; his brother, Alexander K. Longfellow; his sister, Mrs. James Greenleaf; and his brother-in-law, Thomas Appleton. His funeral took place on March 26. The services were held in the house which had so long been his home, and were conducted by his brother, the Rev. Samuel Longfellow, of Portland. Among those who gathered around his bier were Ralph Waldo Emerson, Oliver Wendell Holmes, George William Curtis, and many other eminent men and women. His tomb is in Mount Auburn cemetery, commanding a fine view of Cambridge.

There are few characters in the literary history of the world upon which it is so pleasant to reflect as that of Henry Wadsworth Longfellow. His physical personality was singularly attractive. In face and form he realised as nearly as one can hope to do the ideal of manly beauty, grace and strength. In his later years, with snowy hair and beard, with luminous eyes, and with a smile of unfailing loveliness, he presented at once an aspect of patriarchal kindness and Homeric grandeur. There was never a man who could at once command more respect and awe, and also confidence and love. His voice was sweet and musical, and his whole manner engaging in the highest degree. These qualities were effectively marked and exercised during his long professorship at Harvard. In those days college undergraduates were no respecters of persons, and would often display insubordination and disrespect toward their preceptors. Longfellow did not cultivate close relations with them. He seldom invited any of them to his house. His attitude toward them was one of unfailing courtesy but also of dignified reserve. In an exceptional degree, however, above all his colleagues, he commanded their respect. It is related that on one occasion there was something like a rebellion in the college over some matter, and the President and other members of the faculty in vain tried to quell it. The students would not listen to them, but drowned their voices with angry or derisive cries. Finally Longfellow arose to speak. Instantly a hush fell upon the student mob. "Let us listen to Mr. Longfellow," said the ringleaders, "for he always treats us as gentlemen." It was remarked that he was one of the few college professors of his time who always, in the class room, addressed a student as "Mr." His scholarship and his rare ability to impart instruction also commanded the respect and admiration of the students. He was always lucid, suggestive, and encouraging. Under his direction the Department of Modern Languages at Harvard was developed into by far the largest and most efficient in America.

Attractive, too, was Longfellow in his intercourse with his fellows in the world of literature. He was singularly free from anything resembling jealousy or envy. There was no one else quite so ready and eager to encourage or assist a young and struggling writer, no one so quick and generous to commend worthy work. Doubtless he appreciated his own productions. He would have been unworthy to produce them had he not done so. He knew he was a man of rare genius. But never was there a hint of egotism or self conceit, but always a sweet and unaffected modesty and a readi-



HENRY W. LONGFELLOW

ness to listen to criticism. It is told, as characteristic of the man, that at the time of the publication of his "Village Blacksmith" he was one day having his hair trimmed in a barber's shop, and he repeated aloud to the barber a few lines of the poem; among them the beginning of the second stanza: "His hair is crisp and black and long." "But, Mr. Longfellow," protested the barber, "that isn't right. Hair that is crisp and black is never long." The poet was not displeased at the daring criticism, but accepted it as "expert testimony," thanked the barber for it, and immediately instructed his publishers to change the line, substituting "strong" for "long." The next day, however, he reconsidered the matter, and restored "long." In a note to the publishers he said: "I wrote you yesterday to have the word 'long' changed to 'strong' in 'The Village Blacksmith.' The word 'strong' occurs in the preceding line, and the repetition would be unpleasant. It had, therefore, better stand as it is, notwithstanding the hairdresser's criticism, which, after all, is only technical, for hair can be both crisp and long."

A noteworthy characteristic of the man was his love of children, which was fully matched by the love and confidence which he inspired in them. Many of his poems display this trait in a beautiful manner. It was characteristic that his last public appearance should have been to make an address to school children. His friend Professor Monti related an incident which showed in an attractive light this side of the poet's nature. One day Professor Monti was walking toward Longfellow's house, when he was accosted by a little girl, perhaps twelve years old, who asked him where the poet lived. He offered to show her and they walked together to the gate. Then the child inquired if it would be right for her just to step inside the gate, so that she could say she had been on the grounds of Longfellow's home. The Professor told her she might, and added: "Do you see that window yonder, at that side of the house? Well, if you walk around in front of it, you will probably see a white-haired gentleman sitting at that window, reading. That will be Mr. Longfellow." The child hastened to the spot indicated, in happy anticipation, while the Professor entered the house. He found Longfellow at the window, but with his back turned toward it. "Do turn around and look out of the window!" he cried to the poet; "there is a little girl out there who wants to see you very much!" Instead of merely looking out of the window, Longfellow instantly went to the door, called the child to him, took her by the hand, and then spent an hour in showing her his house and books and pictures, "the old clock on the stairs" of which she had read in one of his poems, and the chair which was given to him by the children of Cambridge. Thus the child was endowed with lifelong memories of the poet.

The chair just mentioned was a huge arm chair, made of the wood of a chestnut tree that overshadowed the old blacksmith shop on Brattle-street, which the poet had immortalized in his poem,

"Under a spreading chestnut tree
The village smithy stands."

Upon a brass plate on the chair was this inscription: "To the author of 'The Village Blacksmith.' This chair, made from the wood of the spreading chestnut tree, is presented as an expression of grateful regard and veneration by the children of Cambridge, who, with their friends, join in best wishes and congratulations on this anniversary. February 27, 1877." It was the seventieth anniversary of the poet's birth. On February 27, 1882, the last birthday anniversary the poet lived to see, he was too feeble to have any celebration. Indeed he had always been averse to any public demonstrations in which he was expected to take part. But many schools throughout the country devoted the day to a study of his writings and to essays and addresses upon his character and life.

There is no poet in the whole range of English literature, save only Shakespeare, who is quoted so much as Longfellow, or whose words have so much become a part of the intellectual furnishing of the popular mind. "That," said his friend, the accomplished critic, James T. Fields, "is because he humanizes whatever he touches. His lyre has nothing alien to any soil. I have heard him quoted by an Armenian monk with a cowl, and sung at campmeeting on the hills of New Hampshire." The very origin of many of Longfellow's poems was typical of their character, or rather determined in advance what that character should be. Mr. Fields has related that the familiar "Psalm of Life" was written on a bright summer morning, at Cambridge, in July, 1838. The poet sat, as he wrote it, at a small table between two windows of his room, his own heart still shadowed with the gloom and crushed with the burden of his affliction in the death of his wife, and his eyes beholding the life and light and beauty of the world about him. It was a poem directly from his own heart, and it was treasured by him for a long time before he would give it to the world. For three-score years now it has been perhaps the best known and most frequently quoted of all his poems, and one of the most familiar in English literature. "The Light of the Stars" was composed on a summer evening whose serene beauty was exactly suggestive of the poem. So, says Mr. Fields, "The Wreck of the Hesperus" was written the night after a violent storm on the coast, and "The Skeleton in Armor" was composed after a stirring ride along the beach. The familiar "Excelsior" was suggested to him by the one word which forms its refrain. That word, printed in capital letters, caught his eye in a newspaper, and he quickly began to write the verses on the back of a letter of Charles Sumner's, which he chanced to have in his pocket.

The story of "Evangeline" was suggested to Longfellow by his friend Nathaniel Hawthorne. The incident was related by Longfellow himself, in the later years of his life, as follows:

"Hawthorne came to dine with me one day, and brought a friend with him from Salem. While at the dinner, Mr. Hawthorne's friend said to me: 'I have been trying to get Hawthorne to write a story about the banishment of the Acadians from Acadia, founded upon the life of a young Acadian girl who was then separated from her lover, spent the balance of her life searching for him, and when both were old found him dying in a hospital.' 'Yes,' said Hawthorne, 'but there is nothing in that for a story.' I caught the thought at once that it would make a striking picture if put in verse, and said, 'Hawthorne, give it to me for a poem, and promise me that you will not write about it until I have written the poem.'

"Hawthorne readily assented to my request, and it was agreed that I should use his friend's story for verse whenever I had the time and inclination to write it. In 1842 I started for Europe, and, when in New York, concluded I would visit Philadelphia, and so went over. It was in the spring about this time, and the country was as beautiful as it is to-day. I spent a week in the Quaker City, stopping at the old Mansion House on Third st., near Walnut. It was one of the best hotels I ever stopped at, and at that time perhaps the best in the country. It has been the private residence of the wealthy Brighams and was kept by a man named Head. The table was excellent, and the bed-chambers were splendidly furnished and were great, large, airy rooms. It has given way now to the demands of business, I believe, for when I was last there I could hardly recognize the place where it stood. During this visit I spent much time looking about, and Philadelphia is one of the places which made a lasting impression upon me and left its mark upon my later work.

"I got the climax of 'Evangeline' from Philadelphia, you know, and it was singular how I happened to do so. I was passing down Spruce st. one day toward my hotel after a walk, when my attention was attracted to a large building with beautiful trees about it inside of a high enclosure. I walked along until I came to the great gate, and then stepped inside and looked carefully over the place. The charming picture of lawn, flower-beds and shade which it presented made an impression which has never left me, and twenty-four years after, when I came to write 'Evangeline,' I located the final scene, the meeting between Evangeline and Gabriel and the death, at this Poorhouse, and the burial in an old Catholic grave-yard not far away, which I found by chance in another of my walks. It is purely a fancy sketch, and the name of Evangeline was coined to complete the story. The incident Mr. Hawthorne's friend gave me, and my visit to the Poorhouse in Philadelphia gave me the ground-work of the poem."

Edmund Clarence Stedman, the distinguished poet and critic, has called Longfellow "our poet of grace and sentiment." He was even more than that, as the same accomplished critic testifies. "His verse," says Mr. Stedman, "is peculiarly open to the test of Milton's requirement, that poetry should be simple, sensuous, passionate. Simple, even elementary, it manifestly is, despite the learning which he puts to use. It is sensuous in much that charms the ear and eye, and in little else; for the extreme of sensuousness is deeply felt, and feeling results in passion, and passionate the verse of Longfellow was not and never could be." No, but for that very reason it has a more universal appeal than the impassioned strains of a Shelley or a Keats, because the average human mind is incapable of appreciating exceptional passions. Sentiment is universal. Passion is exceptional. The poet of passion may appeal with irresistible stress to other poets and to the elect few. But the singer who would touch and move the universal heart must do so with the instruments which that heart understands. When Longfellow wrote such poems as "Resignation," "The Psalm of Life," "The Bridge," and a host of others, he struck not unusual chords that would cause the world to listen with wonder and amazement, but rather the common chords that vibrate in every human heart, and that thus woke in every heart responsive echoes. If universality of aptness constitutes a classic, Longfellow was the most truly classic of all our poets, and of all poets in the world since Shakespeare. He wrote a multitude of poems that ring as true at the antipodes as in New England, and that will be as timely and as vital in the ninetieth as they were in the nineteenth century.

We shall not err, then, if we consider Longfellow to have been the greatest of American poets, and one of the greatest poets in English literature. Such indeed has been the judgment of many competent and unbiased critics. Upon his death a writer in *The Standard* of London declared that "Longfellow commands a wider audience among our people than any poet of this age, save, *perhaps*, Tennyson." *The Telegraph* of London, then edited by the distinguished poet Edwin Arnold, said: "He is almost as well known and widely read in England as in America. His influence has been wholly good. As long as the English language lasts his works will be quoted as models of simplicity of style and purity of thought. Death has taken America's greatest literary son." *The Observer* added: "It is scarcely too much to say that since the death of Byron no living English poet enjoyed so wide a popularity as Longfellow." These and innumerable other like judgments are year by year being corroborated and confirmed by the mature judgment of advancing time. The fact is, Longfellow's works have the enduring quality which is imparted by sanity and by sanity alone. There is nothing decadent, nothing exotic, nothing morbid about them. Few poets have given stronger expression to absolute anguish than he in his lines entitled "Weariness." But there is not in it, nor in any one of all his voluminous works, a single touch or hint of morbidness. Of that so-called genius which raves and defies the moral law and rushes into all manner of excesses, he had none. His was the genius that thought clearly and saw straight, and that sang, not with the poisoned frenzy of a Pythia in notes that none could understand, but with the sweet and limpid purity of the skylark facing the rising sun, in strains that went straight to the heart and to the understanding. Nor was it the least of his distinctions, or the least of his assurances of immortality, that he possessed in an exceptional degree a sympathy with youth. He lived to be old, surpassing the Psalmist's span of life. Yet never did his heart grow old. In many of his poems, from first to last, are inimitable touches of the freshness and buoyancy and indomitable hope of youth. Even in that surpassingly exquisite poem, "My Lost Youth," he does not brood upon the "sere and yellow leaf," but rather exults in finding his lost youth again. In the leafy domes of Deering's woods and the whispering waves that lap the shore at Portland, the magic of the olden days comes back to him.

> The song and the silence in the heart,
> That in part are prophecies, and in part
> Are longings wild and vain.
> And the voice of that fitful song
> Sings on, and is never still:—
> "A boy's will is the wind's will,
> And the thoughts of youth are long, long thoughts."

His writings were throughout instinct with the thoughts of youth, and they were and are long, long thoughts that will endure forever.

W. Fletcher Johnson.

May, 1904.

LONGFORD, an inland county of Leinster, Ireland, is bounded on the N. W. by Leitrim, N. E. by Cavan, E. by Westmeath, S. by Westmeath and Meath, and W. by Lough Ree and Roscommon. With the exception of Carlow, Louth, and Dublin, it is the smallest county in Ireland, its greatest length being about 28 miles, its greatest breadth about 20, and the total area comprising 269,409 acres, or about 421 square miles.

The general level surface of the country is broken occasionally by low hills, which cover a considerable area at its northern angle. The principal rivers are the Camlin, which rises near Granard, and flows past Longford to the Shannon, and the Inny, which, entering the county from Westmeath, crosses its southern corner, and falls into Lough Ree. Lough Ree is partly included in Longford, and the other principal lakes are Lough Gownagh, Derrylough, Lough Drum, and Lough Bannow. The Royal canal intersects the county. The southern division of the county, bounded partly by the Camlin, belongs to the great limestone plain of Ireland, and the northern division is occupied chiefly by clay-slate and graywacke. In the west of the county there is an interpolation, between the two divisions, of yellow sandstone and conglomerate. Isolated hills of sandstone occur at Slievegauldry and at Ballymahon, on both sides of the Inny. Marble of fine quality has been raised near Ledwithstown. In the north indications of iron are abundant, and there are also some traces of lead.

Agriculture.—The climate is somewhat moist and cold, partly owing to the large extent of marsh and bog. The soil in the southern districts resting on the limestone is a deep loam well adapted for pasture, but in the north it is often so thin and poor as to be incapable of reclamation.

In 1881 there were 74,876 acres under tillage, 125,838 pasture, 3697 plantation, and 51,333 waste. The total number of holdings in 1880 was 8682, of which 685 were less than 1 acre. More than one-half of the total number were included in those between 5 and 15, and 15 and 30 acres in extent, which numbered respectively 2482 and 2658. The following table shows the areas under the principal crops in 1855 and in 1881:—

	Wheat.	Oats.	Other Cereals.	Potatoes.	Turnips.	Other Green Crops.	Flax.	Meadow and Clover.	Total.
1855	2,253	38,841	328	16,258	2,730	936	262	20,156	81,764
1881	307	18,670	233	13,108	2,621	1,792	226	37,899	74,856

The total number of horses in 1881 was 6856, of which 4253 were used for agricultural purposes; of cattle 51,547, of which 16,212 were milch cows; of sheep, 24,140; of pigs, 17,900; and of poultry, 232,324. There were 3066 asses and 670 mules. According to the latest return, the land was divided among 436 proprietors possessing 256,668 acres, with an annual ratable value of £151,739, the average ratable value per acre being 11s. 10d. The average size was 588 acres, and 14 per cent. possessed less than 1 acre. The largest owners were Colonel King Harman, 28,779 acres; earl of Granard, 14,978; Lord Annaly, 12,160; George Maconchy, 10,319.

Manufactures.—These are confined almost entirely to coarse woollen and linen cloth.

Railways.—One branch of the Midland Great Western Railway skirts the eastern boundary of the county, and another passes through its centre to Longford.

Administration and Population.—The county includes 6 baronies, with 26 parishes and 891 townlands. It is in the north-west circuit. Assizes are held at Longford, and quarter sessions at Ballymahon, Granard, and Longford. There is one poor-law union wholly within the county, with portions of other two. It is in the Dublin military district and Birr subdistrict. There are barracks for infantry and cavalry at Longford. The county returns two members to parliament.

The only town of any importance is the county town, Longford. From 25,142 in 1760 the population of the county gradually increased till in 1841 it was 115,491, but since then it has diminished to 82,348 in 1851, 64,501 in 1871, and 61,009 in 1881, of whom 30,770 were males and 30,239 females. From 1st May, 1851, to 31st December, 1881, the number of emigrants was 40,726. For the ten years 1871–81 the marriage-rate per 100 of the population was 4, the birth-rate 24·3, and the death-rate 16. In 1881 23·1 per cent. of the population above five years of age were illiterate, the percentage in 1871 being 32. The Roman Catholics formed 91 per cent. of the population in 1881, and the Episcopalians 8.

History and Antiquities.—The early name of Longford was Analé or Annaly, and it was a principality of the O'Farrels. Along with the province of Meath, in which it was then included, it was granted by Henry II. to Hugh de Lacy, who planted in it an English colony. On the division of Meath into two counties in 1543, Annaly was included in West Meath, but in the 11th of Elizabeth it was made shire ground under the name of Longford, and included in the province of Connaught, from which it was transferred to Leinster in the 27th of the same reign.

The principal antiquarian ruin is the Danish rath called the Moat of Granard, at the end of the main street of the town, and occupying a position 593 feet above sea-level. There are monastic remains at Ardagh, Longford, Moydow, Clone, Derg, Druimchei, and Killinmore, as well as on several of the islands of Lough Ree. The principal old castles are those of Rathcline near Lanesborough, and Ballymahon, Burnacor, and Castlecor on the Inny. The principal modern seats are those of Carrickglass on the Camlin, and Castle Forbes, the seat of the earl of Granard. Oliver Goldsmith was born at Pallas, a village near Ballymahon, in this county.

Longford, the chief town of the above county, is situated on the river Camlin, and on a branch of the Midland Great Western Railway, 75 miles west-northwest of Dublin. The principal buildings are the parish church in the Grecian style, St. Mell's Roman Catholic cathedral (one of the finest Roman Catholic churches in Ireland), the court-house, the market-house, and the county jail. Of the old castle and of the Dominican abbey there are slight remains. The town has a considerable trade in grain, butter, and bacon. There are corn-mills, a spool factory, and tanneries. The population in 1871 was 4375, and in 1881 it was 4380.

The ancient name of the town was Athfada, and it is said to occupy the site of a monastery founded by St. Idus, a disciple of St. Patrick. The town obtained a fair and market from James I., and a charter of incorporation from Charles II., as well as the right to return two members to parliament. It was disfranchised at the Union.

LONGINUS, a philosophical critic of great eminence, and one of the brightest spirits of antiquity, uniting Greek subtlety with Roman fervor, flourished in the 3d century, and is known to have perished under sentence of the emperor Aurelian in 273 A. D. He forms one of the last brilliant cluster of pagan literati; and Porphyry, round whom it centred, was the pupil of Longinus. As Porphyry is known to have been born in 233, it is probable that his preceptor, who could not have been less than twenty years his senior, may have been born about 210 A. D. The main authority for the facts of his life is a notice in Suidas, where we find it stated in a preface to a list of his writings that "Longinus Cassius, philosopher, preceptor of Porphyry the philosopher, a learned scholar and critic, lived in the time of the emperor Aurelian, and was cut off by him as having conspired with Zenobia, the wife of Odenathus." From the same authority we learn that Phronto, the rhetorician of Emesa in Syria, was his uncle, and that Phrontonis, sister of Phronto, was mother to Longinus, who thus became heir to his uncle Phronto. As to his birthplace there is no tradition, but it is probable that he was a native of Syria, possibly of Emesa, to which his uncle belonged. He tells us, as we learn from fragments of his works, that he enjoyed great advantages in travel and education, that his parents, being rich, took him to travel and he saw much of the world, and that he studied at Athens under Phronto, at Alexandria under Ammonius Saccas and the pagan Origenes, and at Rome under Plotinus and Amelius. The Neo-Platonic philosophy was then in the ascendant, but Longinus did not embrace the new speculations which Plotinus was then developing, and continued a Platonist of the old type. Hence the sting of a sarcasm attributed to Plotinus—"Longinus may be a philologer, but he is no philosopher." Longinus does not appear to have reciprocated the sarcastic feeling, for we have still extant a fragment of a letter n which he asks Porphyry to come to Phœnicia and to bring with him the treatises of Plotinus, for, he observes, though he does not feel much attraction for the subjects, he yet likes the man. The reputation which Longinus acquired by his learning was immense; it was of him that Eunapius first used the expression that has since become proverbial "a living library"—in modern phrase, a walking encyclopædia.

The most conspicuous event of his life was also the most tragic in its consequences. He became secretary o Zenobia, the widowed queen of Palmyra, who acquired from him a knowledge of Greek, and made him her chief counsellor in state affairs. In this capacity he favored the policy by which she aimed at independence of the Roman empire, encouraged, doubtless, to do so by the recent fate of Valerian, and by the feebleness of the tenure by which Rome held the Syrian provinces. Aurelian, however, crushed the pretension, and, while Zenobia lost her power and was led captive o Rome, Longinus paid the forfeit of his life. According to Zosimus, Zenobia sought to exculpate herself with Aurelian by laying the whole blame on her adviser. He died bravely, not seeking to escape his fate by suicide as a Stoic might have done, but following the example of Socrates and the precept of Plato, to whose philosophy he adhered.[1]

The remains of Longinus that have come down to us, unfortunately scanty, are partly fragments of letters and extracts from criticisms on points of diction; and they bear out the impression we derive from the historical notices of the man. He is vivid and yet minute, lively and penetrating, and his observations show taste, learning, and judgment. Among the most notable of the fragments we have a defence of the Platonic doctrine of the soul as a distinct essence from the body, which defines clearly his philosophical position.

It only remains to advert in a few words to the remarkable production called the *Treatise on the Sublime*, which has usually passed current as a work of Longinus. This remarkable work, which is among the most notable productiohs of ancient criticism, second only in importance to the *Poetics* of Aristotle, and superior to that work in luminous beauty and sense of form, cannot be with certainty ascribed to Longinus, although the internal evidence favors the usual ascription. Of the two most startling difficulties the first is the absence of any mention of a treatise περὶ ὕψους in the list by Suidas. The enumeration is, however, incomplete, and the phrase "many other works," with which it closes, may be held to cover much. A more formidable difficulty is the circumstance that in the most important manuscript (that in the Paris Library, No. 2036, of the 10th century (the heading is Διονυσίου ἢ Λογγίνου, giving thus an alternative author "Dionysius," and in the other important MS., the Laurentian at Florence, the title is Ἀνωνύμου, implying that the author was unknown. According to Vaucher (*Études*, p. 134) this title is not the original one, and there are traces of an earlier title Λογγίνου, which had formed the superscription. Full information as to the critical question will be found in the editions of A. E. Egger (*Longini quæ supersunt*, Paris, 1837). Vaucher's *Études Critiques sur le Traité du Sublime et sur les écrits de Longin*, Geneva, 1854, and Otto Jahn's Διονυσίου ἢ Λογγίνου περὶ ὕψους *de Sublimitate Libellus*, Bonn, 1867. Vaucher ascribes the treatise to Plutarch, but the evidence negatives that supposition, and, although there are difficulties in ascribing the work absolutely to Longinus, as Boileau and Gibbon and the critics of last century traditionally assumed, there is no other name than that of Longinus that presents so many concurring circumstances to justify provisionally the current ascription. The fragments that remain of the undoubted works of Longinus are largely characterized by the same lively force and epigrammatic terseness which distinguish the treatise, "On the Sublime." The translations of this treatise into all the European tongues have been almost innumerable, including the famous one by Boileau, which rendered the work the favorite text-book of the belle-lettristic critics in the last century. The most important English translations are by William Smith, 1739, frequently reproduced; Hathaway, 1834; Spurdens, 1836. (W. D. G.)

LONG ISLAND, an island with an area of 1682 square miles lying off the coast of the United States, between 40° 33′ and 41° 10′ N. lat., and forming part of the State of New York. While the length from east to west is about 120 miles, the width nowhere exceeds 24 miles, and in some places falls to 12 or 15. The western end is separated from the city and rest of New York by the East River, which is nowhere more than three quarters of a mile in breadth, and has been spanned by a great suspension bridge; but between the main body of the island and the mainland (Connecticut, Rhode Island) lies Long Island Sound, widening out to a breadth of 20 miles. The sound, however, is comparatively shallow, the depth in the eastern and seaward portion being usually under 200 feet, while in the portion west of Connecticut river it is nowhere more than 170 feet, and in general only 75–100 feet. Geologically the island is very interesting, consisting, as it does for the most part, of an immense morainal deposit of glacial drift. A range of hills extends with some interruptions for about 60 miles in the line of its longer axis, varying in height from 150 to 384 feet above sea-level. Fort Pond Hill for instance is 194 feet; Neapeague, 135; Amagansett, 161; Shinecock, 140; Osborn's Hill, near Riverhead, 293; Ruland's, south of Coram, 340; West Hills (Jane's Hill), 354; Layton's Hill, 380; Westbury, 260; Hempstead Harbor Hill, 384; John M. Clarke's Hill, 326. From the foot of the hills southward stretches a vast nearly level plain, with an average height of 70 feet, and consisting of post-glacial stratified sand and gravel; and across this run a large number of shallow parallel watercourses, remarkable mainly for the regularity with which they present an elevated bank on the western side and a long declivity on the eastern. On the northern side of the range the surface is very uneven, some of the elevations exceeding 200 feet, and deep fiord valleys stretching down to the sound, and forming a series of excellent harbors. The glacial drift of Long Island is of immense depth, and contains a wonderful number of boulders. "At the eastern extremity," says Lyell on the authority of Mather, "they are of such kinds of granite, gneiss, mica, slate, greenstone, and syenite as may have come across the sound from parts of Rhode Island. Opposite the mouth of the Connecticut river they are of such varieties of gneiss and hornblende slate as correspond with the rocks of the region through which that river passes. Still further west they consist of red sandstone and conglomerate and the trap of that country, and lastly, adjoining the city of New York, we find serpentine, red sandstone, and various granitic and crystalline rocks which have come from the district immediately to the north." One of the boulders near Manhasset measures 54 feet long and 40 feet wide, and rises 16 feet above the level of the soil. Of the numerous lakelets scattered throughout Long Island it is enough to mention Ronkonkoma, near Lakeland, the waters of which are said to decrease and increase in regular periods of four years. Much of the surface of the country is still covered with wood—oak, hickory, and chestnut growing freely on the unmodified drift, and pine forest extending for about fifty miles through the sandy plains. A good rich loam abounds in the northern districts, and the lighter soils of the south are easily rendered productive. Market gardening especially is carried on with success. The climate is comparatively mild, the mean annual temperature being 49° to 51°, the maximum for the year between 95° and 100°, and the minimum 4° to 8°. The average rainfall is about 42·1 inches. Towards its western end more especially, the northern coast of Long Island presents a number of important bays—Glen Cove, Oyster Bay, Huntington Bay, Smithtown Bay, etc.; the western extremity is deeply bifurcated by a very irregular inlet, broken up by various islands into Gardiner's Bay, Little Peconic, and Great Peconic; and along a large part of the southern coast stretches a remarkable series of lagoons, formed by a line of dunes varying in breadth from ¼ to 1 mile, and connected at various points with the ocean. These last—of which the most important is Great South Bay, 40 miles long by about 5 or 6 miles wide—are of great service to the island, and an Act has been passed to increase their utility by connecting them by canals. Coney Island and Rockaway Beach, the most frequented of the many seaside resorts in the Island, lie near the south-western extremity. As regards both birds and fishes, Long Island seems a kind of meeting place between the arctic and the equatorial species. In winter, for instance, it is visited by the eider-duck, the little white goose, the great cormorant, and the auk, in summer by the turkey-buzzard, the swallow-tailed kite, and the fork-tailed flycatcher. A few deer are still to be found; and various tracts of country and islands in the great bays are stocked with game and fish by sportsmen's clubs. The east portion of the island is one of the chief seats of the menhaden fisheries, and the oyster beds of both the north and the south coast are of great value. Those of the Great South Bay (furnishing, amongst others, the famous "blue points") alone give employment in the season to 1500 fishermen. (See E. Ingersoll, "The Oyster Industry," in the *Tenth Census* publications of the United States, 1881.)

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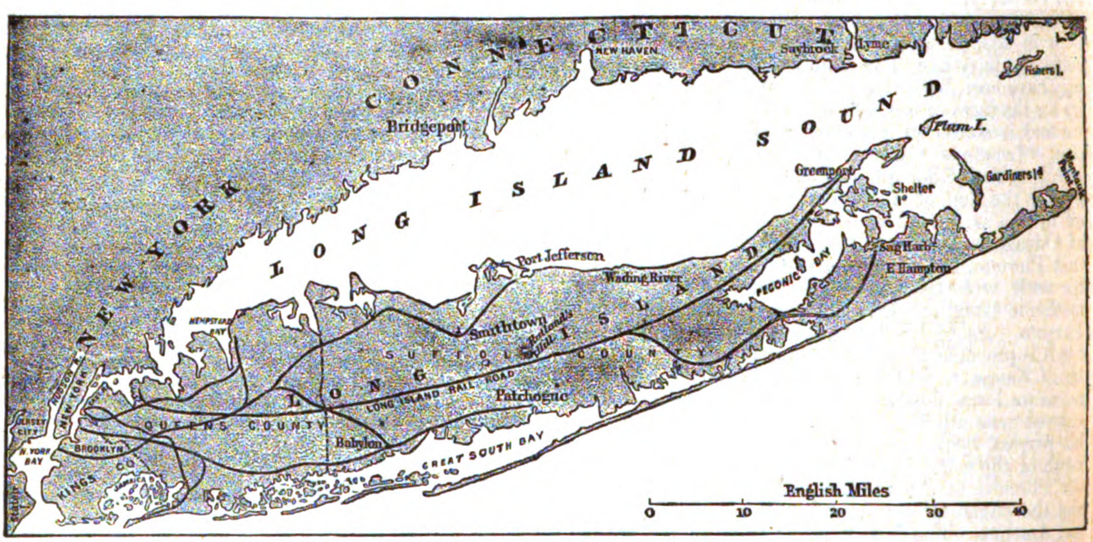
[1] It is probable that he owed part of his political fervor to the influence or inheritance of the name "Cassius," from whatever source this surname was derived. The associations of this name were distinctly anti-imperial and even regicidal, as seen in Caius Cassius and in Cassius Chærea.



Map of Long Island.

Administratively Long Island consists of King's County (72 square miles), Queen's County (410), and Suffolk (1200), which in 1880 had the following population:—

	Total.	Male.	Female.	Native.	Foreign.	White.	Colored.
King's	599,549	289,289	310,260	411,295	188,254	590,278	9,271
Queen's.........	90,547	45,760	44,787	68,556	21,991	86,707	3,840
Suffolk.........	53,926	26,759	27,167	48,319	5,607	51,478	2,448

Of the thirteen or fourteen Indian tribes living in the island at the time of its discovery, the only remnants are about fifty Shinecocks and Montauks.

Besides Brooklyn, which had 566,689 inhabitants, King's County contained Flatbush town, 7634; Flatlands town, 3127; Gravesend town (including Coney Island village), 3676; New Lots town, 13,681; and New Utrecht town, 4742. In Queen's County are Flushing town, 15,919; Hempstead town (including East Rockaway, Garden City, and sixteen other villages), 18,160; Jamaica town, 10,089; Long Island City, 17,129; Newtown town, 9798; North Hempstead town, 7562; and Oyster Bay town, 11,923. I

Suffolk there are no cities, and none of the villages have 500 inhabitants. The "towns" are Babylon, Brookhaven, East Hampton, Huntington, Islip, Riverhead, Shelter Island, Smithtown, Southampton, and Southold. Garden City was built by A. T. Stewart as a model suburban settlement, and contains a fine cathedral. Hicksville is associated with the memory of Elias Hicks the Quaker missionary. Sag Harbor was formerly a great whaling station, and still maintains a good coasting trade. Five miles from Flushing is Creedmoor rifle range, the finest in the United States. On Gardiner's Island the pirate Kidd concealed the treasures partly recovered by the governor of Massachusetts in 1699.

Long Island was so called by its Dutch discoverers in 1609, and the name Nassau, bestowed in 1693 by the colonial legislature, never found popular acceptance. Breucklen (Brooklyn), Amersfoort (Flatlands), Vlissingen (Flushing), Rusdorf (Jamaica), and New Utrecht were founded by the Dutch between 1630 and 1654; and between 1640 and 1665 the English from the New England colonies established Southold, Southampton, Easthampton, Hempstead, Huntington, Oyster Bay, Smithtown, Islip, etc. Though the charter granted by James I. in 1620 expressly excluded territory actually possessed or inhabited by any other Christian prince or state, the grantees in 1635 conveyed to the earl of Stirling among other lands the island of Matowacks or Long Island. A treaty concluded between Dutch and English at Hartford (Connecticut) in 1650 surrendered to England all the land south of Oyster Bay; but, though it was ratified by the states-general of Holland in 1656, no action was taken by the English Government. Long Island was included in the territory assigned to the duke of York in 1663–64, and in 1664 an English squadron conquered the Dutch in time of peace, and set up a government in the duke's name. When the Dutch governor, who had recovered New York in 1673, issued a proclamation requiring the submission of the Long Island towns, they all obeyed except the three most eastern; but the treaty of Westminster in 1674 left Long Island to the English, and it became a regular colony of the crown. In the beginning of the war of American independence, Long Island naturally played a prominent part. The efforts made by Washington to defend it were frustrated by the British under Cornwallis in 1776, and it remained in their hands till the close of the contest.

LONG ISLAND CITY, a city of the United States, the capital of Queen's County, New York, situated on the west coast of Long Island, and separated from New York by the East River and from Brooklyn by the Newtown Creek. The area, which includes what were the post villages of Astoria, Newtown, and Ravenswood, measures 3 miles from east to west and 5 miles from north to south, and the general plan of the place is constructed on a spacious scale. The river frontage extends to about 10 miles. Hunter's Point, as the south-west portion is called, contains the terminal depôts of several railway lines, extensive warehouses for the storage of petroleum, and a variety of industrial establishments—such as granite-works, chemical works, engine-works. In the Astoria district there are factories for pianos, carriages, and carpets. Long Island City dates from 1870; in 1874 its population was about 16,000, and in 1880 17,117.

LONGITUDE. See GEOGRAPHY (MATHEMATICAL) and TIME.

LONGOMONTANUS, or LONGBERG, CHRISTIAN (1562–1647), a Danish astronomer, was born at Longberg, a village of Jutland, in Denmark, on the 4th of October, 1562. Having, when only eight years old, the misfortune to lose his father, who was only a poor laborer, he was taken charge of by a maternal uncle, through whose influence he received lessons from the clergyman of the place. Although, owing to the poverty of his parents, the instruction which he had received up to this time had been of the most elementary kind, his aptitude for learning was so great that, under the tuition which he now received, he made rapid progress in his studies, especially in the mathematical sciences, for which he acquired an intense liking. His mother, however, was unable to pay any longer for his education, and he was reluctantly compelled to return home to work in the fields. By improving every opportunity which his laborious life now permitted, he was still enabled to pursue, to some extent his favorite studies. This state of matters continued for some time; but his intense thirst for knowledge, and the uncalled-for jealousy of his friends, led him in 1577 to steal away from home, to try his fortune in the world. Accordingly, at the age of fifteen, he went to Wiborg, a town about 12 miles distant from his native village. There he spent eleven years, dividing his time between attending the lectures of the professors in the college of that town, and working in the fields. By this means he was able not only to earn a sufficient livelihood, but also to defray the expenses of his education; and his close application to study soon enabled him to acquire considerable knowledge of literature and of the sciences. In 1588, at the age of twenty-six, he removed to Copenhagen, where his great abilities speedily secured for him the esteem and admiration of the professors in the university of that town. By this means he was brought under the notice of the eminent astronomer Tycho Brahe, who received him very kindly, and ultimately appointed him his assistant. He remained with Tycho Brahe for eight years in the island of Hoene, and during that time rendered him such valuable services in his astronomical observations and calculations, that, when Tycho Brahe settled in Germany, he invited Longomontanus to accompany him. This offer he accepted; but having shortly afterwards expressed to Tycho Brahe his desire to return to his native country, the latter at once furnished him, not only with excellent testimonials, but also with money for his journey. On his return to Denmark he made a long detour in order to visit the places whence Copernicus had made his celebrated astronomical observations. On his arrival at Copenhagen, he found a patron in the person of Christian Friis, chancellor of Denmark, who gave him employment in his household. He continued in this situation till 1603, when he received the appointment of rector of the college of Wiborg. Two years later (1605) he was elected to the chair of mathematics in the university of Copenhagen. This appointment he held till his death, on the 8th of October, 1647. Longomontanus, although one of the best astronomers of his age, inherited some of its worst prejudices. A firm believer in astrology, he held, among other things, that comets were messengers of evil. He also imagined that he had squared the circle. He found that the circle whose diameter is 43 has for its circumference the square root of 18252,—which gives 3·14185 . . . . . . for the value of π. Pell and others endeavored to prove that he was mistaken, but they failed to convince him of his error. He refers to his imagined discovery in almost all his published works, and defends his position with great zeal.

The following is a list of his more important works in mathematics and astronomy, with the dates of their first publication:—*Systematis Mathematici*, etc., 1611; *Cyclometria e Lunulis reciproce demonstrata*, etc., 1612; *Disputatio de Eclipsibus*, 1616; *Astronomia Danica*, etc., 1622; *Disputationes quatuor Astrologicæ*, 1622; *Pentas Problematum Philosophiæ*, 1623; *De Chronolabio Historico, seu de Tempore Disputationes tres*, 1627; *Geometriæ quæsita XIII. de Cyclometria rationali et vera*, 1631; *Inventio Quadraturæ Circuli*, 1634; *Disputatio de Matheseos Indole*, 1636; *Coronis Problematica ex Mysteriis trium Numerorum*, 1637; *Problemata duo Geometrica*, 1638; *Problema contra Paulum Guldinum de Circuli Mensura*, 1638; *Introductio in Theatrum Astronomicum*, 1639; *Rotundi in Plano*, etc., 1644; *Admiranda Operatio trium Numerorum 6, 7, 8*, etc., 1645; *Caput tertium Libri primi de absoluta Mensura Rotundi plani*, etc., 1646.

LONGUEVILLE, ANNE GENEVIÉVE, DUCHESSE DE (1619–1679), who played the greatest part in the troubles of the Fronde, and whose name has come down to posterity as the brilliant intriguer in politics in her early and the pious protectress of the nuns of Port Royal in her later years, was the only daughter of Henri de Bourbon, Prince de Condé, and his wife Charlotte Marguerite de Montmorency, and the only sister of Louis, the great Condé. She was born on August 28, 1619, in the prison of Vincennes, into which her father had been thrown for opposition to Marshal D'Ancre. the favorite of Marie de'Medici, who was then regent in the minority of Louis XIII. She was educated in the convent of the Carmelites in the Rue St. Jacques at Paris, which had been recently established under the influence of St. Teresa's reforms by nuns of the strictest piety, whose teaching she never entirely forgot. Her early years were clouded by the execution of the young and brilliant Duc de Montmorency, her mother's only brother, for intriguing against the great Richelieu in 1631, and that of her mother's cousin the Comte de Montmorency Boutteville for duelling in 1635; but, in spite of their sorrow, her parents made their peace with Richelieu, and when she was introduced into society in 1635 she found plenty of court gayety to enjoy. She soon became one of the bright particular stars of the Hôtel Rambouillet, where all that was learned, witty, and gay in France used to assemble, and which had not yet degenerated into the meeting place of those *précieuses* whom Molière was to laugh out of existence. It was first proposed to marry her to the young Prince de Joinville, and thus unite the Guises and Condés, but he died in 1639, and her parents could only find for her husband the Duc de Longueville, a prince of the blood indeed, and governor of Normandy, but a widower, and twice her age. The marriage could not be a happy one, but the young duchess long remained faithful to him, and bore him four children. After Richelieu's death her father became chief of the council of regency during the minority of Louis XIV., her brother Louis won the great victory of Rocroy in 1643 (see CONDÉ), and the duchess became of political importance. In 1647 she accompanied her husband to Münster, where he was sent by Mazarin as chief envoy, and where she charmed the German diplomatists who were making the treaty of Westphalia, and was addressed as the "goddess of peace and concord." On her return she fell in love with the Duc de la Rochefoucauld, the author of the *Maxims*, who made use of her love to obtain influence over her brother, and thus win titles and honors for himself. She was the guiding spirit of the first Fronde, when she brought over Armand, Prince de Conti, her second brother, and her husband to the malcontents, but she failed to attract Condé himself, whose loyalty to the court overthrew the first Fronde. However, La Rochefoucauld won the titles he desired. The second Fronde was again her work, owing to her lover's disgust at losing his new honors, and in it she played the most prominent part in attracting to the rebels first Condé and later Turenne (see CONDÉ). It is not necessary to give the whole history of the wars of the Fronde, which is detailed elsewhere, but it must be noticed that the duchess herself only mingled in politics to please her lover, and gain his ends. In the last year of the war she was accompanied into Guienne by the young and handsome Duc de Nemours, her intimacy with whom gave La Rochefoucauld an excuse for abandoning her, and who himself immediately returned to his old mistress the Duchesse de Chevreuse. Thus abandoned, and in disgrace at court, the duchess betook herself to religion. She accompanied her husband to his government at Rouen, and devoted herself to good works. She took for her director M. Singlin, so famous in the history of Port Royal, and from that time began her new religious life. Till 1663 she chiefly lived in Normandy, when her husband died, and she came to Paris. There she became more and more Jansenist in opinion, and her piety and the remembrance of her influence during the disastrous days of the Fronde, and above all the tender love her brother, the great Condé, bore her, made her a conspicuous figure. The king pardoned her, and in every way showed the respect he had for her. She became the great protectress of the Jansenists; it was in her house that Arnauld, Nicole, and De Lane were protected; and to her influence must be in great part attributed the release of De Sacy from the Bastille, the introduction of Pomponne into the ministry and of Arnauld to the king. Her famous letters to the pope are part of the history of PORT ROYAL (*q. v.*), and as long as she lived the nuns of Port Royal des Champs were left in safety. Through the latter years of her life she had, despite the honor in which she was held, much to bear. Her eldest son resigned his title and estates, and became a Jesuit under the name of the Abbé d'Orleans, while the younger, after leading a very debauched life, was killed, bravely leading the attack in the passage of the Rhine in 1673. As her health failed she devoted herself more and more to religion, and hardly ever left the convent of the Carmelites in which she had been educated. On her death in 1679 she was buried with great splendor by her brother Condé, and her heart, as she had directed, was sent to the nuns of that Port Royal des Champs which she had so greatly protected and defended. Her life is noteworthy, both from the harm she did in the turbulent days of the Fronde, though she acted, hardly knowing what she did, from love rather than from selfish ambition, and also from the greatness of her penitence, when her protection of Port Royal more than redeemed her fame, and gave her a title to the grateful remembrance of all who reverence true piety and learning more than the artificial glitter of the reign of the "grand monarque."

The chief authority for Madame de Longueville's life is a little book in two volumes by Villefore the Jansenist, published in 1738. Cousin has devoted four volumes to her, which, though immensely diffuse, give a vivid picture of her time. Her connection with Port Royal should be studied in Arnauld's *Memoirs*, and in the different histories of that institution.

LONGUS, the Greek romancer. Nothing is known of the life of the author of *Daphnis and Chloe*, and it is only inferred from some apparent imitations of the *Æthiopica* of Heliodorus that he wrote after the time of Theodosius. He may therefore be placed in the 5th century. His position in literature is interesting and not unimportant; he represents the romantic spirit of expiring classicism, the yearning of a highly artificial society for primitive simplicity, and the endeavor to create a corresponding ideal. The little idyl in the seventh oration of Dion Chrysostom is a beautiful example of this tendency three centuries before Longus, and the letters of Synesius, nearly in his own day, attest a genuine feeling for nature and a country life. In its literary aspect, nevertheless, this movement has little in common with the return to pure nature which inspired a Wordsworth, or the realism of George Sand's delineations of the peasantry of Berri. Longus's style is rhetorical, and his shepherds and shepherdesses are wholly conventional. It is no small credit to him to have achieved so purely ideal a delineation with so little apparent affectation, and without any of the tediousness of almost all modern pastoral writers. If unable to blend the reality and ideality of the pastoral life as Shakespeare has done in *As You Like It* and *The Winter's Tale*, he has nevertheless imparted real human interest to a purely fanciful picture, and shows no little knowledge of human nature in his delineation of the growth of a passionate attachment between two innocent children. Daphnis and Chloe were probably the prototypes of Paul and Virginia; and, notwithstanding the naiveté of some details, the Greek has a decided advantage over the Frenchman in the simplicity and sincerity which constitute the true modesty of nature. As an analysis of feeling, *Daphnis and Chloe* makes a nearer approach to the modern novel than its chief rival among Greek erotic romances, the *Æthiopica* of Heliodorus, where the attraction mainly consists in the ingenious succession of incidents.

Longus has found an incomparable translator in Amyot, bishop of Auxerre, whose French version, as revised by Paul Louis Courier, is better known than the original. It appeared in 1559, thirty-nine years before the publication of the Greek text at Florence by Alamanni. The chief subsequent editions are those by Jungermann (Hanau 1603), Villoison (Paris, 1778, which first gave a standard text), Courier (Rome, 1810, the first entirely complete edition), Seiler (Leipsic, 1835), and Piccolos (Paris, 1866), pronounced by M. Pons the *ne plus ultra* of accuracy. Pons's account of the literature and bibliography of the subject, appended to his edition of Courier's version (1878), is very careful and complete. There are English translations by Thornley, Craggs, and Le Grice, the last with omissions. The illustrated editions, generally of Amyot's version, are very numerous, and some are very beautiful. Prudhon's designs are especially celebrated.

LONS-LE-SAULNIER, capital of the department of Jura, France, is situated at a distance of 275 miles by rail from Paris, on the Vallière, a small tributary of the Saône, about 820 feet above the sea-level, at the point where the Besançon, Lyons, and Châlon-sur-Saône railways converge. It is pleasantly surrounded by vine-clad hills from 300 to 500 feet in height, consisting of lower spurs of the Jura chain. It owes its name to its salt-pits, which have been used from a very remote period; the large quantities of ashes derived from the wood burnt in the process of evaporation are extensively utilized in agriculture. Since 1839 there has been an establishment for the use of the mineral waters. The principal industry of the place is the manufacture of sparkling wines, the Étoile growth being the best for this purpose. There is also a foundry, in addition to printing establishments, tanneries, distilleries, brush factories, and manufactures of coverlets and carpets. About a mile to the west of the town are the salt-mines of Montmorot, employing one hundred and fifty workmen; the bed of rock salt, which lies at a depth of 400 feet, and is nearly 100 feet thick, yields about 9500 tons of pure salt yearly, 885 tons of sulphate of soda, and 300 tons of chloride of potassium. Lons-le-Saulnier possesses no buildings of special interest; one of the public squares contains a statue of Lecourbe, and there is a museum containing Gallo-Roman antiquities and various works of art. The library, which like the museum is in the town-hall, has 20,000 volumes. The population in 1876 was 11,371.

Lons-le-Saulnier, originally a Gallic town, was fortified by the Romans, destroyed by the barbarians, and, afterwards rebuilt and extended, belonged for a long time during the mediæval period to the powerful house of Châlon, a younger branch of that of Burgundy. It was burned in 1364 by the English, and again in 1637, when it was seized by the duke of Longueville for Louis XIII. It became definitively French in 1674. It was there that the meeting between Ney and Napoleon took place on the return of the latter from Elba, on March 31, 1815. Rouget de l'Isle, the author of the Marseillaise Hymn, was born at Montaigu near this town.

END OF VOLUME FOURTEENTH.

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